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Title: Determinants of pro-environmental behaviour in a circular program for plastic packaging – A case of Plastic Heroes in Amsterdam

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Summary

In order to make a more effective use of resources in the Netherlands, the Dutch Government created Plastic Heroes, a national program for collection and recycling of plastic packaging that focuses on avoiding plastic to get lost in the chain (Rijksoverheid, 2016). The program differs from other plastic recycling schemes because it is financed by the packaging industry (Plastic Heroes, 2017a), which indirectly incentives the manufacturers to optimise plastic packaging as they pay taxes according to the weight of packages commercialised.

In Amsterdam, Plastic Heroes was fully implemented in 2013 but after two years of operation, the seven districts of the city had different results from the project. The best results were found in Zuid, where 11% of plastic packaging was recycled, while in Zuidoost only 2%, the worst scenario among all districts (Gemeente Amsterdam, 2015). Therefore, this research intended to explain the factors that led Zuid and Zuidoost to have such different results for the same program.

The research strategy used was case study, which describes and explains the problem in a real-life context, usually by combining qualitative and quantitative data. In this research, data was collected through secondary sources, observations, questionnaires and semi-structured interviews. Through the literature review, three main concepts were investigated regarding their influence in pro-environmental behaviour: psychological factors, awareness of circular economy and situational factors. Demographic characteristics such as age, gender, nationality, migration background, education level and income were also included as control variables.

The psychological factors were based on the Theory of Planned Behaviour, which involves three variables: attitude towards the behaviour, subjective norm and perceived behavioural control. Awareness of circular economy was examined based on the understanding of the concept. Additionally, situational factors were analysed by the infrastructure provision and information about the program.

The statistical analysis was based on independent t-tests and binary logistic regressions. The former was used to compare the means of Zuid and Zuidoost, from which the variables age, gender, migration background, income, education and understanding of circular economy were the only significant ones. The latter was useful to investigate what variables were significantly predicting recycling of plastic packaging and explaining differences between the two settlements. From all models analysed, the only variables that were found to be positively influencing in the behaviour were having Dutch background, being female and being well-informed about the program. Education was also significant, however, there was a negative relationship between having primary education and recycling plastic packaging with Plastic Heroes.

Several recommendations were made addressing new ways of improving the program in the context of Zuid and Zuidoost. It was suggested for the municipality to develop new communication tools such as using social media. It could also be effective to update and improve the already existing information in the website and in the containers. Additionally, it was recommended to engage community centres in raising awareness.

Keywords

Plastic, packaging, pro-environmental behaviour, circular economy, recycling

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I dedicate this thesis to my parents and my sister. You are all an inspiration for me to work with love and determination.

Abbreviations

CE	Circular Economy
DRPP	Do not recycle plastic packaging
EU	European Union
IHS	Institute for Housing and Urban Development Studies
ISWM	Integrated Sustainable Waste Management
GDP	Gross Domestic Product
NAM	Norm-Activation Model
PBC	Perceived Behavioural Control
RPP	Recycles plastic packaging
SRGA	*Samenwerkende Reiningingsdiensten Gementee Amsterdam* (English translation: Cooperative for cleaning services of the municipality of Amsterdam)
TRA	Theory of Reasoned Action
TPB	Theory of Planned Behaviour
USEPA	United States Environmental Protection Agency
VANG	*Van Afval Naar Grondstof* (English translation: From Waste To Resource)
WWF	World Wildlife Fund

Table of Contents

List of Charts

List of Figures

List of Tables

Chapter 1: Introduction

1.1 Introduction

This chapter presents background information about the use of plastic in the contemporary world and the transition to circular economy (CE) as a possibility to avoid extraction of more natural raw materials from the environment. Besides, it is introduced in this section the roles being played by the European Union (EU) and the Netherlands to lead this transition. Among the programs of the Dutch Government for improving circularity, there is Plastic Heroes. This program for collection and recycling of plastic packaging differs from other recycling programs as it is financed by the packaging manufacturers and aims at keeping the highest quality of plastics within the chain. Lastly, this chapter shows the results obtained currently by the program in Amsterdam, followed by the research objective and questions.

1.2 Background Information

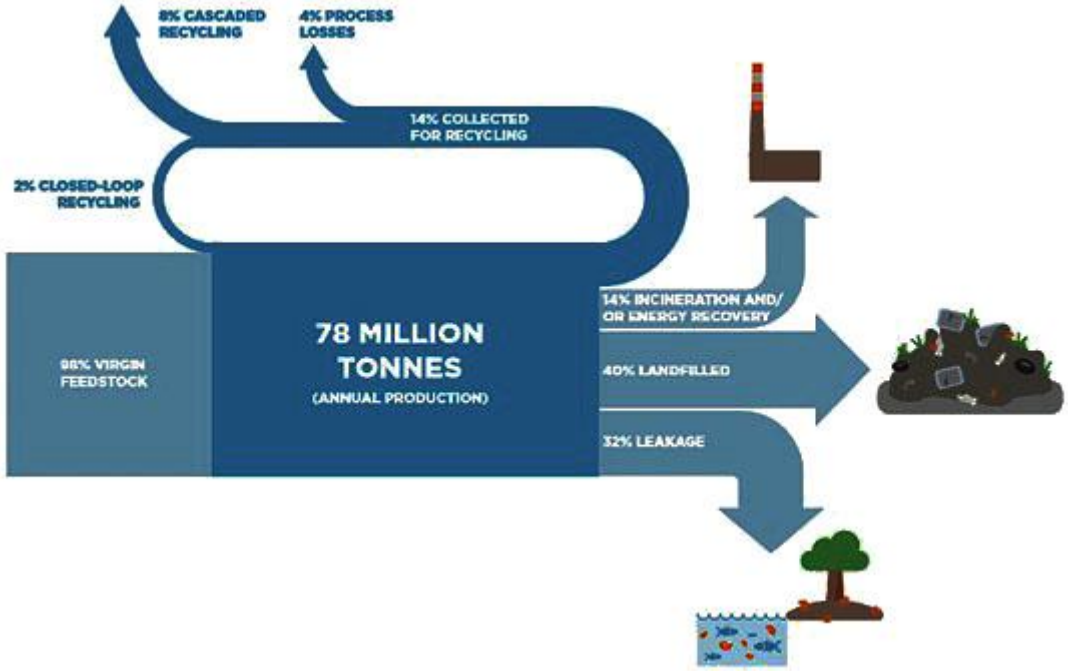
Cities are centres of innovation and engines of economic growth but are also huge resource-drains. Today, cities consume 75% of natural resources and produce 60-80% of all greenhouse gas emissions while occupying only 3% of global land surface (Social-Economische Raad, 2016)[1]. Since the 20th century, the use of natural resources has grown so dramatically that in the early 70s, humanity was already demanding more from our planet than it can sustainably recover. In 2012, we reached the alarming situation of requiring 1,6 Earths to support our yearly resource demand (WWF, 2016).

One of the industries that were mostly responsible for the consumption of our resources was plastic production. In the past 50 years, the amount of plastic produced increased from 15 million tons in 1964 to 311 million tons in 2014. It is an impressive 20-fold growth. Being a low-cost material that is at the same time versatile and durable allowed it to be extensively applicable in many economic sectors such as packaging, construction, transportation, healthcare and electronics. Because of that, it is expected that the consumption of this material will double in the following 20 years. Another surprising fact is that from all the plastic produced, the largest application is for packaging, which represents 27% of the total volume and whose market has a growth rate of 5% annually, based on data of 2015 (Ellen MacArthur Foundation, 2016)[2].

According to the Ellen MacArthur Foundation (2016), in 2013, 78 million tons of plastic packaging were produced and from this amount, 40% was landfilled and 32% was leaked, which means it goes to the natural ecosystem and takes centuries to decompose. Only 2% of this huge amount of plastic packaging actually closes the loop and avoids the use of raw natural resources. Figure 1 shows the alarming situation of the plastic packaging industry as huge amounts of raw materials are taken from nature never to be reused or recycled causing unimaginable harms to our planet. Additionally, from the 14% that are collected for recycling, 4% get lost is the processes and 8% are recycled into lower-quality materials.

[1] The Social-Economische Raad is a Dutch institution that advises the government and the parliament in the outlines of socio-economic policies (Social-Economische Raad, 2016).
[2] The Ellen MacArthur Foundation is a British leading organization created in 2010 to help accelerate the transition to the circular economy internationally by establishing the concept in the agenda for governments, businesses and academia (Ellen MacArthur Foundation, 2017)

Figure 1 - Global flows of plastic packaging materials in 2013[3]



(Source: Ellen MacArthur Foundation, 2016)

The figure shows how the production of goods have been done for decades through a linear economy[4] where resources are taken from nature to produce products that are consumed and, afterwards, disposed in dumping sites and landfills or incinerated. In this kind of system, it is assumed that our resources are unlimited and that the environment has the capacity to absorb all the waste and the pollution caused by it. Is that really possible? It is already known that Earth cannot sustain that anymore (Murray, Skene, et al., 2015).

In order to make more efficient use of resources, instead of the linear system, a circular economy[5] is proposed. A circular system basically is a regenerative and waste-free system that aims at restoring fluxes to their natural levels by cycling all materials at the highest quality (Gladek, Van Odijk, et al., 2015). According to Murray, Skene et al. (2015), this new economic model is the most recent and promising attempt to integrate economic development with environmental wellbeing. Based on that need, there is an increasing number of cities and countries around the world planning to achieve the circular economy in the following decades, such as the Netherlands and other countries in the EU.

The countries participating in the European Union understand that this new system can benefit them not only environmentally but also economically. The circular economy is seen as an opportunity to increase Europe's competitiveness around the globe by becoming more independent of other countries (European Commission, 2014) and a potential to rise the EU GDP by up to 3,9% (Ellen MacArthur Foundation, 2012). Due to that, in 2015 the EU issued a regulation called "Circular Economy Package" aimed at removing barriers to the transition to this new system (Mooren, 2016, European Parliament, 2016). Among the targets set by this regulation, there is achieving 65% of municipal waste recycling and 75% of packaging

[3] Closed-loop recycling: recycling of plastics into the same or similar quality applications. Cascaded-recycling: recycling of plastic into other, lower-value applications.
[4] The concept of Linear Economy will be thoroughly developed in Chapter 2.
[5] The concept of Circular Economy will be thoroughly developed in Chapter 2.

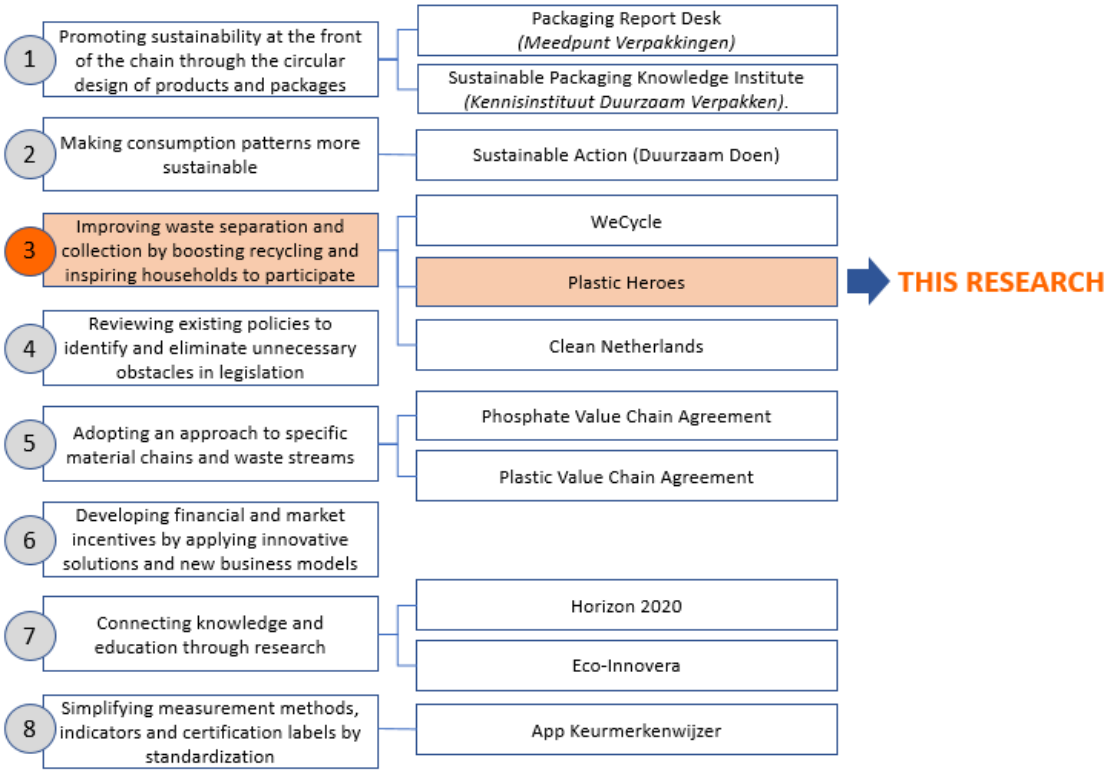
recycling by 2030 (European Parliament, 2016). As part of the EU, the Netherlands approach towards circular economy follows the same pattern (Rijksoverheid, 2016)[6].

1.3 From Waste to Resource

The Netherlands appeared as one of the EU countries showing the highest interest in achieving the circular economy because of a combination of necessity and economic benefits. In 2015, the Netherlands was importing 68% of necessary raw materials from abroad. The Dutch government, therefore, set the objective of reducing by 2030 50% of use of primary raw materials such as minerals, fossil fuels and metals, in order to become less dependent on the imports of other countries such as China, which is the provider of several scarce resource materials. Regarding the economic opportunities, the Netherlands sees the circular economy as a way of creating more green jobs, of innovating in businesses through new start-ups and new business models and, also of exporting the Dutch knowledge to other countries that will start their transition in the future (Rijksoverheid, 2016).

Turning waste into a resource is part of 'closing the loop' in circular economy systems (European Commission, 2014). Due to that, as part of the Dutch initiative to stimulate the circular economy, the program *Van Afval Naar Grondstof* – VANG ("From waste to resource") was created in 2013 under the responsibility of the Ministry of Infrastructure and the Environment (Rijksoverheid, 2016, Ministry of Infrastructure and the Environment, 2015). The program has eight operational objectives as presented in Figure 2 in a summarized way along with some actions and projects being boosted by the Dutch government to achieve the objectives, presented in the second column of the diagram (Ministry of Infrastructure and the Environment, 2014).

Figure 2 - Objectives of the VANG program and some projects that are directly connected to each of them



(Source: adapted from Ministry of Infrastructure and the Environment, 2014)

[6] *Rijksoverheid* is the Dutch name for the Government of the Netherlands.

The diagram shows the VANG program is broad and ambitious, having objectives that focus in different parts of the value chain (Ministry of Infrastructure and the Environment, 2014). The chosen project for this research is Plastic Heroes as emphasised in the diagram.

Plastic Heroes is a national program for collection and recycling of plastic packaging. The program was selected for this research among all the others from VANG because it focuses on avoiding plastic to get lost in the chain. By raising awareness of the plastic issue (Moore, 2016), the program aims at increasing levels of high-quality recycling while avoiding landfilling and incineration. Besides, the program also targets reducing litter in the streets, in order to avoid pollution in the cities and, consequently in nature. Additionally, it differs from other plastic recycling schemes because it is financed by the packaging industry, which incentives the manufacturers to optimise plastic packaging as they pay taxes according to the weight of packages commercialised (Plastic Heroes, 2017a).

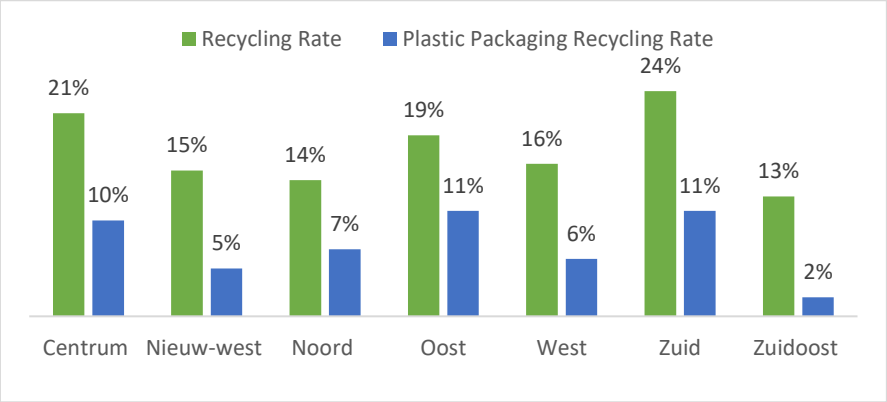
1.4 Problem Statement

The Netherlands recycles approximately 50% of all its waste (Dutch Waste Management Association, 2015, European Parliament, 2016, Plastic Heroes, 2017b) and with regards to plastic packaging recycling, the country experience an increase from 42% of recycling in 2012 to 50% in 2014 (Rijksoverheid, 2016). However, some municipalities still have a lot of room for improvement (Ministry of Infrastructure and the Environment, 2014; Rijksoverheid, 2016). such as the city of Amsterdam, that presented only 7,5% of plastic packaging recycling in 2015 (Gemeente Amsterdam, 2015).

Plastic packaging is the material with the biggest portion in volume in the waste of Amsterdam, representing 25% (Gemeente Amsterdam, 2015). However, before the implementation of Plastic Heroes in Amsterdam, the only way of recycling plastic packages was through the *Statiehelds* (Deposit System), which are stations located in the supermarkets where people could take their 1.5-liter plastic bottles and get a coupon of a little discount to use in another purchase. Another alternative for the population was taking the plastic packaging waste to one of the *Afvalpunten* (Waste Points) of the city (Gemeente Amsterdam, 2010) but this system required more effort and time from people to participate as there were only six of them in the whole city. In those conditions, the level of plastic that was recycled was practically zero (Plastic Heroes, 2017a).

After two years of the implementation of Plastic Heroes in the city, the recycling of plastic packaging increased from 0% to 7,5% in 2015, which is the average for all the districts in the city. However, when looked at separately, it is possible to see a clear disparity among the different districts in the city, as presented in Chart 1 (Gemeente Amsterdam, 2015).

Chart 1 - Household plastic packaging recycling rate in 2015



(Source: Gemeente Amsterdam, 2015)

A map of Amsterdam is provided in Figure 3 to make the division of districts more visual.

Figure 3 - Map of Amsterdam divided in districts

(Source: I amsterdam, 2017a)

Chart 1 shows that, after two years of implementation of Plastic Heroes, the district with the lowest rate is Zuidoost, with 2% only and the one with highest level of recycling in general and of plastic packaging is Zuid with 11%, which represents an alarming difference of 5,5 times in comparison with Zuidoost. Since the aim of the circular economy is to close the loops and eliminate waste, the first step is understanding what lead people to perform or not this pro-environmental behaviour (Sperl, 2016).

Among the factors influencing in pro-environmental behaviour, the psychological aspects of each person play a crucial role. This concept represents a mixture of self-interest from the individual of behaving in certain way, combined with the social environment in which the person is inserted (Bamberg and Möser, 2007). In addition, it is necessary also to understand how the awareness of circular economy influences in pro-environmental behaviour. Previous researches in China show there is a positive relation between both variables (Liu, Li, et al., 2009, Guo, Geng, et al., 2017).

Nevertheless, it has been found that for pro-environmental behaviour, other essential aspects to be considered are situational factors (Timlett and Williams, 2011). These factors can be facilitators or inhibitors of a certain behaviour, such as the infrastructure provided to make this behaviour more convenient for the population to perform (Miranda and Blanco, 2010). In the case of this research, these concepts were deeply analysed to explain what factors lead to residents of Zuid and Zuidoost to participate in Plastic Heroes and, based on that information, it is possible to make recommendations to improve and expand the program.

1.5 Research Objective

The research objective of this study is, therefore, to explain the factors that led two districts of Amsterdam to have such different household plastic packaging recycling rates after two years of implementation of the Plastic Heroes program that aim at creating a circular economy for the plastic packaging chain.

1.6 Research Question

1.6.1 Main Question

How did psychological factors, awareness of circular economy and situational factors influence the different results in pro-environmental behaviour in the districts Zuid and Zuidoost in Amsterdam after the implementation of Plastic Heroes Program?

1.6.2 Sub-questions

How was Plastic Heroes implemented in the two districts?

How did psychological factors influence the pro-environmental behaviour in plastic packaging recycling using Plastic Heroes?

How did awareness of circular economy influence the pro-environmental behaviour in plastic packaging recycling using Plastic Heroes?

How did situational factors influence the pro-environmental behaviour in plastic packaging recycling using Plastic Heroes?

1.7 Relevance of the study

Recognizing the key role cities play in shaping our future is part of the Millennium Development Goals[7] to achieve worldwide urban environmental sustainability and efficient use of resources (United Nations, 2015). We need to envisage cities and human settlements that minimize their environmental impact and protect their biodiversity.

It is crucial, therefore, for cities to change the course of socio-economic development (WWF, 2016) and for people to change their behaviour towards a more environmentally sustainable future (Steg and Vlek, 2009). In that sense, understand the factors to lead people to participate or not in the Plastic Heroes program is very important for Dutch government in helping achieve the targets for circular economy and make better use of resources, in this case plastic in especial.

1.8 Scope and Limitations

For this research, only the districts of Zuid and Zuidoost of Amsterdam were selected to be studied as they were the ones that presented the most different results after the implementation of the project. It would definitely be interesting to include the other districts in the comparison, but it was decided to get deeper information in the two districts rather than having a broad perspective of all of them. More about the methodology used will be further explained in Chapter 3.

Additionally, as part of the data collection, interviews were conducted with households from the two districts. However, prior to field work it was proposed to interview also professionals from the municipality in the waste management department and community centres. Unfortunately, those interviews could not be administered. During data collection in June and July, the employees at the municipality were on vacation which prevented the researcher to have contact with them. Nevertheless, regarding the community centres, none of them

[7] The Millennium Development Goals are a set of targets agreed internationally to deal with worldwide problems such as hunger and poverty. Among the goals, there is achieving environmental sustainability (United Nations, 2015).

consented to participate in an interview as they claimed not having any kind of engagement with the waste management, environmental awareness and plastic issues.

Chapter 2: Literature Review / Theory

2.1 Introduction

Chapter 2 begins with a detailed explanation of the development of solid waste management since the 19th century until the contemporary world, with the origination of the concept of circular economy. The concern with environmental issues increased along time and the participation and engagement of the population has become more and more essential. Due to that, several aspects that influence pro-environmental behaviour have been studied, which led to the conception of important theories. Some of them were thoroughly revised such as the Norm-Activation Model (Schwartz, 1977) and the Theory of Reasoned Action (Ajzen and Fishbein, 1980), but the selected for this research was the Theory of Planned Behaviour (TPB) by Ajzen (1985). This theory involves psychological factors related to behaviour, however, other aspects were also observed as important such as awareness of circular economy and situational factors, that can inhibit or facilitate the behaviour. Based on the theories and concepts developed through the literature review, Chapter 2 finally introduces the conceptual framework which structures and guides the whole research.

2.2 Solid Waste

Rubbish, garbage, trash, litter, residue, waste. There are many ways people name things that are not useful for them anymore. The question that poses is how do cities deal with it? The following sections explain what is solid waste management and how this concept is developing towards the circular economy.

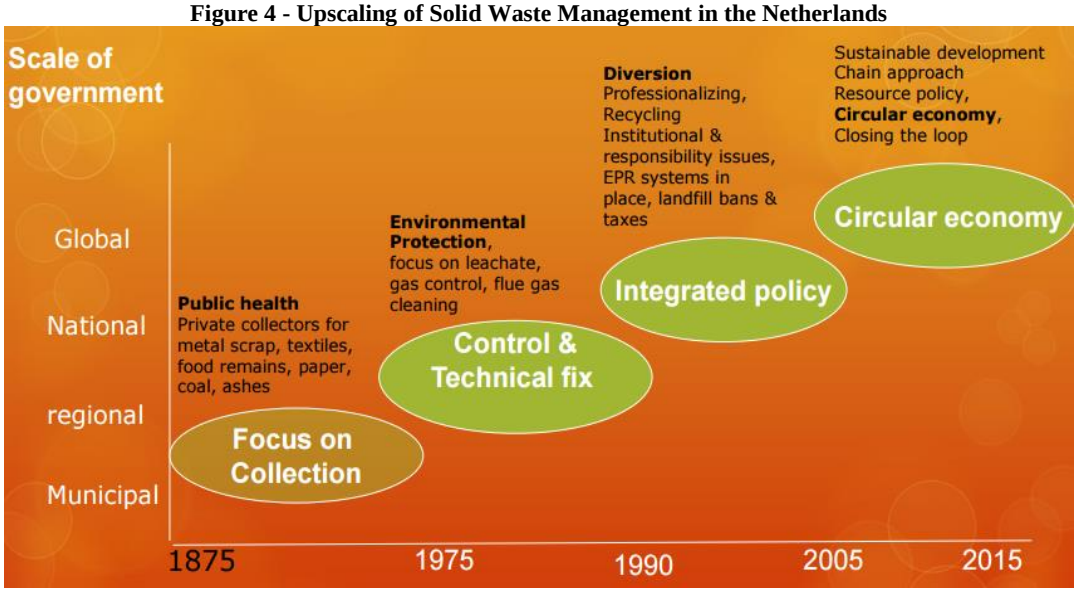
The focus of this study is plastic, which represents 27% of the total volume and whose market has a growth rate of 5% annually, based on data of 2015 (Ellen MacArthur Foundation, 2016). However, this chapter refers to waste in general, as the theories and concepts can be applied independently of the material.

2.2.1 Upscaling of Solid Waste Management

One of the most challenging problems for humanity in the urban environment has always been solid waste management (Scheinberg, Wilson, et al., 2010) and it is the most important service provided by municipalities (Hoornweg and Bhada-Tata, 2012). According to Jacobi (2006), countries and municipalities started investing in this infrastructure sector for health and safety reasons. However, today the planet demands more: these projects must also be sustainable.

Figure 4 presents how the methods for managing waste transformed over different periods of time and in relation to different levels of government. The graph is related to the Netherlands, but it can be generalized to other countries to some extent. It is important, though, to consider that each country or city is in a different stage and the Netherlands is one of the most advanced countries in terms of waste management (Rijksoverheid, 2016).

Figure 4 - Upscaling of Solid Waste Management in the Netherlands



(Source: Houtman, 2016)

According to the graph presented in Figure 4, the first regulations and policies on waste management happened in city level and they were focused only on waste collection for public health reasons. The lack of a proper collection system and consequent accumulation and decomposition of waste in the streets could cause several problems such as contamination of soil and water and proliferation of rats and insects. Several diseases were explained by these problems like cholera and leptospirosis that were highly lethal. For these reasons, the previous plans for solid waste management were mainly focused in protecting citizen's health and taking the waste far from the cities (Klundert and Anschütz, 2001, Scheinberg, et al., 2010).

After public health issues were tackled, the attention in solid waste management turned to environmental protection (Houtman, 2016). Until this point, the waste was mainly disposed in areas without any control of the decomposition process resulting in highly polluted places due to the release of gas and leachate on the environment. The gas eliminated in the decomposition of waste contains large quantities of methane (almost 50%) which is 20 times more threating for climate change than carbon dioxide. Another issue was the leachate, because the release of this liquid in the environment could cause contamination of soil and water and, consequently, be dangerous not only for people living in the surrounding areas but also for the flora and fauna. In that context, the focus of solid waste management started to address the disposal methods in order to protect more the environment. Policies to encourage use of landfills instead of dumping sites are an example of this approach, because landfills monitor the release of gas and leachate and give these compounds a proper treatment (USEPA, 2012).

Still following the graph in Figure 4, it possible to see that in the last few decades, the solid waste management sector developed to a more integrated approach (Houtman, 2016). According to Wilson, Velis, et al. (2013), before the introduction of sustainability to solid waste management, this service was just a combination of processes that were badly integrated among each other and did not take into account the whole system. As an example, the collection of waste was important for public health, but the production of waste and disposal involved systems that were technically independent which made it inefficient and unsustainable. The concept of Integrated Sustainable Waste Management (ISWM) emerged from this need of looking at waste management from a broader perspective (Scheinberg, et al., 2010).

The ISWM addresses solid waste management problems taking into consideration the three pillars of sustainability, which are economic, environmental and social sustainability (Wilson, et al., 2013). This system also emphasises the importance of local conditions and cultural circumstances of the location where the scheme is been applied by recognizing three important dimensions in waste management: stakeholders, waste system elements and sustainability aspects (Klundert and Anschütz, 2001, Wilson, et al., 2013, Hoornweg and Bhada-Tata, 2012).

The first dimension is referred to the stakeholders involved in waste management in a specific city or country. They must be identified in that context as well as their interests and their importance. A good example is the presence of informality in developing cities, which leads to many different stakeholders like the waste pickers and the informal private sector that must be considered in order to develop effective waste management programs (Klundert and Anschütz, 2001, Wilson, et al., 2013).

The second dimension refers to the practical or technical elements of a waste management system such as generation, separation, recycling, reuse, collection, transportation, incineration and disposal (Klundert and Anschütz, 2001, Wilson, et al., 2013). The Europen Commision (2010) follows a waste management hierarchy where priority is given to preventing waste, opposite to using landfills or incinerators as an alternative to dealing with waste.

The third dimension of ISWM are the sustainability aspects which basically refers to the realities existed where the project is operated (Hoornweg and Bhada-Tata, 2012). There are six aspects: environmental, political/legal, institutional, socio-cultural, financial and, lastly, technical. The environmental aspects focus on the effects that each specific waste management system has on the environment, in terms of pollution, health and conservation of resources. On the other hand, the political and legal facets relate to the regulations and policies at national and local level that shape boundaries and priorities of a project (Klundert and Anschütz, 2001). The institutional aspects are related to the institutional structure which affect in the control and implementation of ISWM projects. With regards to socio-cultural features, it is essential to consider the cultural particularities to understand factors such as waste generation and composition, community involvement in waste management and social condition of waste workers. Concerning financial and economic aspects, cost recovery issues and accountability can be totally different depending on the city or country. Lastly, technical aspects are related to practical concerns of the implementation, such choice of equipment, design of facilities and maintenance plans (Klundert and Anschütz, 2001).

Most of the countries, especially developing ones, are still developing policies and regulations to boost an integrated approach to solid waste management. However, the most developed countries, such as the Netherlands and other countries in the EU, are already one step ahead: in transition from ISWM to CE (Houtman, 2016). The Netherlands is at this moment in stage of looking at waste as resource flows rather than a problem and adopting circular economy policies (European Commision, 2014, Guo, et al., 2017). The basic aim of the circular economy is to decouple economic growth from environmental harm while building a resource-efficient and environmentally friendly society (Geng, Sarkis, et al., 2016, Liu, et al., 2009). The following section will introduce the concept of Circular Economy and how it can be applied in different situations.

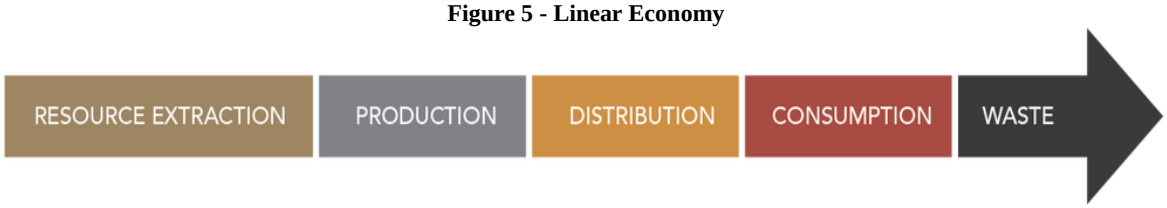
2.3 Circular Economy

Without a doubt, the improvement in quality of life brought by technology came hand in hand with more disposable products and more objects with shorter lifespans (European Commission, 2010). Millions of tons of materials that could rather be reused or recycled end up being disposed in landfills and dumpsites, or incinerated, which means that a resource is lost and more must be taken from nature as raw material (Wilson, et al., 2013). Having that in mind, in order to improve resource-efficiency, the whole life-cycle of a product should be considered. That is the central idea of the circular economy that will be thoroughly explained in the following sections.

2.3.1 Definition

After the Industrial Revolution in the 18th and 19th century, the way we produce goods changed completely. The implementation of an increasingly more productive and innovative system led to an improvement in the average life standards worldwide and to a rapidly advance of technology, which brought benefits in many areas. However, one of the negative consequences of that is that we found society massively exploring the raw materials and having to deal with huge amounts of polluting contaminants and solid waste from when people decide to "throw away" what they bought and consumed. The name given to this system of "take-make-dispose" is Linear Economy, as presented in Figure 5. (Kobza and Schuster, 2016, Liu, et al., 2009).

Figure 5 - Linear Economy



(Source: Export Leadership Forum, 2015)

As it can be seen in the picture, the linear economy is a unidirectional system where raw materials are transformed into a product that is, afterwards, consumed and disposed as waste (Elia, Gnoni, et al., 2017). In the last few decades, driven by the desire of maximizing profit, most businesses, especially the global scale ones, decided to irresponsibly cut costs, which created a destructive system where people buy products but cause environmental harm and social inequality (Kobza and Schuster, 2016). In 2011, 80% of the world's resources were consumed by 20% of the world's population (Lehmann, 2011).

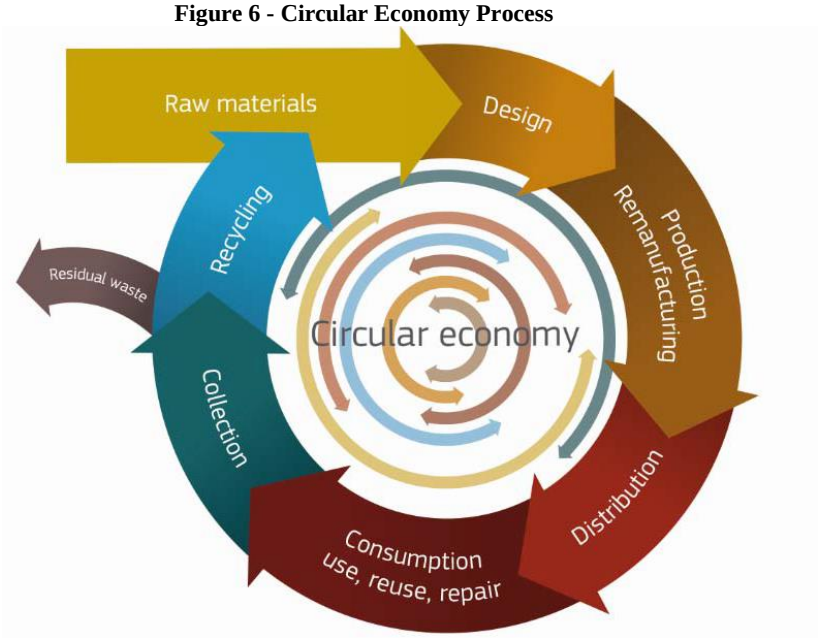
Due to the resource shortage the world is facing now, the Linear Economy is a system fade to failure (Kobza and Schuster, 2016). Therefore, it is high time we decouple economic growth from environmental losses (Ghisellini, Cialani, et al., 2016, Geng, et al., 2016) by improving resource-efficiency, reducing the production of waste and the emissions of greenhouse gases (Guo, et al., 2017). One of the possible ways to achieve that is through the circular economy (Kobza and Schuster, 2016, Liu, et al., 2009).

The Circular Economy is a relatively new concept and various authors define it in slightly different ways (Ghisellini, et al., 2016, Kobza and Schuster, 2016). As stated in Kobza and Schuster (2016), the widely-used definition is the one from the leading foundation in research about the circular economy, the Ellen MacArthur Foundation. This foundation is a British organization created in 2010 to help accelerate the transition to the circular economy internationally by establishing the concept in the agenda for governments, businesses and academia (Ellen MacArthur Foundation, 2017). According to the Ellen MacArthur Foundation (2012: pg. 9), the "circular economy is an industrial system that is restorative or regenerative

by intention and design" and "aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models".

In addition to that, according to Kobza and Schuster (2016), the key difference between linear economy and circular economy is the fact that the latter is based on life-cycle thinking. It implies considering the environmental impact of the whole life-cycle of a product from production and design to transportation, distribution, consumption, reuse and recycling. Besides, at the end-of-life of a good, it should not be seen as waste but rather as a resource that can be used to make new products, which avoids the use of new raw materials. In the circular economy, the value of the products last as long as possible and the recovery and valorisation of waste are key to bring the resources back to the value chains (Elia, et al., 2017). Figure 6, provided by the European Commission (2014) presents that idea more clearly.

Figure 6 - Circular Economy Process



(Source: European Commission, 2014)

Murray, Skene et al. (2015), however, defines circular economy with a moderately different view. According to the authors, the term took the word "circular" for both a linguistic and a descriptive meaning. By the former, it would simply relate to the opposite of "linear", used for linear economy. However, by the latter it would mean to restore the cycles to their natural levels, because in nature, nothing is disposed to not be used anymore. Instead, all materials flow in cycles, one species waste is another's food, all the energy is provided by the sun and when an animal dies, the nutrients go back to the soil to be used again.

2.3.2 Applications

There are different ways of applying the circular economy and three levels of initiatives which are: micro, meso and macro-level (Murray, et al., 2015, Ghisellini, et al., 2016). For this research, the circular economy in micro and macro-level are the most important ones as Plastic Heroes, although being a national program for collection and recycling of plastic packaging in cities, is also financed by the manufacturers who have to pay for the amount of packaging they produce. That encourages the industry to optimize their packages and to recycle plastic with the highest quality possible.

Micro-level

The micro-level application corresponds to single enterprises that want to change their processes to improve circularity (Murray, et al., 2015). The term "circularity" in this case means to increase durability, reparability and recyclability, which implies extending the life cycle of a product and keeping the highest value possible of it (Kobza and Schuster, 2016).

Another important aspect is the production process that should be made in a more sustainable way. It can be done by using non-toxic materials and alternative resource materials such as residual materials or other recycled and reused products (Elia, et al., 2017). Besides, it can be by using compostable that make it easier for the consumer to put it back in the cycle afterwards (Murray, et al., 2015).

Several companies nowadays see the circular economy as a way of enhancing the environmental performance of their products through the whole lifecycle but also as a way of improving their supply chain efficiency and increasing profitability (Ghisellini, et al., 2016).

Meso-level

Although the micro-level application is possible, it is tough for a company to implement a complete circular system on its own. The meso-level application relates to a cluster of businesses that work together to create a circular network and promote economic development allied with environmental benefits. In these case, what companies do is use economies of scale and cooperation to design, source, produce and deliver goods (Winkler, 2011).

A good example of this application is the concept of eco-industrial parks or industrial symbiosis districts, which are areas where several different companies locate and share resources such as water, waste and energy. Commonly, the residual material of an industrial process of a company is the main resource of the process of another one. This type of approach of the circular economy can happen both by top-down regulations and policies and also by bottom-up agreements among the participant companies (Ghisellini, et al., 2016).

According to Winans, Kendall et al. (2017), one of the countries that is a pioneer in this kind of project is China. By 2009, China had 100 eco-industrial parks and the Chinese government issued a national circular economy program to encourage these initiatives with policies. It is believed it can benefit achieve sustainable development in the three pillars of sustainability: environmental, economic and social aspects (Geng, Zhang, et al., 2009).

Macro-level

The macro-level implementation relates to the circular economy applicable in city and national level (Geng, et al., 2016). The numerous material flows that exist in an urban context should be, in this new system, circulating within the boundaries of the cities (Sperl, 2016). Imports and exports should be avoided, and resources should be provided locally as much as possible (Sperl, 2016).

Circular economy in city level is still a developing concept that has a challenging application. It involves looking at macro-level circular economy application is through local or national policy strategies that incentive micro and meso-level approaches, such as eco-design regulations and tax policies on pollutant companies (Geng, et al., 2016). Besides, it also considers the integration and redesign of several infrastructure systems in order to achieve more sustainable transportation, water and wastewater recycling, clean energy production and solid waste reduction, reuse and recycling (Ghisellini, et al., 2016).

In that sense, we definitely cannot summarize circular economy as recycling but boosting resource efficiency demands good service provision and integration in waste management sectors (European Environment Agency, 2014). Encouraging waste prevention, reuse and recycling while limiting landfilling have been part of the targets for the EU in closing the loop to achieve circular economy systems (European Commission, 2014).

The linear economy is approaching its limits and it is time for society to find a way to be less resource-dependent and to change mindsets to better use the goods that we already have. Various environmental problems are caused and can be avoided by human behaviour, through people's lifestyles and daily choices. Changing the behaviour of people towards pro-environmental is challenging but can reduce the harms of human activity in the planet (Steg and Vlek, 2009, Liu, et al., 2009).

2.4 Pro-Environmental Behaviour

A transition to environmental behaviour can happen through various mechanisms and agents. There is a lot of undergoing debate and research to understand what factors influence behaviour and how it can be changed to sustainable actions (Brown and Vergragt, 2016). The following sections present the theories and concepts used in this research to explain pro-environmental behaviour.

2.4.1 Definition

Before explaining what factors can help and barrier pro-environmental behaviour and theories that explain the phenomenon, it is necessary to first define the concept. Pro-environmental behaviour, according to Kollmuss and Agyeman (2002), is the act of consciously making choices and behaving in ways that minimize the negative impacts on nature. Ones, Wiernik, et al. (2015) complements the definition by defining pro-environmental behaviour simply as contributing to environmental sustainability through individual actions such as reducing waste, recycling and saving energy.

The vital role played by people's choices and lifestyles in achieving sustainable development and reducing environmental impact is one of the few points agreed by the international community (Liu, et al., 2009, Steg and Vlek, 2009). However, in order to properly issue meaningful programs and policies, it is necessary to deeply understand the factors that lead to pro-environmental behaviour.

Among the factors already studied to influence in pro-environmental behaviour are awareness, social norms, attitudes, feelings of guilt (Bamberg and Möser, 2007), status, effort, behavioural opportunities, situational factors (Steg and Vlek, 2009), connectedness to nature, demographic characteristics, environmental relevant values (Ones, et al., 2015) among others.

Another important aspect to be taken into consideration is the inconsistency of people when making sustainable choices, in other words, one person can act environmentally friendly in one aspect of their life, but not in others. One example would be a person that does waste segregation and recycling but that chooses a polluting mode of transportation. This fact indicates that many different factors impact in behaviour and each case should be looked at attentively (Steg and Vlek, 2009).

When it comes to recycling in specific, other factors influencing in the behaviour are also knowledge about the recycling programs, rewards (if applicable), satisfaction with the infrastructure provided, among others (Miranda and Blanco, 2010). In the case of this research, having pro-environmental behaviour means participating in the Plastic Heroes project by segregating plastic packaging and taking it to the containers provided by the municipality in

both districts of the city. Therefore, it is important to understand what factors are influencing the most when it comes to recycling behaviour in this project. Some of these factors are going to be detailly addressed in this research through the use of theories and concepts that explain general behaviour choices and that can be applied to sustainability.

2.4.2 Theories

One of the first theories to analyze behaviour was the Norm-Activation Model (NAM) in 1977. This theory explains behaviour based on social interactions and moral norms, resulting in people acting in a certain way because of a feeling of obligation to do it as they are part of a community. The NAM should be chosen when the focus of the study is social norms or the researcher thinks this aspect is more important than others for a specific situation (Bamberg and Möser, 2007, Schwartz, 1977).

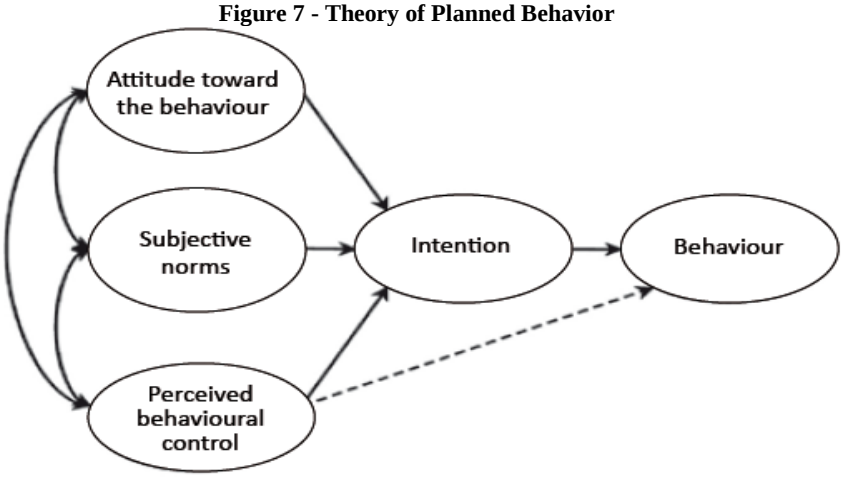
As more research was done in psychology, it was found that, allied with subjective norms, there was also self-interest of people as a determinant of behaviour. This mix of self-interest and social motives led to the creation of the Theory of Reasoned Action (TRA). According to this theory, the self-interest shows the personal beliefs, or in other words, the attitude of a person towards a specific behaviour while the subjective norm represents the normative belief. Both ideas cause the intention of behaviour, which in the case of the TRA, is directly related to the behaviour in itself. In other words, if an individual has the intention to perform a behaviour, they will (Ajzen and Fishbein, 1980, Fishbein and Ajzen, 1975, Madden, Ellen, et al., 1992).

In 1985, however, the authors of the TRA complemented the concepts of this theory and created the Theory of Planned Behaviour (TPB). This theory, apart from the self-interest and the social norm aspects, which were already mentioned in the TRA, includes a third aspect: the perceived behavioural control. This last idea basically means how much the person thinks he/she is in control of the behaviour and how easy or hard it is for the person to perform it. Based on the fact that, for pro-environmental behaviour and more specifically for recycling, the three concepts are important, the theory chosen in this research is the Theory of Planned Behaviour. Previous studies showed that these three components are important to explain pro-environmental behaviour (Bamberg and Möser, 2007, Ajzen, 1985).

2.5 Psychological Factors – Theory of Planned Behaviour

In the last decades, the TPB has been widely used to successfully explain various types of behaviour and, among them, pro-environmental behaviours such as water consumption, sustainable purchasing and household recycling (Steg and Vlek, 2009). Figure 7 shows the scheme of the TPB, which has been proved to be a good theory to be used when both aspects of self-interest and social-interests need to be addressed, which is the case of this research (Bamberg and Möser, 2007, Ajzen, 1991). However, it is also important to understand the limitations of the TPB. According to Chu and Chiu (2003), this theory was developed to analyse single behaviours and not a set of alternatives that people might have. Also, several authors showed the need of adding more concepts to their study in order to complement the idea presented in this theory, which also proves its limitations (Cheung, Chan, et al., 1999).

Figure 7 - Theory of Planned Behavior



(Source: Ajzen, 1991)

In the TPB, behaviours are determined by behavioural intentions, which are constructed by the three aspects already introduced in the previous section: attitude towards the behaviour, subjective norm and perceived behavioural control (Ajzen, 1991, Cheung, et al., 1999, Braakhuis, 2016, Timlett and Williams, 2011). All of them will be detailed in the following sections.

In the case of perceived behavioural control, it can be seen from the figure that this aspect can have either an indirect and a direct effect on behaviour. In the former, it influences intention and consequently behaviour and, in the latter, directly in behaviour (Ajzen, 1991). For this research, the direct effect will not be considered as other concepts will be included in the conceptual framework, to be presented in the end of this chapter.

2.5.1 Attitude towards the behaviour

According to Kollmuss and Agyeman (2002), attitude is a feeling about a person, an object, an issue which can be favourable or unfavourable. In the case of behaviour specifically, attitude towards the behaviour represent to what extent a person has a positive or negative evaluation about the behaviour in question (Ajzen, 1991). The attitudes are constructed based on the belief that the behaviour will lead to a certain consequence or outcome and the evaluation of that consequence shapes the attitude (Braakhuis, 2016). As an example, applying that idea to recycling, it can be said that a person will have a positive attitude towards recycling when the outcome it can have to society and the environment is evaluated by this person as positive. In other words, if one thinks recycling does not have an actual positive impact, their attitude towards it is therefore negative (Cheung, et al., 1999, Bamberg and Möser, 2007).

Besides, other ways of influencing the attitude towards a certain behaviour is through rewards or punishments, which affect the way people evaluate the consequence of a certain act. That means that what defines the attitude towards a behaviour is the sum of perceived negative and positive consequences, determining a global attitude (Bamberg and Möser, 2007). Nevertheless, it is important to emphasize that attitude towards a behaviour is very different from the behaviour itself (Ajzen, 1991). From previous studies, it was found that attitudes do not play a very strong role in influencing behaviour, although the relation exists. A recent study conducted in Hangzhou, China had similar results based on a community-based survey also did not find any significant influence of attitude in the behaviour (Xu, Ling, et al., 2017)

However, attitudes can be used as a predictor of behaviour, taking into consideration that other factors may also have an effect (Schultz, Oskamp, et al., 1995, Cheung, et al., 1999). A previous

study conducted in Greece by Botetzagias, Dima, et al. (2015) also resulted in attitude as a significant predictor to recycling behaviour. Because of that, it was important to consider attitudes towards recycling in this thesis.

When using TPB to analyse a certain behaviour, one important aspect to have attention to is the fact that the study of the attitude should be specifically for that behaviour, not as an umbrella issue (Braakhuis, 2016). Using again the case of recycling, when inquiring people about their attitude towards that behaviour, the researcher should ask straightforward questions about recycling, not about general environmental issues or other types of pro-environmental behaviour. This is a way of guaranteeing the internal validity and the consistency of the research (Cheung, et al., 1999).

2.5.2 Subjective Norm

The second determinant of behaviour intention according to the TPB is subjective norm. This concept is related to the beliefs of a person on how other people view a behaviour (Braakhuis, 2016). According to Ajzen (1991) these beliefs can create a perceived social pressure, which therefore influence the intention to perform or not a behaviour. In other words, subjective norm shapes the beliefs that the act will be approved or disapproved by other people, such as family members or neighbours. (Cheung, et al., 1999).

Subjective norms cause a person to have a certain behavioural intention to comply with what other people are doing (Cheung, et al., 1999), to avoid social exclusion (Bamberg and Möser, 2007), to reflect their concerns about society or to contribute to the welfare of the community (Ebreo, Hershey, et al., 1999). In summary, behavioural intention can be determined by subjective norms because if people are part of a community, some behaviours are expected from them as part of the community (Ebreo, et al., 1999).

In the case of pro-environmental behaviour, previous studies already proved the contribution of subjective norm to the explanation of certain behaviours such as energy saving, waste recycling, transportation mode choice and sustainable purchasing (Bamberg and Möser, 2007). When it comes specifically about recycling, according to Schultz, Oskamp, et al. (1995) and Chu and Chiu (Chu and Chiu, 2003), researches found that recycling by friends, family and neighbours influenced in individual's own actions. Cheung, Chan, et al. (1999) also points out the importance of community leaders in engaging people in recycling programs.

However, more recent researches such as the one in China by Xu, Lin, et al. (2017) and in Greece by Botetzagias, Dima, et al. (2015) and by Ioannou, Zampetakis, et al. (2013), who did not find subjective norm as statistically significant. A possible explanation for these results was offered by Schwartz (1977), who mentioned that if social norms are personally adopted by individuals, it is not seen as pressure anymore but rather an internal motivation.

Based on those facts, in the case of this research the study of subjective norms was an aspect that needed to be considered because it can have different effects in different neighbourhoods.

2.5.3 Perceived Behavioural Control

The last determinant considered in the TPB is the perceived behavioural control. This concept represents the extent to which a person thinks he/she is in control of that behaviour or that he/she can perform it successfully. In other words, it relates to how easy or difficult, or which impediments or obstacles an individual perceive in performing a certain behaviour (Ajzen, 1991, Braakhuis, 2016). In addition, Madden, Ellen, et al. (1992) explained perceived behavioural control also relates to an individual's belief of having the requisites needed to perform a behaviour. "The more resources and opportunities individuals think they possess,

the greater should be their perceived behavioural control over the behaviour" (Madden, et al., 1992: p. 4).

In the case of recycling, important factors to be taken into consideration are household space and time. Some people might perceive their space at home as too small to segregate waste or that it makes the space messy, which leads them to not develop intention towards recycling (Timlett and Williams, 2011). Same idea can be used when it comes to time, because individuals might perceive recycling as a behaviour that takes more time than they have or want to spend with it, leading to not performing the behaviour (Chu and Chiu, 2003).

The authors Chu and Chiu (2003) did a study in Taiwan that showed a good example of perceived behavioural control influencing recycling behaviour and consequently the solid waste management system of the city. According to them, in Taiwan, the houses are usually very small which makes it harder for citizens to segregate daily waste at home. Additionally, these results also comply with previous studies conducted by Xu, Lin (2017) and Botetzagias, Dima, et al. (2015) who found perceived behavioural control as a significant predictor of household waste separation behaviour.

Therefore, in their study, Chu and Chiu (2003) recommend that, in order to boost household recycling, policies should concentrate on increasing the frequency of door-to-door collection or on establishing on-site recycling containers in buildings or stores. The example shows how important is the idea of perceived behavioural control in explaining recycling behaviour. Therefore, this concept will be analysed in this research as well.

2.6 Awareness of Circular Economy

Even being the Theory of Planned Behaviour a broadly applied theory to explain recycling behaviour, in the case of this research, it was decided to expand it a little bit. As the theory is not specifically for pro-environmental behaviour, the concept of awareness is not considered as a determinant for behaviour. However, including this concept can enrich this study and make it more interesting.

Environmental awareness is defined by Kollmuss and Agyeman (2002) as a combination of the knowledge of human impact on the environment and the emotional involvement caused by the affection with these impacts. Previous studies already found that there is a positive relation between awareness and pro-environmental behaviour, in various degrees (Bamberg and Möser, 2007, Miranda and Blanco, 2010).

According to the study conducted by Miranda and Blanco (2010) environmental awareness has a very significant correlation with recycling rate. In other words, the more highly environmentally aware a person is, the more he/she will participate in recycling programs (Miranda and Blanco, 2010). Previous studies showed that the portion of the population that is more aware and that perform more pro-environmental behaviour are usually women with high education level (Kollmuss and Agyeman, 2002). Adding to that, Schultz, Oskamp, et al. (1995) presents more specific information saying that people with the highest level of environmental awareness tend to be young, female, highly educated, higher earners, ideologically liberal and urban dwellers.

2.6.1 Understanding of Circular Economy

The Netherlands is one of countries with the highest levels of environmental awareness, along with Sweden, Germany, Austria, Switzerland, Denmark, Finland, Luxembourg and Norway (Miranda and Blanco, 2010). Although a great number of researches already investigated the impact of environmental awareness in pro-environmental behaviour, there is a lack of research

in awareness of CE specifically. Being Amsterdam a city that is working so much to achieve the circular economy and, considering the lack of research in awareness of circular economy in the Netherlands, it was decided to add this concept in the framework. Because the Plastic Heroes project is part of a bigger plan from the Netherlands to achieve Circular Economy (Rijksoverheid, 2016), it is interesting to understand if the awareness or unawareness or even misunderstanding of the concept of CE influence in the behaviour of the population. Also, if this aspect can somehow help explain the difference in plastic packaging recycling behaviour in the districts of Zuid and Zuidoost in Amsterdam.

Comprehending the perspective of the people towards CE can help us better understand how the CE can be promoted and implemented (Guo, et al., 2017). In 2009, awareness of CE was measured by Li, Liu et al. (2009) by asking people in the city of Tianji, China, if they had ever heard the term "circular economy". The results showed that only 13.1% of the respondents chose the answer "I understand circular economy very well", 58.2% had just heard of it, and 28.7% had never heard of the word "CE". In conclusion, the authors explained that in order for policies to be effectively applied, people's support and involvement is key. Therefore, more time, money and effort should be invested in motivating and engaging the citizens.

A few years laters, the knowledge of CE was measured by Guo, Geng et al (2017) by asking if people of Urumqi Midong area had ever heard of the concepts "circular economy" and "sustainable development". The research presented as result that people were a lot more familiar with "sustainable development" than "circular economy" and the authors concluded that more efforts should be put in promoting the dissemination of the concept. Especially considering that China that is a pioneer in circular economy application, as already explained in previous sections.

2.7 Situational Factors

However, in the case of recycling and other pro-environmental behaviours such as use of public transport and sustainable consumption, there is a very strong component in the equation which are the situational factors. Situational factors are facilitators or inhibitors of a certain behaviour, which can be both about the service provided and the information about it (Schultz, et al., 1995). This section will explain what are situational factors and how they might influence in the choice of performing recycling behaviour.

2.7.1 Infrastructure Provision

Pro-environmental behaviour results from an interaction between personal and situational factors. It is important to not attribute behaviour only to the disposition of an individual but consider situational forces that are simultaneously present in the equation (Timlett and Williams, 2011). People tend to perform behaviours that are more convenient to them in many ways such as less costly, less time-consuming or that demand less effort. For that reason, many pro-environmental behaviours can only happen if the necessary infrastructure is well provided, such as taking public transportation or recycling. In other words, the poorer the service, the less likely people are to use them. (Kollmuss and Agyeman, 2002).

In the case of recycling, a good example is the collection methods that can be a facilitator or inhibitor. If the collection method is made by recycling stations, it requires more time and effort for people to participate if they do not live close to one, making it an inhibitor of the behaviour. Probably only very motivated people will travel a longer distance to take the recyclable waste. That is why the perception of each person is important (Timlett and Williams, 2011).

Following the same idea, if the collection is done by containers very well distributed and accessible within a city or neighbourhood, it can turn into a facilitator of the behaviour. In other

words, the number and the location of the containers should ensure the population has access to the infrastructure (Miranda and Blanco, 2010). However, it is important to note that the important aspect in this case is not the location in itself but rather the perception of the location of containers. Different people living in the same building can perceive the location of a recycling container in different ways. Some might think a container is very close to their house while others might disagree. Another important factor when it comes to the use of containers is the frequency of collection. It can be a barrier for people of a certain area if the collection is not done in a proper frequency and whenever they take their waste to the containers they are full (Cheung, et al., 1999).

Schultz, Oskamp, et al. (1995) also gives the example of collection of recyclable waste that sometimes is done according to a schedule that does not coincide with the schedule of households, making it difficult for them to engage in the behaviour. The examples show the importance of improving the infrastructure to make it more convenient to the people, in a way that require them less effort (Schultz, et al., 1995).

For these reasons, in the case of this research, it is necessary to understand if the population in both districts studied are satisfied with the infrastructure provided by Plastic Heroes. That can be done by asking their perception on the type of collection method adopted, number and location of containers.

2.7.2 Information about the program

As mentioned before, another important factor to be considered regarding the situational factors of recycling infrastructure, is the communication with the users. Providing knowledge for the population is key to engage citizens to participate and perceive a certain behaviour (Cheung, et al., 1999). According to Miranda and Blanco (2010), in order to encourage people to participate in recycling, it is more appropriate to provide information rather than focusing on attitudes, for example.

It is necessary to include in the project ways of orienting the people about the collection method, what to do with different materials, among other details of the project (Cheung, et al., 1999). Previous studies showed that people that are well informed about recycling programs in their cities, are more likely to commit to participating and feel satisfying about it (Miranda and Blanco, 2010).

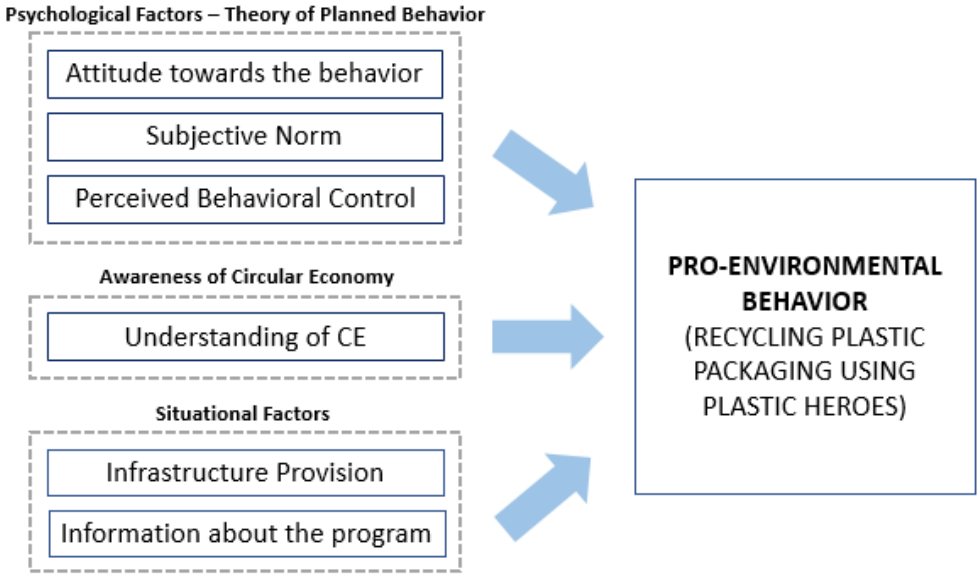
According to Miranda and Blanco (2010), information campaigns are the most common method of promoting recycling behaviour. This method is based on the use of mass media, advertisements in the local press, brochures delivered to citizens, posters, among others. It is important when implementing a recycling project, to consider how people can have better access to that information and if it is adequate, in other words, if it is transmitting what is intended to.

When it comes to mass media such as TV and radio, it can be said that the biggest advantage is definitely the amount of people that can reached, in considerably lower costs (compared to other methods). Written messages, on the other hand, are an easier way to get the message across. However, both methods have some drawbacks due to the fact that they not necessarily bring actual changes in behaviour. Regardless of the tool used, one important aspect to be considered when studying in an international city is that many people might not speak the local language and, consequently, not understand the information about the program and not participating (Miranda and Blanco, 2010).

2.8 Conceptual Framework

Based on the literature review presented in this chapter, the conceptual framework to be used in this research is presented in Figure 8 as follows.

Figure 8 - Conceptual Framework



(Source: author, 2017)

The psychological factors will be based on the Theory of Planned Behaviour, considering the concepts of attitude towards the behaviour, subjective norm and perceived control as determinants. Also, awareness of circular economy will be also considered as an independent variable based on what is the understanding of people regarding this concept. Lastly, situational factors are also included, being these the infrastructure provided and the information about the program.

The dependent variable in the framework is pro-environmental behaviour, which in the case of this research is the act of recycling plastic packaging using the Plastic Heroes project. The following Chapter shows how the theoretical information was developed into measurable indicators and how the data was collected.

Chapter 3: Research Design and Methods

3.1 Introduction

Chapter 3 introduces how the literature presented in Chapter 2 was developed into empirical research. The theories and concepts selected to be the basis of this research need therefore to be divided in indicators in order to be measured. First, the operationalization table clarifies what are the variables and indicators chosen and the data collection method used for each. Then, the use of case study as a research strategy is discussed, concentrating in how to avoid problems regarding the validity and the reliability of data collection. Finally, this chapter presents the data analysis instruments chosen to answer the research questions.

3.2 Revised Research Questions

3.2.1 Main Question

How did psychological factors, awareness of circular economy and situational factors influence the different results in pro-environmental behaviour in the districts Zuid and Zuidoost in Amsterdam after the implementation of Plastic Heroes Program?

3.2.2 Sub-questions

How was Plastic Heroes implemented in the two districts?

How did psychological factors influence the pro-environmental behaviour in plastic packaging recycling using Plastic Heroes?

How did awareness of circular economy influence the pro-environmental behaviour in plastic packaging recycling using Plastic Heroes?

How did situational factors influence the pro-environmental behaviour in plastic packaging recycling using Plastic Heroes?

3.3 Operationalization

Operationalization is the name given to the translation of theories and concepts developed in the literature review into indicators that can be measured and collected using different methods.

3.3.1 Definition of variables

Psychological Factors

The psychological factors are explained based on the Theory of Planned Behaviour and considering the variables: attitude towards de behaviour, subjective norm and perceived behavioural control. The first variable regards to each individual's evaluation of the behaviour. In this case, the indicator measure is the perception of the act of recycling, which means if the people perceive recycling as something beneficial to the environment and worthwhile (Ajzen, 1991, Kollmuss and Agyeman, 2002).

The second variable, subjective norm, relates to a person's beliefs on how other people perceive recycling of plastic packaging (Ajzen, 1991, Braakhuis, 2016), such as neighbours, friends and family members (Cheung, et al., 1999). The indicators to be measured in this research are then the perception of the behaviour of the people that live with the respondent and of neighbours.

Lastly, perceived behavioural control can be simplified into perceived easiness of performing recycling (Ajzen, 1991, Braakhuis, 2016, Madden, et al., 1992). Based on that, the indicators used are the perception of availability of space at home and time to recycle plastic packaging.

Awareness of Circular Economy

For the concept awareness of circular economy, the variable to be considered is understanding about circular economy. One of the indicators chosen is acquaintance of terms related to circular economy such as "sustainable development", "close the loop" and "circular economy".

Besides, another indicator is the knowledge about CE, because respondents might know the idea but not the concepts related to it. The indicators were selected based on previous questionnaires already done in China by Liu, Li, et al. (2009) and Guo, Geng, et al. (2017).

Situational Factors

Situational factors are specific situations that can facilitate or inhibit a certain behaviour; in this case, plastic packaging recycling (Schultz, et al., 1995, Timlett and Williams, 2011). The variables to be analysed are infrastructure provision and information about the program. For the first one, the indicators are satisfaction with the type of collection method, satisfaction with the maintenance of containers, satisfaction with the frequency of collection and finally, satisfaction with the location of containers.

Besides, the second variable "information about the program" was also included in the operationalization being the indicators as "knowledge about the program" and "perception of access to information".

Pro-environmental Behaviour

The concept of pro-environmental behaviour is defined by individual's actions that contribute to environment sustainability and, therefore, minimize the negative impacts of human activity in nature (Kollmuss and Agyeman, 2002, Ones, et al., 2015). The indicators are, therefore, the participation in the program Plastic Heroes by taking the plastic packaging materials to one of the containers .

Demographic Characteristics – Control Variables

For the purpose of this research, the demographic characteristics of the two districts in Amsterdam were introduced as control variables. The ones studied are age, gender, education level, income, nationality and migration background as control variables. The first four aspects are the most reported in studies regarding pro-environmental behaviour. The last factor that regards the nationality and migration background was included also because there are still few studies that investigated the effect of ethnic differences. As the city of Amsterdam is full of people from other nationalities apart from Dutch, this aspect should not be excluded as one of the reasons to impact in the recycling rate of the two districts to be analysed (Schultz, et al., 1995).

3.3.2 Operationalization Table

The operationalization presented in Table 1 summarizes the ideas already introduced in Chapter 2 and recapped in the previous section in Chapter 3. It presents the concepts related to each of the sub-questions and the variables related to each of them, as well as the indicators.

Table 1 - Operationalization Table

Specific Research Questions	Concepts/Theories	Variables	Indicators	Data Collection Method
How was the project implemented in the two districts?	-	Implementation of the program	Chosen collection method	Secondary qualitative and quantitative data. Observations
			Number of containers	
			Location of containers	
			Maintenance of containers	
			Information about the program	
How did psychological factors influence the pro-environmental behaviour in plastic packaging recycling using Plastic Heroes?	Psychological Factors (Theory of Planned Behaviour)	Attitude towards the behaviour	Perception of the act of recycling	Questionnaires Interviews
		Subjective Norm	Perception of the behaviour of people who live with the respondent	Questionnaires Interviews
			Perception of the behaviour of neighbours	
		Perceived Behavioural Control (Perceived Easiness)	Perception of availbility of space	Questionnaires Interviews
			Perception of availbility of time	
How did awareness of circular economy influence the pro-environmental behaviour in plastic packaging recycling using Plastic Heroes?	Awareness of circular economy	Understanding of circular economy	Acquaintance of terms related to circular economy	Questionnaires Interviews
			Knowledge about the concept	
How did situational factors influence the pro-environmental behaviour in plastic packaging recycling using Plastic Heroes?	Situational Factors	Infrastructure Provision	Satisfaction with the type of collection method	Questionnaires Interviews Observations
			Satisfaction with frequency of collection	
			Satisfaction with the location of the containers	
			Satisfaction with conditions of maintenance of containers	
		Information about the program	Knowledge about the program	Questionnaires Interviews Observations
			Perception of access to information	
(Dependent Variable)	Pro-environmental Behaviour	Pro-environmental Behaviour	Participation in the program	Questionnaires Interviews
-	Control Variables	Demographic Characteristics	Age	Secondary quantitative data Questionnaires Interviews
			Income	
			Education	
			Gender	
			Nationality	
			Migration Background	

(Source: author, 2017)

3.4 Research Strategy

The best research strategy for this research is **case study**. According to Van Thiel (2014), a case study can be almost anything that the researcher wants to examine, from a project and an organization or a neighbourhood to a city or a country. In this type of research strategy, the subject of the study is explored, described or explained in an everyday or real-life context; in other words, the most important aspect is the consideration of the context or the environment where the case is inserted. The search for suitable solutions for real problems makes the case study one of the most broadly applied strategies in Public Administration research.

The case study focuses on a small number of units or situations while including a large or unknown number of variables. Based on the real-life scenario, it goes for deep and detailed understanding of the problem, usually through qualitative data and, not rarely, gathering data from different collection methods to increase the wealth and the internal validity of the research. However, as case study is so focused on one specific context, it is difficult to generalize it to other situations, which decreases its external validity (although it can still be significant in other similar cases) (Van Thiel, 2014).

This type of research strategy is the most adequate for this research because it aims in explaining in a deep and detailed way how the districts of Zuid and Zuidoost in Amsterdam had such different developments of plastic packaging recycling after the implementation of Plastic Heroes in the city. It is possible to note that the context and real-life setting of the areas are especially important, which makes case study indeed the most suitable research strategy. In this case, the number of units are small (two districts in the city) while the number of variables that might be influencing in that phenomenon are large, as already presented in the operationalization.

Among the different types of case study, co-variation allows for a clear relationship between the dependent and independent variables and, therefore, is the one that can bring the most valid explanations for this problem (Van Thiel, 2014, Blatter and Blume, 2008).

3.5 Validity and Reliability

Regarding the challenges of conducting public management research, it is important to consider the validity and the reliability expected from each strategy and ways of improving it, if necessary. For case study, the specificity of the context can be a threat to both aspects of the research, which need to be addressed carefully. In case of explanatory question, the research will have a high level of reliability when the explanation found is most certainly the right one. A good way of ensuring reliability is working on the measurement instruments to make it solid. That can be done through consultation with other researchers (via literature or other) and by anticipating possible mistakes in the data collection to avoid them (Van Thiel, 2014).

In that scenario, the concept of validity can be divided into external and internal validity. The former relates to the possibility of the results of a research being generalized in other cases. That aspect is one of the disadvantages of case study. As considering the context of the districts of Amsterdam is essential, generalizing it to other places is limited, although it can be significant to the other areas as well.

When it comes to internal validity, however, if a research is internally valid, it means that it really measured what was intended to be measured. A good way of improving internal validity of case studies is through triangulation of data. Triangulation is a technique that enables using different measurement instruments, data sources, research methods or researchers in order to check and compare results. By doing that, the researcher can gather much more information and ensure the data is valid, independently of the number of units studied (Flyvbjerg, 2006).

In this research, a few precautions were taken to avoid low levels of reliability and validity, which are:

- Using different sources of data, which are in this case: questionnaires, interviews, observations and secondary data.

- Checking data collection instruments used by previous researchers in order to anticipate mistakes and try to avoid them.

- Making observations about the infrastructure and consulting secondary data to have more insights about the most accurate questions to ask the respondents.

- Testing questionnaires beforehand to guarantee they really answer the research questions and to make sure respondents understand what is being asked.

- Translating the questionnaires into Dutch to ensure respondents have a good understanding of the questions, if they are not comfortable with English.

3.6 Data Collection Methods

When it comes to data collection, for this research the best alternative was mixing qualitative and quantitative data as well as primary and secondary data. This was a way of enriching the research, having more insights about the findings and improving the validity of the results through triangulation. The collection method was a combination of questionnaires, interviews, observations, secondary data used to obtain different information, as shown in Table 1.

3.6.1 Primary Data

Observations

While collecting secondary data about how the project was implemented in Amsterdam, it was planned to go to field and make observations. Among the information that was intended to be observed was the condition of maintenance of containers, the information provided to the citizens and the surroundings of the area. All the containers from both districts were meant to be visited.

In order to get the location of containers, two different sources were programmed to be consulted, being one of them the website of the municipality and the other the company that treats plastic packaging in Amsterdam (See Annex 3).

Semi-structured Interviews

In interviews, the researcher asks open questions and allows the respondent to answer freely, not having to choose between options like in the questionnaires. The interview guides can be accessed in Annex 4.

Eleven interviews were planned to be conducted to add some more qualitative data to the questionnaire. The preferable interviewees were residents from the area (both that participate in Plastic Heroes and do not participate). Also, it was desirable to interview managers of community centres in each area as well as one person from the staff of the municipality. The number of interviews is described section 3.7 in more detail.

Questionnaires

As already mentioned in section 3.5, before applying the questionnaires, it was planned to collect data from observations and secondary sources. These previous actions were intended to help generate questions that were more suitable for the project by adapting the ones that might

have been inaccurate and adding new questions. A version of the questionnaires was annexed in this document under Annex 5.

The questionnaires were planned to be conducted face to face in areas of great movement of residents of the area, such as parks and public spaces. Locations close to metro stations should be avoided because there might be a large amount of people from other areas, which would affect the reliability of the research.

Besides, it is also important to emphasize that in questionnaires, respondents have questions and options to choose from. Although providing a good idea of the general opinion, questionnaires do not allow respondents to include new ideas. In order to enrich the research, it was included in the questionnaire an open question where people could answer freely and that provide some qualitative data as well.

3.6.2 Secondary Data

The first data collected was secondary data both quantitative and qualitative and it was planned to be obtained directly from the municipality website and through reliable online sources. Essential quantitative data aspects were, for example, socio economic and demographic characteristics of the population living in the areas (See Annex 1).

Apart from that, other important quantitative data was the average of weight of plastic collected in each container, as well as an average of the weight per month in each district since the beginning of implementation in 2013. The researcher intended to contact the company who treats the plastic waste in Amsterdam in order to acquire this information.

Regarding the qualitative part, it was decisive to gather information on how the program was implemented in the two districts. Primarily, his information was planned to be collected by visiting websites and directly contacting organizations such as Plastic Heroes, the municipality of Amsterdam, the website of "I Amsterdam" and the *Afvalfonds Verpakkingen* (Packaging Waste Fund). For the complete list of secondary sources, see Annex 2.

3.7 Sampling method and sample size

When applying questionnaires, the researcher looked for the sampling method that can better avoid bias and represent the target population. Therefore, the sampling method used was random sampling and it was divided in two groups (two districts).

The sample size is very important to increase the reliability of the research and representativeness of the population. It depends on the degree of confidence required and the resources of the researcher such as time and money (Alreck and Settle, 1994). In public administration research, it is usually common to use a higher level of confidence; however, due to time constraints, 90% was adopted, which means there is a margin of error of 10%.

The formula used to calculate sample size is the following:

$$n = \frac{N}{(N.e^2 + 1)}$$

where n=sample size, N=population and e=margin of error.

Table 2 - Sample size for respondents in Zuid and Zuidoost

District	Population N	Sample n
Zuid	144.432	99,93
Zuidoost	87.854	99,89

(Source: author, 2017)

Table 2 shows that the required sample for each district is, approximately, 100 respondents. In order to decrease problems that might come with the margin of error of 10%, secondary data, interviews and observations were used to triangulate.

Regarding interviews, the sampling method used was convenience sampling for residents of Zuid and Zuidoost and purposive sampling for the staff of community centres and of the municipality of the city (See Table 3).

When it concerns observations, the researcher intended to visit all the containers, which means there is no sampling, as 100% of units were included in the analysis. Table 3 shows the number of respondents planned to be obtained during field work for each data collection method.

Table 3 - Sample size and method – Proposal

Data Collection Method	Zuid	Zuidoost	Total	Sampling Method
Observations to containers	76	31	107	100%
Questionnaires with citizens	100	100	200	Random Sampling
Interview with household who recycles plastic packaging	2	2	4	Convenience Sampling
Interview with household who does not recycle plastic packaging	2	2	4	
Interview with managers of community centres	1	1	2	Purposive Sampling
Interview with staff from the municipality of Amsterdam	1		1	Purposive Sampling

(Source: author, 2017)

3.8 Data Analysis Methods

The data obtained through secondary data and observations was used to better understand the context of the city and how the project was implemented in the two selected districts. The singularities of the context are extremely important in a case study, as already explained in section 3.4. These data were analysed manually and further used to improve the questionnaires and to support the results from the quantitative data analysis. Besides, the interviews and the qualitative data in the questionnaires[8] were used in the form of quotes to support and explain the findings from the quantitative data.

The analysis of quantitative data collected through the questionnaires was done using the software SPSS, a tool for statistical analysis. In order to investigate the reliability of the data, a Crombach's alpha test was conducted for each theoretical variable presented in the operationalization table (Table 1). The reliability test returns a coefficient which ranges from 0 to 1, where 0 means no consistency at all and 1 means perfect consistency. When 0,70 or above is obtained, there is enough reliability (Field, 2009).

Along with this reliability test, for all variables an independent t-test was also conducted. This test determines if there is significant difference between the means in two unrelated groups (Field, 2009), which in this case demonstrated if there was a significant difference between the means of the responses from people in Zuid and Zuidoost. Table 4 shows the statistical tests

[8] Obtained from the last question of the questionnaires that asks the respondents to make more comments. See the whole questionnaire in Annex 5.

used for each variable to compare Zuid and Zuidoost in terms of psychological factors, awareness of circular economy, situational factors and control variables.

Table 4 – Statistical Tests

Concepts / Theories	Variable	Scale of Measurement	Statistical Test
Dependent Variable			
Pro-environmental behaviour	Pro-environmental behaviour	- Binary (0 = DRPP, 1 = RPP)	- Independent t-test
Independent Variables			
Psychological Factors (Theory of Planned Behaviour)	Attitude towards the behaviour	- Ratio[9]	- Crombach's alpha - Independent t-test
	Subjective Norm	- Ratio	- Crombach's alpha - Independent t-test
	Perceived Behavioural Control	- Ratio	- Crombach's alpha - Independent t-test
Awareness of Circular Economy	Understanding of Circular Economy	- Ratio	- Crombach's alpha - Independent t-test
Situational Factors	Infrastructure Provision	- Ratio	- Crombach's alpha - Independent t-test
	Information about the program	- Ratio	- Crombach's alpha - Independent t-test
Control variables			
Demographic Characteristics	Age	- Ratio	- Independent t-test
	Gender	- Nominal (Female=1, Male=2)	- Independent t-test
	Nationality	- Nominal (Dutch=1, Western=2, Non-western=3)	- Independent t-test
	Migration Background	- Nominal (Dutch=1, Western=2, Non-western=3)	- Independent t-test
	Income	- Ordinal (Less than 1.000 euros=1, Between 1.001 and 3.500=2, More than 3,501=3, Not available=4)	- Independent t-test
	Education	- Ordinal (Primary Education=1, Secondary Education =2, Undergraduate and Postgraduate=3)	- Independent t-test

(Source: Author, 2017)

Finally, it was important to investigate what variables were significantly influencing in the dependent variable, which in this case was having pro-environmental behaviour by participating in Plastic Heroes. In order to do that, several models of Binary Logistic Regression were conducted in SPSS. According to Field (2009), this type of statistical analysis

[9] The theoretical variables are ratio because they were created with the means of the responses from the questionnaires that were Likert Scale.

is used when the dependent variable is binary (0 or 1), being in this case 0=do not recycle plastic packaging (DRPP) and 1=recycles plastic packaging (RPP). For this research, Binary Logistic Regression was conducted to investigate the likelihood of an individual to recycle plastic packaging based on the district they live in, on theoretical variables and on control variables. In order to do that, five models were administered allowing the researcher to analyse various results based on different combination of variables. Table 5 shows these combinations by marking the variables that were included in the model with a "X".

Table 5 - Variables included in each of the five regression models

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
District variable	X	X	X		
Theoretical Variables					
Attitude towards the behaviour			X	X	X
Subjective Norm			X	X	X
Perceived Behavioural Control			X	X	X
Understanding of Circular Economy			X	X	X
Infrastructure Provision			X	X	X
Information about the program			X	X	X
Control Variables					
Age		X	X		X
Gender		X	X		X
Nationality					
Migration		X	X		X
Income - Less than 1.000		X	X		X
Income - Between 1.000 and 3.500		X	X		X
Income - More than 3.500					
Income - Not available					
Education - Primary		X	X		X
Education - Secondary					
Education – Undergraduate and Postgraduate					

(Source: Author, 2017)

With regards to the control variables, one can observe that some of them were not included in the models. The reason for this was that several models were made prior to the five presented ones, and these variables appeared rather random and could, therefore, ruin the models. Due to that, the variables that were inserted in the models were age, gender, migration background, income – less than 1,000, income – between 1,000 and 3,500 and primary education. The results from the models were presented in sector 4.8.1 and further discussed in 4.8.2.

Chapter 4: Research Findings

4.1 Introduction

Chapter 4 presents the findings and the analysis of the comparison between Zuid and Zuidoost from the collected data. This chapter is structured in four main parts. The first one provides an overview of the data collected in contrast to what was proposed in Chapter 3. The second part contribute to a better understanding of Plastic Heroes, from the context of creation in national level to the implementation of the program in Amsterdam in 2013, based on secondary data and observations. This initial discussion already answers the first sub-question from Chapter 1 about the implementation in Zuid and Zuidoost. Subsequently, the following part shows the statistical analysis of the results obtained through the questionnaires and the interviews regarding control variables, psychological factors, awareness of circular economy and situational factors. The other sub-questions were answered in this third part. Finally, in the last part, logistic regressions were performed to explain what factors are most significant in explaining differences in pro-environmental behaviour in Zuid and Zuidoost in the context of Plastic Heroes. The final analysis, combined with all the information discussed throughout the whole chapter led to the response of the main research question in the end of this chapter.

4.2 Data Collection & Sampling

The following sections present in detail the data that was collected during fieldwork, while comparing to what was proposed in Chapter 3, section 3.7. Limitations led to different data collected than what was intended, which were further discussed in this section.

4.2.1 Primary Data

This section discusses the data collection from the observations, questionnaires and interviews and shows a comparison with the proposal described previously in Chapter 3, section 3.7. Table 6 shows in detail the number of questionnaires, interviews and observations that were intended, and the actual data collected.

Table 6 - Sample size and method – Collected

Data Collection Method	Proposed			Collected		
	Zuid	Zuidoost	Total	Zuid	Zuidoost	Total
Observations to containers	76	31	107	77	36	113
Questionnaires with citizens	100	100	200	97	98	195
Interview with household who recycles plastic packaging	2	2	4	3	2	5
Interview with household who does not recycle plastic packaging	2	2	4	3	2	5
Interview with managers of community centres	1	1	2	0	0	0
Interview with staff from the municipality of Amsterdam	1		1	0		0

(Source: author, 2017)

In the case of observations, two lists with locations were obtained being one from the website of the municipality and the other one by contacting the company that treats plastic packaging waste in Amsterdam. However, while in fieldwork, more containers were found, especially in

Zuidoost, where 6 containers were not on the list. In Zuid, the same situation happened but just for 1 container. Thus, the total number of containers visited was 113.

The questionnaires were conducted face-to-face in areas of great movement of local people from Zuid[10] and Zuidoost[11]. Doing questionnaires face-to-face is more time consuming but can ensure a higher response rate. They were applied in areas where people were chilling and had time to fill a questionnaire with more attention and patience. If it was applied with people in front of train/metro stations, the response rate would probably be lower because a great number of people circulating in these areas do not live there or are in a hurry and do not have time or willingness to answer the questions.

Based on the calculation of the sample size shown in Chapter 3, section 3.7, 100 respondents were desirable per district. From which, 97 and 98 valid ones were obtained in Zuid and Zuidoost. The reason for the difference was that many respondents were not from the focus areas and others would start answering the questionnaire but stop in the middle of the process, which invalided them. The discrepancy, however, is not much substantial and did not cause any problem during the statistical analysis.

Concerning the interviews, major differences occurred when comparing to the proposal. Prior to field work it was proposed to interview professionals from the municipality in the waste management department and community centres. Unfortunately, those interviews could not be administered. During data collection in July and August, the employees at the municipality were on vacation which prevented the researcher to have contact with them. Besides, all the community centres of both districts were contacted but none of them consented to participate in an interview as they claimed not having any kind of engagement with waste management or plastics recycling. That information already shows that the municipality does not benefit from the role of community centres to spread information or raise awareness.

Nevertheless, with regards to the interviews with residents of the area, in Zuid the number of people obtained was higher than planned. In Zuid, people in general were more open to talk about the subject so it was easier to get respondents when compared to Zuidoost. However, in both areas the sampling obtained was quite diverse with different characteristics among each other. The whole list of respondents with a small description about them is presented in Table 7.

Table 7 - Description of interviewees - households

Respondent	District	Gender	Nationality	Recycles plastic packaging?	Special characteristics
A	Zuid	Male	Dutch	Yes	Just got back from an exchange program in France
B	Zuid	Female	British	Yes	Lives in Amsterdam Zuid for years
C	Zuid	Female	Dutch	Yes	Extremely environmentally conscious person (vegan)
D	Zuid	Male	Dutch	No	Lives in Amsterdam Zuid for years
E	Zuid	Male	Israeli	No	Recently moved to Amsterdam from Israel

[10] The location in Zuid was Beatrixpark, close to Amsterdam Zuid station.
[11] The location in Zuidoost was Bijlmerplein, close to Amsterdam Bijlmer ArenA station.

F	Zuid	Female	Dutch	No	Recently moved to Amsterdam from a small village out of the city
G	Zuidoost	Female	Dutch	Yes	Goes frequently to the community centres in Amsterdam Zuidoost
H	Zuidoost	Male	British	Yes	Moved to Amsterdam from Britain one year ago
I	Zuidoost	Female	Dutch	No	Born in the Netherlands, migration background Nigeria
J	Zuidoost	Male	Surinamese	No	Extremely environmentally unconscious

(Source: author, 2017)

The interviews had an equal number of men and women respondents as well as people who recycle and do not recycle plastic packaging, both in Zuid and Zuidoost. With regards to nationality, the sample has a good diversity with the largest number of Dutch but also of western and non-western migrants. In addition, the characteristics presented in the last column help to better understand what is the specific context of each respondent. The first column of the table gives a letter to each person in order to facilitate the presentation of the quotes from the respondents that were further used in this chapter.

4.2.2 Secondary Data

Different documents and websites of secondary data were analysed to allow a deep understanding of the creation of Plastic Heroes and the implementation in the city of Amsterdam. Table 8 shows the complete list of sources and the information obtained from them. More details about each document are available in Annexes 1 and 2.

Table 8 - List of sources - secondary qualitative and quantitative data

Source	Information
Afvalfonds Verpakkingen (Packaging Waste Fund)	Explanation of how the fund works
	Responsibilities of producers and importers of packaging based on the Packaging Agreement.
	Explanation of the legal requirements of the fund
Afvalscheidingswijzer (Waste Separation Index)	What to do with other materials that are not packaging
AMS[12]	Previous research done about waste recycling in one area of Amsterdam
EP-Nuffic[13]	Explanation of how the education system works in the Netherlands
Gemeente Amsterdam (Municipality of Amsterdam) – website	Information about weight of plastic recycled in each container in each area since the implementation in Amsterdam that started in 2013.
	Complete list with materials that should go in the containers
	Location of containers in Zuid district
	Location of containers in Zuidoost district
I Amsterdam – website[14]	Basic information about recycling for people who live in Zuid district

[12] AMS is the Amsterdam Institute for Advanced Metropolitan Solutions
[13] EP-Nuffic is the Netherlands Organization for International Cooperation in Higher Education.
[14] I Amsterdam is the official portal website of the city of Amsterdam

	Basic information about recycling for people who live in Zuidoost district
	Location of the districts in Amsterdam
	Area of the district Zuidoost
	Area of the district Zuid
Kennisinstituut Duurzaam Verpakken (Knowledge Institute for Sustainable Packaging)	Objective explanation of the legislation for packaging not only in the Netherlands but in the European Union
MWH[15]	Evaluation of the results of pilot projects of Plastic Heroes implemented in four different areas of Amsterdam in 2010
OIS Gemeente Amsterdam - Onderzoek, Informatie en Statistie Gemeente Amsterdam (Research, Information and Statistics of the municipality of Amsterdam)	Population of the districts of Amsterdam in percentages according to being Dutch, Western and Non-Western. Includes data from 2017 and projections for 2020 and 2030.
	Total number of people living in each district of Amsterdam
	Total and percentage of people living per district of Amsterdam according to migration background in 2017
	Total population according to age and gender per district of Amsterdam in 2017
	Income per district and growth rate from 2011 to 2014
	Education level divided in low, medium and high in Amsterdam in 2014
	Number of people per household in average from 2014 to 2017
Plastic Heroes - website	Information about the collection method(s) used in Amsterdam and other Dutch cities
	Explanation of what the program is and how it works (in general, not specifically in Amsterdam)
	Information about the whole process of recycling from the moment the waste gets to the sorting installation until its recycled.
SRGA[16]	Follow up on the situation of plastic collection and recycling in the city after the implementation of pilot projects between 2010 - 2011
	Follow up on the costs for plastic collection in Amsterdam
TNS NIPO[17]	Study conducted to understand the process of transition from the *Statiegelds* to Plastic Heroes.

(Source: author, 2017)

These documents were used to fully investigate the origins of program and the process of implementation in Amsterdam. Aligned with data from primary sources, this data enable a deep understanding of Plastic Heroes, which is thoroughly discussed in the following sections.

4.3 Plastic Heroes

For the last decades, the plastic packaging industry in the Netherlands was influenced by several regulations and programs for waste management, circular economy and sustainable packaging. In that scenario, the program Plastic Heroes was created and started to be implemented in several cities across the country.

[15] MWH is the company hired by the municipality to conduct the research. http://www.mwhglobal.com.
[16] SRGA stands for *Samenwerkende Reiningingsdiensten Gementee Amsterdam*, which translates to english as Cooperative for cleaning services of the municipality of Amsterdam.
[17] TNS NIPO is the organization hired by the *Afvalfonds Verpakkingen* (Packaging Waste Fund) to conduct research. http://www.tns-nipo.com

4.3.1 Context

In 2004, the EU amended the Directive 94/62/EC, which is a regulation specifically for packaging, and set up a target to achieve 65% of plastic packaging recycling by the year 2025 (European Parliament, 2015). In order to follow the regulations of the EU, in 2008, the Netherlands created the program Plastic Heroes to improve the plastic packaging recycling infrastructure. The project, however, was only widely implemented in the country in 2013 when other regulations were created in the EU and in the Netherlands for packaging and for circular economy that helped incentive and finance the program.

The Netherlands is one of the countries of the EU that showed the highest interest in achieving the circular economy. Handling raw materials with higher efficiency is key to decoupling economic growth from environmental degradation and contributing to a cleaner environment (Rijksoverheid, 2016). Due to that, as part of the Dutch initiative to stimulate the circular economy, the program *Van Afval Naar Grondstof* – VANG was created under the responsibility of the Ministry of Infrastructure and the Environment in order to push forward some actions towards circular economy (Ministry of Infrastructure and the Environment, 2014). The five sectors of economy prioritized by the Dutch Government are: biomass and food waste, manufacturing industry, construction materials, consumer goods and plastics, which is where Plastic Heroes is inserted (Rijksoverheid, 2016).

During the same year, in order to lower the pressure that plastic plays in the environment and to help achieve the targets for the EU, in 2013, the Netherlands issued the *Raamovereenkonst Verpakkingen 2013-2022* (Packaging Agreement 2013-2022) to boost recycling and prevention of all packaging materials such as plastics, glass, paper, wood, metals and cardboard. Among the consequences of the framework, there was the decision that every company needs to record and account the amount of packaging released to the Dutch market and the ones who produce more than 50,000 kg a year of packaging are obliged to register in the *Afvalfonds Verpakkingen* (Packaging Waste Fund) (Afvalfonds Verpakkingen, 2017c, Afvalfonds Verpakkingen, 2017b).

The main goal of this fund is to help implement the Packaging Agreement and to make packaging companies financially responsible for the waste management systems provided in the cities (Mooren, 2016, Afvalfonds Verpakkingen, 2017a). In other words, municipalities are the ones fully responsible for implementing and maintaining the infrastructure of collection and recycling of packaging waste but companies in the sector have financial responsibility for their products through the contribution to the fund. In that scenario, the program Plastic Heroes was only widely implemented after the inclusion in the VANG program for circular economy and the release of the Packaging Agreement and, consequently, the creation of the *Afvalfonds Verpakkingen* to help finance the program (TNS NIPO, 2015, Plastic Heroes, 2017a)[18].

4.3.2 The program

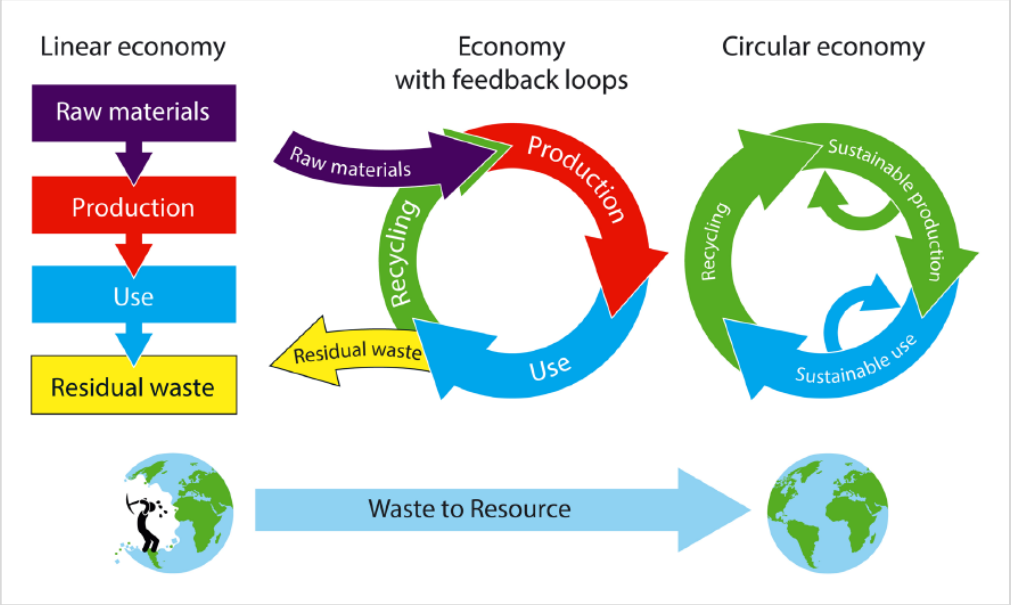
Plastic Heroes is a national program for collection and recycling of plastic packaging which focuses on avoiding plastic to get lost in the chain. According to the Ellen MacArthur Foundation (2016), the main reasons why plastic leaves the global cycles are leakages, landfilling and incineration. Leakages are the principal cause of accumulation of plastic in the oceans, causing innumerable issues for the marine fauna and flora (Plastic Soup Foundation, 2017). Similarly, a lot of valuable plastic materials are also lost when landfilled and incinerated (See Figure 1). However, another important reason why plastic is lost in the chain in due to losses in the process of recycling and cascaded recycling, or in other words, recycling to lower-

[18] TNS NIPO is the organization hired by the *Afvalfonds Verpakkingen* to conduct this research. http://www.tns-nipo.com

quality materials, still requiring the extraction raw materials to produce high-quality plastic (Ellen MacArthur Foundation, 2016).

By raising awareness of the plastic issue (Moore, 2016), Plastic Heroes aims at increasing levels of high-quality recycling while avoiding landfilling and incineration. Besides, the program also targets reducing litter in the streets, in order to avoid pollution in the cities and, consequently in nature. Additionally, the program differs from other plastic recycling schemes because it is financed by the packaging industry, which incentives the manufacturers to optimise plastic packaging as they pay taxes according to the weight of packages commercialised (Plastic Heroes, 2017a). Therefore, although the program focuses in circular economy in macro-level, it also incentive micro-level approaches, which agrees with the idea presented by Geng, et al. (2016) that national policies for circular economy in macro-level can encourage micro and meso-level decisions. Figure 9 presents a representation of the role of the programs in the transition from linear to circular economy in the plastic chain.

Figure 9 - Process of transition from the linear economy to the circular economy



(Source: Ministry of Infrastructure and the Environment, 2014)

The program is focused in household plastic packaging waste and, among the materials that can be recycled through the program, there are: plastic bags, bottles, drank cartons and tubs (Plastic Heroes, 2017a). The whole list with the materials can be accessed in Annex 6. Other kinds of plastics can be taken to the *Afvalpunts* (waste points), which are locations where people can take any kind of waste to be recycled. However, in general, the objects made of plastic that are not on this list go in the residual waste bins (Milieu Centraal, 2017).

When it comes to the infrastructure provided to the users, there is a close cooperation between the program and the municipalities that participate, who can organize the plastic collection according to their own needs and limitations. The cities receive financial compensation and have to choose between the three options offered by Plastic Heroes (Plastic Heroes, 2017a).

The following sections explain what the three methods are and give examples on which cities in the Netherlands chose each specific method (or a combination of more than one). In Annex 7 there is a list created with the collection method adopted in 26 cities in the Netherlands based on the information provided in the website of Plastic Heroes.

Collection door to door using Plastic Heroes bags

In this kind of collection method, the municipality offers bags for plastic packaging and picks it up at the users' homes (Plastic Heroes, 2017c). Figure 10 shows an example of the bag.

Figure 10 - Example of Plastic Heroes bag

(Source: Plastic Heroes, 2017c)

According to the website of the program, in some municipalities the bags are offered even when the collection door to door is not the one implemented. In that case, the bags are only used as a tool to help in the segregation, because they have further information. The bags can be obtained in the *Afvalpunts* in the city for free (Plastic Heroes, 2017c).

Cities like Nijmegen, Dordrecht and Gouda use only the door-to-door method while Utrecht, Almere and Breda combine it with the use of containers, which will be explained in more detail in the next section.

Containers

The most used method across the Netherlands are the containers. They are usually distributed around the city and located close to supermarkets, residences and bins of paper and glass (Plastic Heroes, 2017c). Figure 11 and Figure 12 show an example of a container of Plastic Heroes.

Figure 11 - Example of Plastic Heroes container – above ground[19]

(Source: author, 2017)

Figure 12 - Example of Plastic Heroes container – underground[20]

(Source: author, 2017)

The three biggest cities in the Netherlands use only this method for plastic packaging collection: Amsterdam, Rotterdam and Den Haag. Other cities combine it with the collection door to door as already mentioned (Plastic Heroes, 2017c).

[19] Picture taken by the author at Arent Janszoon Ernststraat, Amsterdam in 16/07/2017.
[20] Picture taken by the author in Van Nijenrodeweg 795, Amsterdam in 16/07/2017.

Post-separation

In the post-separation method, the waste is separated through the use of machines after the collection. In that case, the population does not need to do segregation at source, people can throw the plastic, along with other materials in the residual waste bin (Plastic Heroes, 2017c).

Among the 26 cities in the Netherlands that were checked only Groningen uses this method for plastic recycling, but it is independently of Plastic Heroes (See Annex 7).

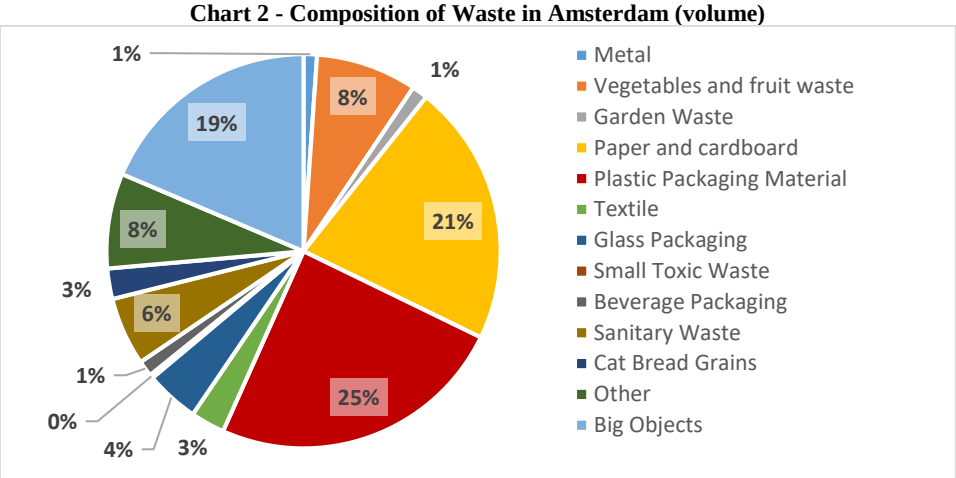
4.3 Implementation in Amsterdam

The following sections explain how the national program was implemented in Zuid and Zuidoost of Amsterdam, which therefore answers the first sub-question of this research. It is demonstrated how the program started in the city as pilot projects and progress so far after the full implementation in 2013.

4.3.1 Beginning and progress

As already mentioned in Chapter 1, plastic packaging material represents on average 25% of the waste produced in Amsterdam. It is the biggest proportion of materials found in the waste, followed by cardboard and paper representing 21% as Chart 2 shows.

Chart 2 - Composition of Waste in Amsterdam (volume)



(Source: adapted from Gemeente Amsterdam, 2015)

Chart 2 demonstrates the importance and the impact that the program can have in the city if more plastic is recycled, which is why it was implemented. Before the implementation of Plastic Heroes, one way of recycling plastic packages in Amsterdam was through the *Statiehelds* (Deposit System). These are stations located in the supermarkets where people can take their 1.5-liter plastic bottles and get a coupon with 25 cents of discount to use in another purchase in the store. As big plastic bottles are just a tiny portion of the amount of plastic waste, it is easy to imagine that the level of plastic recycled was around 0%. Besides, the other option for highly-motivated Amsterdammers was to take the materials to the *Afvalpunts* (Waste Points), which are only 6 locations in the whole city.

In that scenario, Plastic Heroes first started to be implemented in May 2010 through pilot projects in four neighbourhoods of the city. Among the objectives of the pilots, there was comparing recycling plastic with burning (for energy generation), doing a cost-benefit analysis of different collection methods, raising awareness of the population and studying the best locations to put the containers (SRGA, 2011).

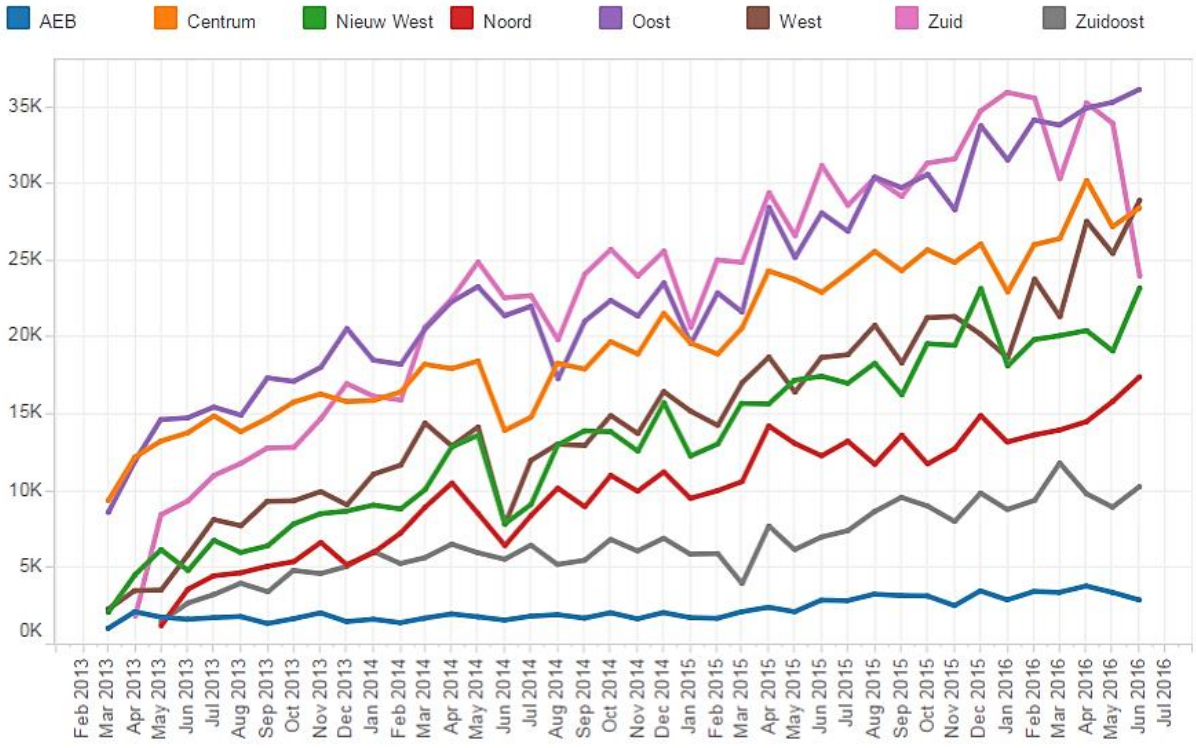
In 2011, the municipality reported the results from the project, which were not very positive for financial reasons. According to the report, the bag collection was the most successful however the most expensive, while containers located close to supermarkets had the best cost-benefit relation. In addition, the report expressed the difficulty in knowing how many households participated because 80% said they recycled while an average of 86% - 96% was going to residual waste. Besides, it was hard to properly determine when households from other areas used the containers in the areas being researched (SRGA, 2011).

In general, according to SRGA (2011b), the results were not a reason for enthusiasm because it was still too expensive. The report also says that at that moment, there was a national discussion about how to help finance the project. In that case, the municipality claimed they would not stop the plastic packaging collection because they needed to keep trying to find the best solution for plastic waste. Additionally, stopping after the pilots would eliminate a lot of potential created, especially people's willingness to participate.

4.3.2 In Zuid and Zuidoost

In 2013, the program started to be financed by the plastic packaging manufacturers through the *Afvalfonds Verpakkingen* and that was when the program was fully implemented in the city. The complete development of the amount of plastic packaging recycled in the different districts in Amsterdam is detailed in Chart 3. This data was obtained by contacting the company responsible for the treatment of plastic in Amsterdam[21] and it helped understand how the recycling of plastic packaging developed with time.

Chart 3 – Total amount of plastic packaging collected per month (kg)[22]



(Source: Boon, E., 2016)

[21] This group of quantitative data was provided in the following links that were last accessed in 13/09/2017: https://public.tableau.com/profile/stadsdeel.zuid.afvalinzameling#!/vizhome/AVIKunststofinzameling_V3/TotalenStadsdelen https://public.tableau.com/profile/stadsdeel.zuid.afvalinzameling#!/vizhome/Kunststofinzameling2_1/Dashboard1

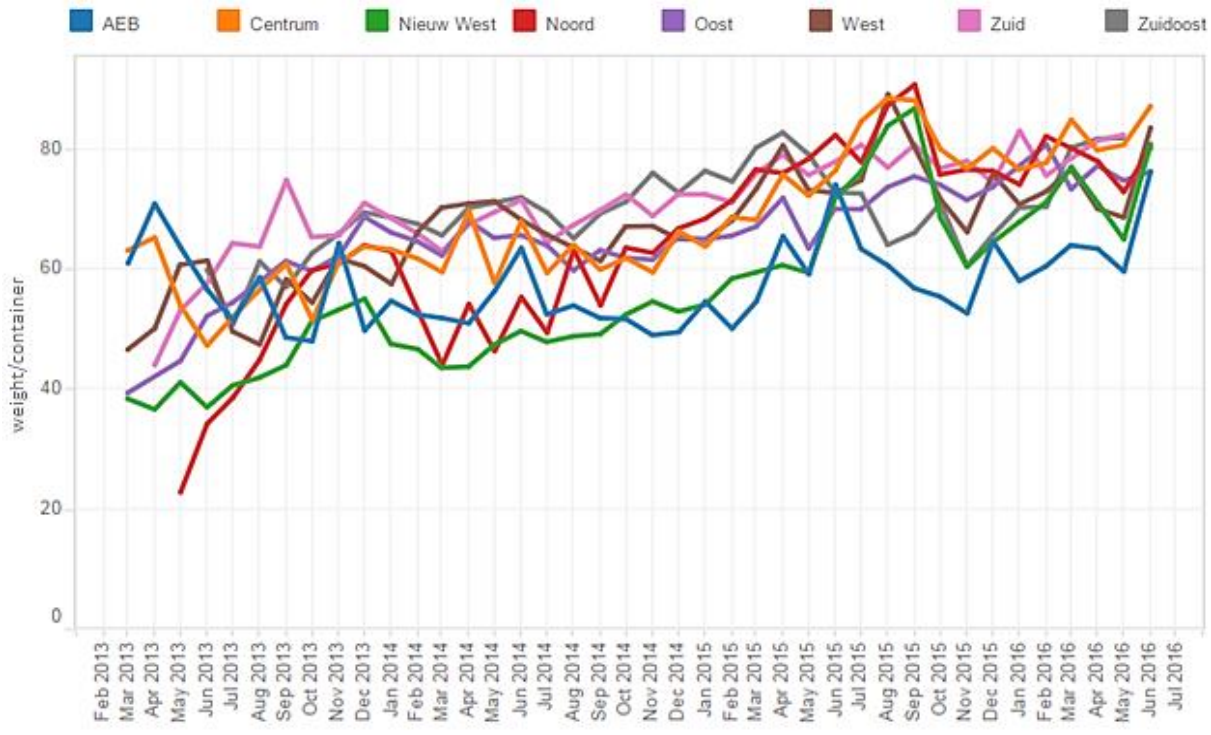
[22] The line in the bottom named AEB represents the sum of the 6 *Afvalpunts* in Amsterdam.

In Chart 2, the difference between Zuid and Zuidoost in terms of quantity of plastic packaging collected and the development of the system in each area is very clear. In Zuidoost, the collection started in May 2013 with around 1 ton of plastic and increased to 10 ton until the last date provided in the chart, which is June 2016. The curve, however, do not oscillate too much when compared to other areas, including Zuid.

Zuid, however, had a considerable faster growth in the amount of plastic collected going from around 1 ton in April 2013 and achieving 10 ton already in June 2013, only two months. The quantity of plastic kept growing until December 2013, when it started oscillating a lot towards the last date available, which is June 2016. The system reached its peak in January 2016 when the collection was approximately 36 ton.

Another interesting information is the amount of waste collected per month per container. In other words, how much plastic packaging there is in a container when it is emptied, on average. Chart 4 presents this data from all the districts. Although the focus of this research is Zuid and Zuidoost, it is interesting to see the general comparison.

Chart 4 - Total amount of plastic packaging collected per month/per container (kg)



(Source: Boon, E., 2016)

From the chart, it is possible to see that Zuid and Zuidoost have similar amounts of plastic packaging waste removed per container each month on average. That does not mean they have same amount of plastic packaging waste production. It actually means they have different frequencies of collection and different ratios of amount of plastic packaging/number of containers, which ends up having a similar quantity of waste each time the collection happens. It is part of the role of the municipality to balance the number of containers with the frequency of collection to optimize the costs with infrastructure the most. According to the report published in 2011 by the municipality, finding that balance was one of the ways to help finance the project (SRGA, 2011).

The frequency of collection in the neighbourhoods could not be obtained by the researcher from any source. During the observations, no information about it is written in the containers, although containers for other materials had this data. Also, contacting the municipality and Plastic Heroes was not successful as well. The latter replied that the municipality is responsible for managing the program. And with regards to the former, the researcher contacted them via phone, email and Whatsapp and different people from the staff responded they did not have that information.

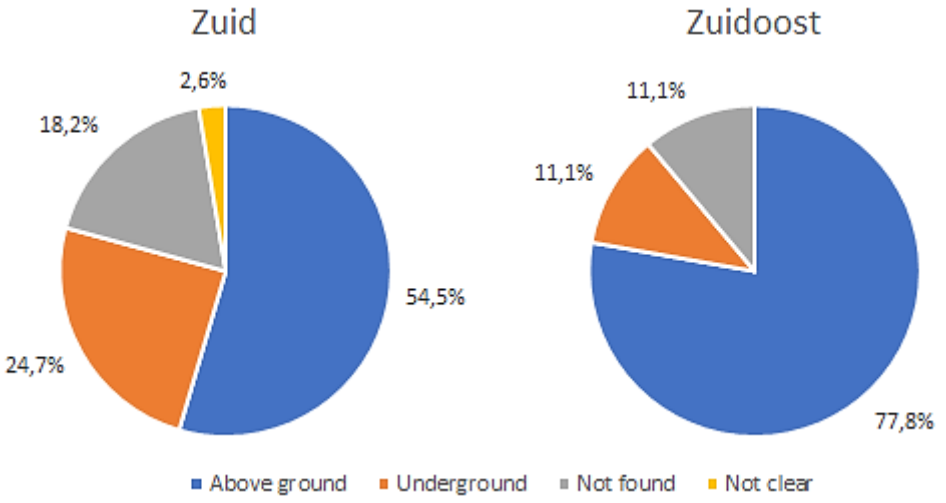
4.3.3 Infrastructure

Through observations, a lot of information was obtained about the infrastructure such as the location of containers, maintenance conditions of containers, type and quality of information provided to the user.

With regards to the locations, as already mentioned in section 3.6 in Chapter 3, two lists of locations were obtained being one from the municipality website and the other from the plastic treatment company. The former was much shorter than the latter and some locations were in both lists, some just in one, some containers were not in any of the lists and some could not be found even being on the list (See Annex 3).

Besides, some locations had just the name of the street, no number or other indication of the precise address, which required the researcher to go through the whole street in the attempt to find it. This lack of precise information require effort which the population might not be willing to do. In Zuid, 18,2% of the containers were not found while in Zuidoost 11,1% (6 in Zuidoost and 1 in Zuid) as shown in Chart 5. When contacted about the locations, the employee of the municipality replied that all the information needed was in the website. These observations indicate incoherence among the information provided to the user and the reality.

Chart 5 - Distribution of containers - type



(Source: author, 2017)

The chart also shows the percentage of containers that are above ground and underground. Both were earlier exemplified in Figure 11 and Figure 12 in section 4.3.2. In both areas, most containers were above ground (42 in Zuid and 28 in Zuidoost) and a smaller number were underground ones (19 in Zuid and 4 in Zuidoost). Both districts, however, had containers that were not found due to lack of precise information about the addresses.

Additionally, in the graph for Zuid there is 2,6% of containers labelled as “not clear”. The reason for that is because few containers had orange stickers but nothing specifying if it was

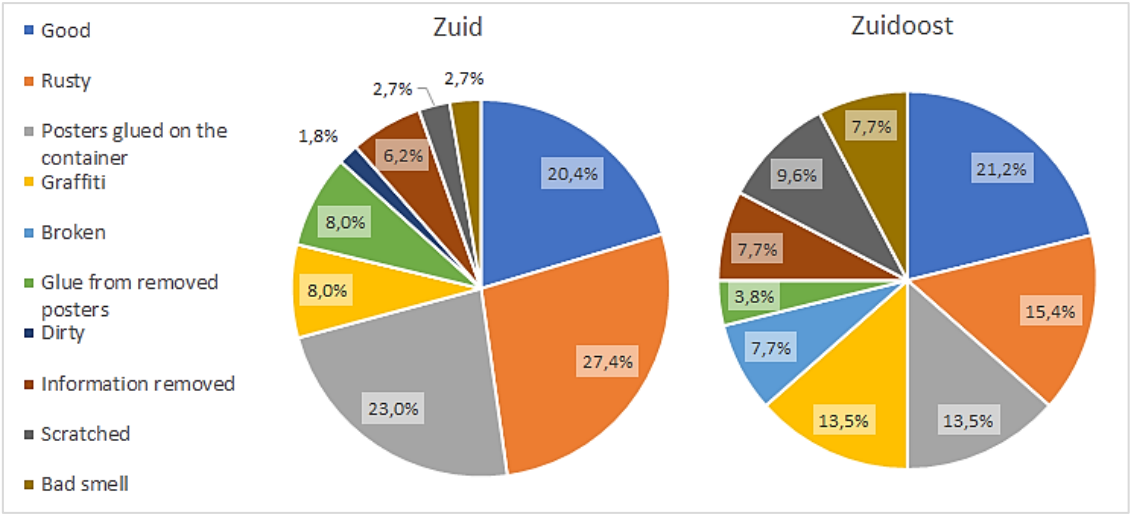
for plastic recycling or Plastic Heroes, although they were located in the indicated address. Figure 13 illustrates that scenario[23]. All these situations add to the difficulties for people to recycle plastic packaging through the project.

Figure 13 - Example of container without specification

(Source: author, 2017)

Apart from the location and the number of containers provided in each area, it was also observed the maintenance conditions of containers. Chart 6 presents the problems encountered in field work related to these conditions.

Chart 6 - Distribution of containers - maintenance



(Source: author, 2017)

From the charts, it is noticeable that in both Zuid and Zuidoost, around 20% of containers were good condition. However, three issues appeared frequently in both areas as well which are

23 Picture taken by the author at Uiterwaardenstraat, Amsterdam on 21/07/2017.

presence of rust (Figure 14[24]), posters glued on the containers (Figure 15[25]) and grafitti (Figure 16[26]). From this information, one can conclude that in terms of maintenance of containers, the infrastructure in both districts are comparable. In Zuid, the presence of glue from removed posters was also affecting the aesthetic conditions of the containers (Figure 17[27]) while in Zuidoost, scratches were more common (Figure 18[28]).

Figure 14 - Example of container with rust

(Source: author, 2017)

Figure 15 - Example of container with posters glued to it

(Source: author, 2017)

[24] Picture taken by the author at Carillonstraat, Amsterdam on 21/07/2017.
[25] Picture taken by the author at Bertelmanplein, Amsterdam on 21/07/2017.
[26] Picture taken by the author at Leusdenhof 7, Amsterdam on 16/07/2017.
[27] Picture taken by the author at Holendrechtplein, Amsterdam on 16/07/2017.
[28] Picture taken by the author at Tekkostraat 110, Amsterdam on 16/07/2017.

Figure 16 - Example of container with graffiti*

***Plastic vervuilt*=Plastic pollutes**
(Source: author, 2017)

Figure 17 - Example of container with glue from removed posters

(Source: author, 2017)

Figure 18 - Example of container with scratches and information removed

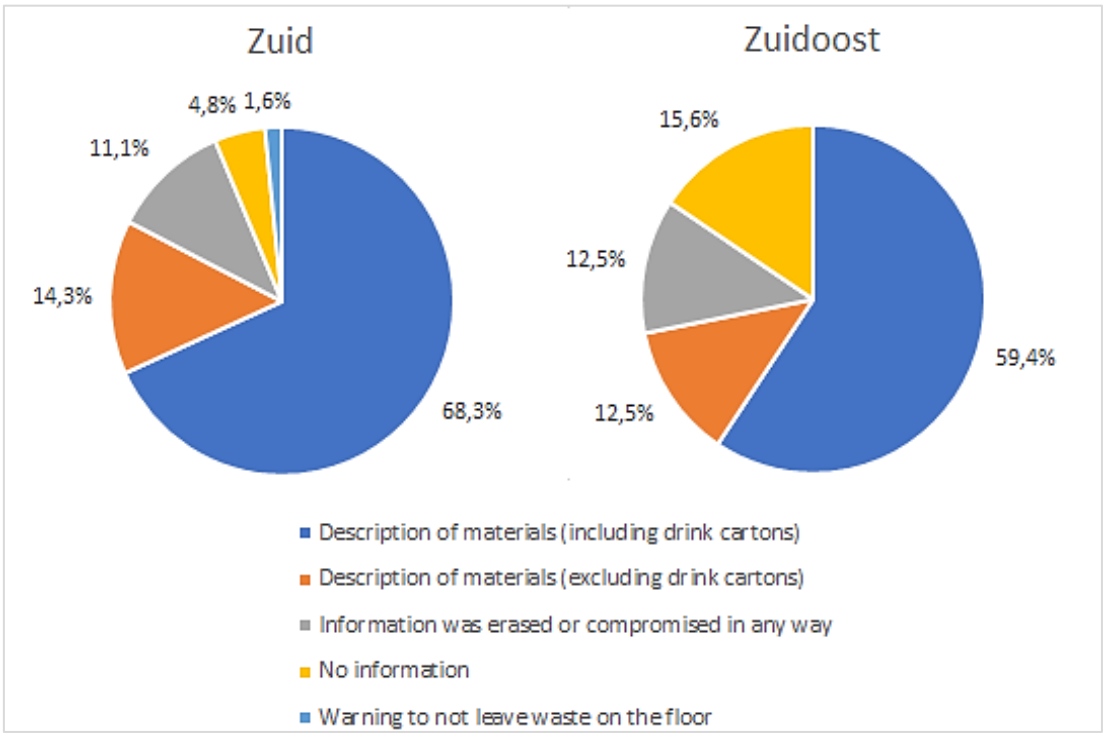
(Source: author, 2017)

In the last picture, it can also be observed that the information about the container explaining what it is was removed, which was also frequent in around 6% to 7% of the containers in Zuid and Zuidoost. The information provided to users was another feature of the program observed during fieldwork.

According to the municipality, the information is provided via the website and using billboards in the containers. However, through the former, everything is presented in Dutch (Gemeente Amsterdam, 2017). It has an icon that says "English", but when you press it, the website goes directly to the one called "I amsterdam", which is more directed to tourists. When the word "waste" was searched in this website, pages for Zuid and Zuidoost were found where there is basic information about recycling, but it lacks more practical information about the facilities. They say that if one wants more information about the location of the containers for plastic packaging, should click on a link provided by them, but this link brings you back to the previous website (I amsterdam, 2017b, I amsterdam, 2017c). So whoever is looking for information about plastic recycling and does not speak Dutch need to translate it to another language. That requires more effort because often the translations are done in other websites and, not rarely, are confusing to understand. These aspects should definitely be considered in a city that is so proud for being one of the most international cities and hosting people from 176 nationalities in the world (World Population Review, 2017).

In addition, some helpful documents are also provided in the website of Plastic Heroes, however, to access them, the user needs to be already motivated to recycle plastic packaging. However, the main information source on the containers itself as shown in Chart 7. Everything in Dutch as well.

Chart 7 - Distribution of containers - information



(Source: author, 2017)

From Chart 7, one can observe that the majority of containers had information about the types of materials to be discarded there, including drink cartons. However, 14,3% in Zuid and 12,5% in Zuidoost were still outdated and did not include this information.

Also, many containers had no information (4,8% in Zuid and 15,6% in Zuidoost) or it was compromised in some way (11,1% in Zuid and 12,5% in Zuidoost), such as being covered with posters or partially or totally removed.

The containers, however, did not refer to the name of the project "Plastic Heroes". The only mention to the program was an illustration of the mascot in the bottom part of the container as shown in Figure 19[29].

Figure 19 - Sticker with the mascot of the program

(Source: author, 2017)

[29] Picture taken by the author at Eosstraat Hestiastraat, Amsterdam on 21/07/2017.

Based on the data previously presented, one can conclude that in terms of information, the project was also implemented in a similar manner in both districts.

4.3.4 Summary

In order to easily compare Zuid and Zuidoost in terms of the implementation of the program, Table 9 presents a summary of all the indicators described in Table 1 in Chapter 3.

Table 9 - Summary of observations in Zuid and Zuidoost

Indicator	Zuid	Zuidoost
Type of collection method		
Above ground	54,5%	77,8%
Underground	24,7%	11,1%
Not found	18,2%	11,1%
Not clear	2,6%	0,0%
Number of containers		
Total number	77	36
Population	144.432	87.854
Resident per container	1.876	2.440
Location of containers		
Area of district	17 km²	22 km²
Container per km²	5	2
Maintenance of containers		
Good conditions	20,4%	21,2%
Rusty	27,4%	15,4%
Posters glued on the container	23,0%	13,5%
Graffiti	8,0%	13,5%
Broken	0,0%	7,7%
Glue from removed posters	8,0%	3,8%
Dirty	1,8%	0,0%
Information removed	6,2%	7,7%
Scratched	2,7%	9,6%
Bad smell	2,7%	7,7%
Information about the program		
Description of materials (including drink cartons)	68,3%	59,4%
Description of materials (excluding drink cartons)	14,3%	12,5%
Information was erased or compromised in any way	11,1%	12,5%
No information	4,8%	15,6%
Warning to not leave waste on the floor	1,6%	0,0%

(Source: author, 2017)

Table 9 shows that the implementation of Plastic Heros both in Zuid and Zuidoost are comparable with regards to the type of collection, the maintenance of containers and the information. Although having different percentages in each of these variables, the main characteristics were similar. Nevertheless, Zuid and Zuidoost differed concerning number and location of containers. Zuid has a population of 144.432 residents for 77 containers which results in 1.876 people for each container. However, Zuidoost, although having a much smaller population (87.854) is provided with 36 containers which measures 2.440 residents per container. These numbers show that Zuidoost has 30% more people per container.

Besides, another difference between Zuid and Zuidoost is the containers in relation to the area. Zuid has an area of 17km² while Zuidoost 22km². That results in 5 containers per km² in the former and 2 in the latter. This fact affects directly in the location of containers because in Zuidoost they are much more farther from one another than in Zuid, which can contribute to longer distances that people need to travel in order to access the containers.

4.4 Profile of respondents

This section compares the profile of respondents of questionnaires and interviewees with the population of Zuid and Zuidoost to investigate the representativeness of the sample obtained. Doing that also helps recognize possible situations of bias, which facilitate analysing the statistical analysis that were further conducted. Table 10 presents data regarding the dependent variable and the control variables as already mentioned in Table 1 in Chapter 3.

Table 10 - Comparison of control variables among different sources of data

Variable	Questionnaires		Secondary Data[30]		Interviews	
	Zuid	Zuidoost	Zuid	Zuidoost	Zuid	Zuidoost
Pro-environmental behaviour						
Yes	62,90%	43,90%	-	-	50,00%	50,00%
No	37,10%	56,10%	-	-	50,00%	50,00%
Age						
< 20	5,20%	6,70%	16,10%	23,40%	-	-
21 to 30	24,70%	13,30%	20,60%	17,80%	-	-
31 to 40	29,90%	18,90%	18,90%	14,20%	-	-
41 to 50	17,50%	24,40%	13,60%	13,00%	-	-
>50	22,70%	36,70%	30,80%	31,60%	-	-
Gender						
Female	61,50%	30,10%	52,30%	47,70%	50,00%	50,00%
Male	38,50%	69,90%	50,00%	50,00%	50,00%	50,00%
Nationality						
Dutch Population	75,30%	71,10%	58,80%	26,20%	66,70%	50,00%
Western Population	16,50%	8,90%	23,30%	10,40%	16,70%	25,00%

[30] Data from 2014 regarding income and education level and from 2017 regarding age, gender, nationality and migration background (OIS Gemeente Amsterdam, 2017b, OIS Gemeente Amsterdam, 2017f, OIS Gemeente Amsterdam, 2017g, OIS Gemeente Amsterdam, 2017a, OIS Gemeente Amsterdam, 2017d, OIS Gemeente Amsterdam, 2017e, OIS Gemeente Amsterdam, 2017c) .

Non-western Population	8,20%	20,00%	17,90%	63,40%	16,70%	25,00%
Migration Background						
Dutch Population	63,90%	20,00%	21,10%	5,70%	66,70%	25,00%
Western Population	14,30%	10,00%	22,40%	6,20%	16,70%	25,00%
Non-western Population	20,60%	69,50%	56,00%	88,10%	16,70%	50,00%
Education						
Low education level	2,00%	14,10%	15,00%	38,00%	-	-
Medium education level	19,00%	34,80%	31,00%	42,00%	-	-
High education level	79,00%	51,10%	54,00%	20,00%	-	-
Income						
Average per household in €1.000/year gross	-	-	120,1	79,5	-	-
Less than €1.000 net	6,00%	26,10%	-	-	-	-
Between €1.001 and €3.500 net	38,00%	40,20%	-	-	-	-
More than €3.501 net	18,00%	5,40%	-	-	-	-
Not Available	37,00%	28,20%				

(Source: author, 2017)

Additionally, since this research was based on the difference between Zuid and Zuidoost, it is necessary to verify whether this contrast is indeed significant based on the data obtained through the questionnaires. The statistical test used to compare the means between the two settlements based on the responses was the independent t-test. This test determines if there is significant difference between the means in two unrelated groups (Field, 2009). In order to do that test, two hypotheses are made:

- Null hypothesis: there is no significant difference between the means.
- Alternative hypothesis: there is a significant difference between the means.

The null hypothesis is rejected when the value of $p \leq 0{,}05$ and is accepted when $p > 0{,}05$.Table 11 presents the number of observations, the mean and the standard deviation for the district and control variables, followed by the value of t and p from the statistical tests.

Table 11 - Independent t-test for control variables

Variable	Zuid			Zuidoost			t	p
	N	M	SD	N	M	SD		
Pro-environmental behaviour	97	0,629	0,486	98	0,439	0,499	2,696	0,008
Age	97	39,990	15,881	90	44,922	14,836	-2,190	0,030
Gender	96	1,385	0,489	93	1,699	0,461	-4,534	0,000
Nationality	97	2,412	2,486	90	2,289	2,260	0,354	0,723
Migration Background	97	2,784	2,579	90	3,989	2,300	-3,363	0,001
Education	97	3,196	0,812	92	2,522	0,920	5,349	0,000
Income	97	3,639	1,883	92	2,859	1,919	2,822	0,005

(Source: author, 2017)

Pro-environmental behaviour

Based on the data from Table 10 and Table 11, the majority of respondents of questionnaires in Zuid (M=0,629, SD=0,486) reported that they recycle plastic packaging while in Zuidoost (M=0,439, SD=0,499) the minority does. According to the independent t-test, there is a significant difference between the two settlements when it comes to this variable (p=0,008).

With regards to the interviews, the proportion of people who recycle was equally distributed in both areas. However, based on the amount of plastic that is recycled in both areas, it was expected less people that recycle in the sample. One possible reason for this phenomenon is that people who recycle might have been more interested in answering the questionnaire than someone who do not. Also, another issue is that some people might have replied "yes" even not really doing it, just because recycling is seen as socially correct as stated by Kollmuss and Agyeman (2002).

Age

When it concerns to the age of respondents of questionnaires, both districts had averages significantly difference, based on the statistical test: 39,990 years old in Zuid (SD=15,881) and 44,992 in Zuidoost (SD=14,836). There was a good distribution of age among both areas being the minimum 14 in Zuid and 16 in Zuidoost and maximum 77 and 84 respectively. The whole table with frequencies of all ages can be seen in Annex 8.

When comparing with the data obtained through the municipality, one can observe that in Zuid, the sample had the majority of people from 31 to 40 years old, while in reality it is from 50 onwards. This scenario should be taken into consideration in case the variable age is significant. In Zuidoost, the majority of respondents were from the same group that was also a majority in the whole population, which is more than 50 years old. This data was not obtained when conducting the interviews.

Gender

With regards to gender both districts have approximately 50% of men and women. Therefore, it was expected the sample to have a similar number of men and women to have a representative sample in terms of gender, which was what happened in the interviews. It was not the case in the questionnaires because in Zuid, 61,5% of the respondents were women while in Zuidoost only 30,1%. In fact, the independent t-test showed there is a significant difference between the means of both settlements, being Zuid M=1,385 (SD=0,489) and Zuidoost M=1,699 (SD=461), with p=0,000. In that scenario, one ought to consider that the sample might be bias, in case gender appeared as a significant determinant for plastic recycling.

The lack of balance among men and women possibly occurred because, in Zuid, the questionnaire was conducted at a park, where many more women were observed playing with their kids or even babysitting when compared to the number of men. In Zuidoost, however, there were a lot more men gathered together at the public space, while women were mostly alone or in a hurry to go to work. The reason for that difference might be that, in Zuidoost, women are the breadwinners of the houses while in Zuid it is the opposite.

Nationality

Regarding nationality, in Zuid, 58,8% of the population are Dutch, while in Zuidoost far less are: only 26%. Regarding the foreigners, the Netherlands differentiate western of non-western people. In that scenario, Zuid presents 23,3% of westerns while Zuidoost has massive 63,4% of the population of non-western. Such a great variety of nationalities might influence in the access of information due to language barriers. When applying the questionnaires, it was observed that many respondets from Zuidoost spoke Dutch but not English. In Zuid, the result

was the opposite as foreigners spoke English but not Dutch. The complete list with nationalities can be accessed in Annex 9.

In the questionnaires, the great majority of the respondents were Dutch, 75,3% in Zuid and 71,1% in Zuidoost, which does not represent the reality effectively. According to the independent t-test, there is no significant between both settlements in the sample (p=0,723), as in Zuid M=2,412 (SD=2,486) whereas in Zuidoost M=2,289 (SD=2,260). The interviews followed the same pattern as the questionnaires, with Dutch being the majority of respondents in both districts. A possible reason for difference is the fact that Dutch might be more interested in the topic and therefore more willing to fill the questionnaire.

Migration Background

Another important aspect that was taken into consideration is the migration background, because Zuid and Zuidoost have a very different scenario when it regards to that. In Zuidoost, there are approximately 40% of people with Surinamese background (OIS Gemeente Amsterdam, 2017b), resulting in 88,10% of residents of this area with non-western background.

Nevertheless, in the questionnaires, the discrepancy between Zuid and Zuidoost was even more intense. Zuid presented 63,9% of Dutch which is much higher than the 21,1% from the data of the municipality. Through the independent t-test, it was found a significant difference (p=0,001) between the mean in Zuid (M=2,784, SD=2,579) and Zuidoost (M=3,989, SD=2,300).

A possible explanation for this difference is the choice of location to conduct the questionnaires, which might be an area where people with Dutch background live. In Zuidoost, on the other hand, the biggest group was of Surinamese corresponding 41% of all the valid responses, which complies with the real population (See Annex 10 for the complete list of migration background of respondents).

Education

With regards to education level, according to data from 2014, Zuid has more people with higher level of education when compared to Zuidoost. Table 10 shows Zuid has more than half of its population with high level of education, while only 20% have the same level in Zuidoost.

When conducting the questionnaires, the education level of residents was investigated by providing the options: primary education, secondary education, undergraduate and postgraduate. In order to compare with the data from the municipality, the percentage of people who chose the last two options were summed. Doing that resulted in both districts with the majority of people have high level of education.

However, even with that limitation, in the independent t-test, both districts presented means regarding education that were significantly different (p=0,000). For Zuid, the mean was M=3,196 (SD=0,812) whereas in Zuidoost M=2,522 (SD=0,920).

Income

A similar pattern to education was verified for income, because households in Zuid earn on average 50% more than in Zuidoost, based on the data provided in the website of the municipality. Nevertheless, it was observed in the questionnaires that either in Zuid (38%) and Zuidoost (40,2%) most people responded that their household earned between €1.001 and €3.500 net per month, which is inconsistent with the data from the municipality. A possible

reason for this difference might be privacy issues causing more people to select "prefer not to say" and "I do not know"[31] therefore reducing the number of comparable answers.

However, even in these conditions, the results from the independent t-test show a significant difference between districts (p=0,005). Zuid had M=3,629 (SD=1,883) while in Zuidoost the mean was M=2,859 (SD=1,919).

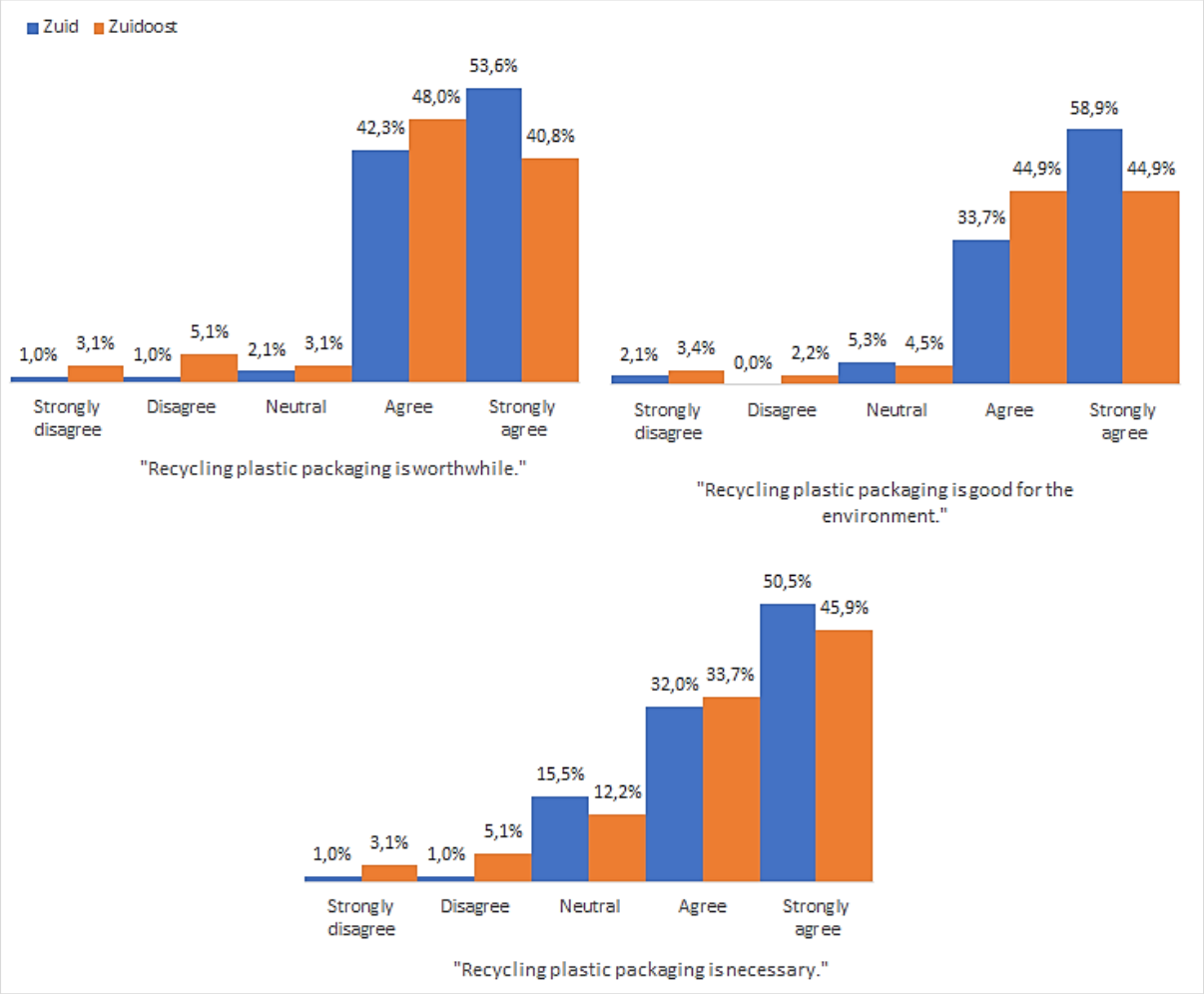
4.5 Psychological Factors

This section presents the data analysis regarding the psychological factors: attitude towards the behaviour, subjective norm and perceived behavioural control as already explained in Table 1 in Chapter 3.

4.5.1 Attitude towards the behaviour

For the variable attitude towards the behaviour measured by the indicator perception of the act of recycling, three Likert-scale questions were designed and included in the questionnaire, for which the results are presented in Chart 8.

Chart 8 - Responses for questions regarding "attitude towards the behaviour" – perception of the act of recycling



(Source: author, 2017)

[31] In SPSS, the responses "Prefer not to say" and "I do not know" from questionnaires were grouped as "Not available" to facilitate the statistical analysis.

The chart shows that in all questions, both districts showed a positive perception of the act of recycling with the majority of responses in "Agree" and "Strongly agree". However, Zuid had a greater number of respondents replying "Strongly Agree" than Zuidoost. The opposite happened regarding the option "Agree", because Zuidoost had the majority in this case. For both districts, the responses "Strongly disagree", "Disagree" and "Neutral" were much less substantial.

In order to allow for further analysis, the answers for these three questions need to be grouped. However, before doing so it is necessary to conduct a reliability test to guarantee that it is reliable to make such combination. The reliability test returns a coefficient of consistency (Crombach's alpha) which ranges from 0 to 1, where 0 means no consistency at all and 1 means perfect consistency. When 0,70 or above is obtained, there is enough reliability to combine the new indicator (Field, 2009).

Additionally, as already explained in Chapter 3, section 3.8, the statistical test used to compare the means in both in Zuid and Zuidoost based on the responses was the independent t-test. Table 12 presents the results of the independent t-test as well as the Crombach's alpha (α).

Table 12 - Statistical analysis of variable "attitude towards the behaviour"

α	Zuid			Zuidoost			t	p
	N	M	SD	N	M	SD		
0,888	97	4,4107	0,68383	98	4,2041	0,87394	1,837	0,068

(Source: author, 2017)

A Crombach's alpha of 0,888 was obtained, which proves that the indicator was measured in a consistent way and therefore is reliable. The mean of the responses from Zuid was M=4,4107 (SD=0,69383), while in Zuidoost the mean was M=4,2041 (SD=0,87394). According to the independent t-test, the means are not significantly different because p=0,068 (p > 0,05 and therefore we accept the null hypothesis). In other words, the attitude towards the behaviour is not significantly different among Zuid and Zuidoost.

From the interviews, similar results were obtained because in both areas respondents showed a positive attitude towards recycling plastic packaging. The following quotes were extracted from the interviews with residents of Zuid and also from comments made on the open question of the questionnaire.

> *"I think it is really important so, although it occupies a considerable space in my house, I create the space. Same with the time, if you care you create time to do it." (Respondent B, Zuid)*

> *"I live here for 20 years already and, as soon as they put the containers, I started to do it right away. And now I notice how much plastic I have." (Respondent C, Zuid)*

> *"We are only short-term in Amsterdam but still try to recycle as much as we can." (Comment in the questionnaire, Zuid)*

In Zuidoost, some respondents also showed a very positive perception of recycling plastic packaging which are presented in the following quotes.

> *"In my house we separate the plastic, every day" (Respondent G, Zuidoost)*

> *"It is always good to separate plastics even it looks like over used but can recycle to get other materials." (Comment in the questionnaire, Zuidoost)*

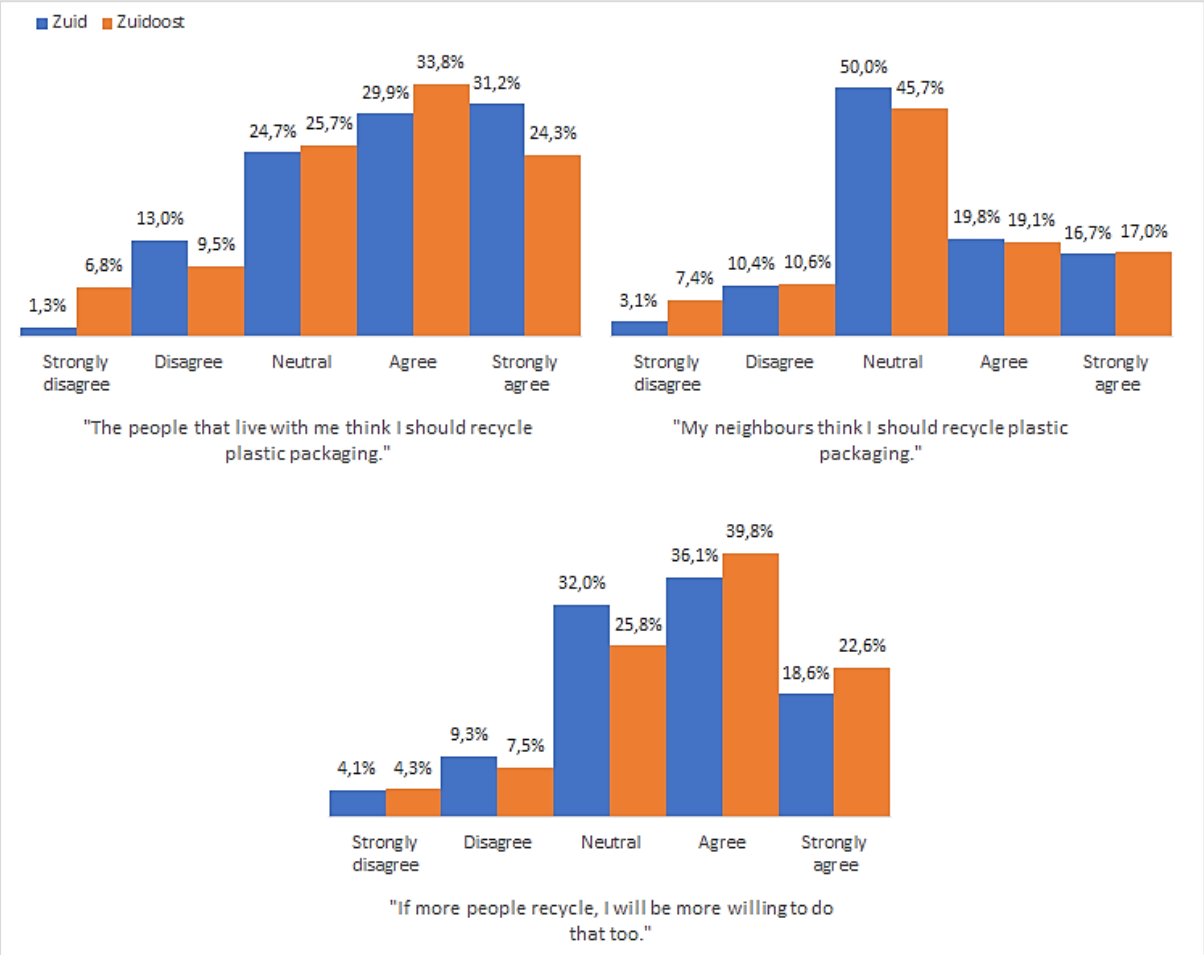
In Zuidoost, however, one respondent had a very negative perception of recycling plastic packaging, which did not happen in Zuid. This fact also complies with the findings from statistical analysis because Zuidoost had indeed a lower mean for the variable when compared to Zuid. The following quote was extracted from the interview.

> *"I think it's stupid, why would you do that? Why would you waste your time? So if I recycle this plastic bottle, then what?" (Respondent J, Zuidoost*)

4.5.2 Subjective Norm

The variable subjective was measure with the indicator opinion of housemates and neighbouds. From the questionnaires, the following results were obtained, which were presented in Chart 9.

Chart 9 - Responses for questions regarding "subjective norm" – opinion of housemates and neighbours



(Source: author, 2017)

From the graphs, it can be observed that in Zuid and Zuidoost the pattern of responses was similar in all three questions. In the first question, Zuid had a comparable percentage of respondents choosing "Agree" and "Strongly agree", while in Zuidoost the majority chose "Agree". In the second question, however, the massive majority of respondents from both settlements chose "Neutral" as an answer, which might be explained by their lack of knowledge or interest about other people's opinions about the topic. Finally, in the last question, both districts had the greater percentage of responses as "Agree", meaning they agree that if more people recycle, they would be more willing to do the same.

As already explained in the previous sections, in order to use the indicator to represent the variable subjective norm, firstly a realibility test had to be conducted followed by the independent t-test, for which the results are presented in Table 13. Check the complete analysis in Annex 12.

Table 13 - Statistical analysis of variable "Subjective Norm"

α	Zuid			Zuidoost			t	p
	N	M	SD	N	M	SD		
0,741	97	3,5326	0,82026	96	3,5347	0,91859	-0,017	0,987

(Source: author, 2017)

The first aspect to have attention to is the Crombach's alpha to prove the reliability of combining the questions to analyse it as one variable. The value for this coefficient was 0,741 in this case, which is a good number to guarantee there is enough reliability.

The statistical analysis presented a similar result for subjective norm as it did for the previous variable. For Zuid, the mean was M=3,5326 (SD=0,82026) and for Zuidoost, M=3,5347 (SD=0,91859). According to the independent t-test, there is no significant difference between the two settlements (p=0,987).

From the interviews, one of the respondents in Zuid mentioned the actions of neighbours in her responses, specifying the older population living close to her house, who depend on other people to do simple daily activities.

> *"I see my neighbours do it but maybe half of the people, not many. Sure not all of them. In this area, there live a lot of older people… you know… they put everything in the rubbish bin. They depend on someone to put the dirt away, they can hardly walk you know. And it is quite a big group." (Respondent C, Zuid)*

However, that is the only mention among all the interviews to actions of neighbours towards plastic packaging recycling. This might be an indication that other factors might be much more relevant for the interviewees. Besides, another possible reason for this fact might be the lack of knowledge or interest about other people's opinions, especially about this topic.

Additionally, one interesting aspect was commented by one of the respondents who cooperates in activities hosted in one of the community centers in Zuidoost. She mentioned the lack of involvement of these institutions. The following quote was extracted from the interview:

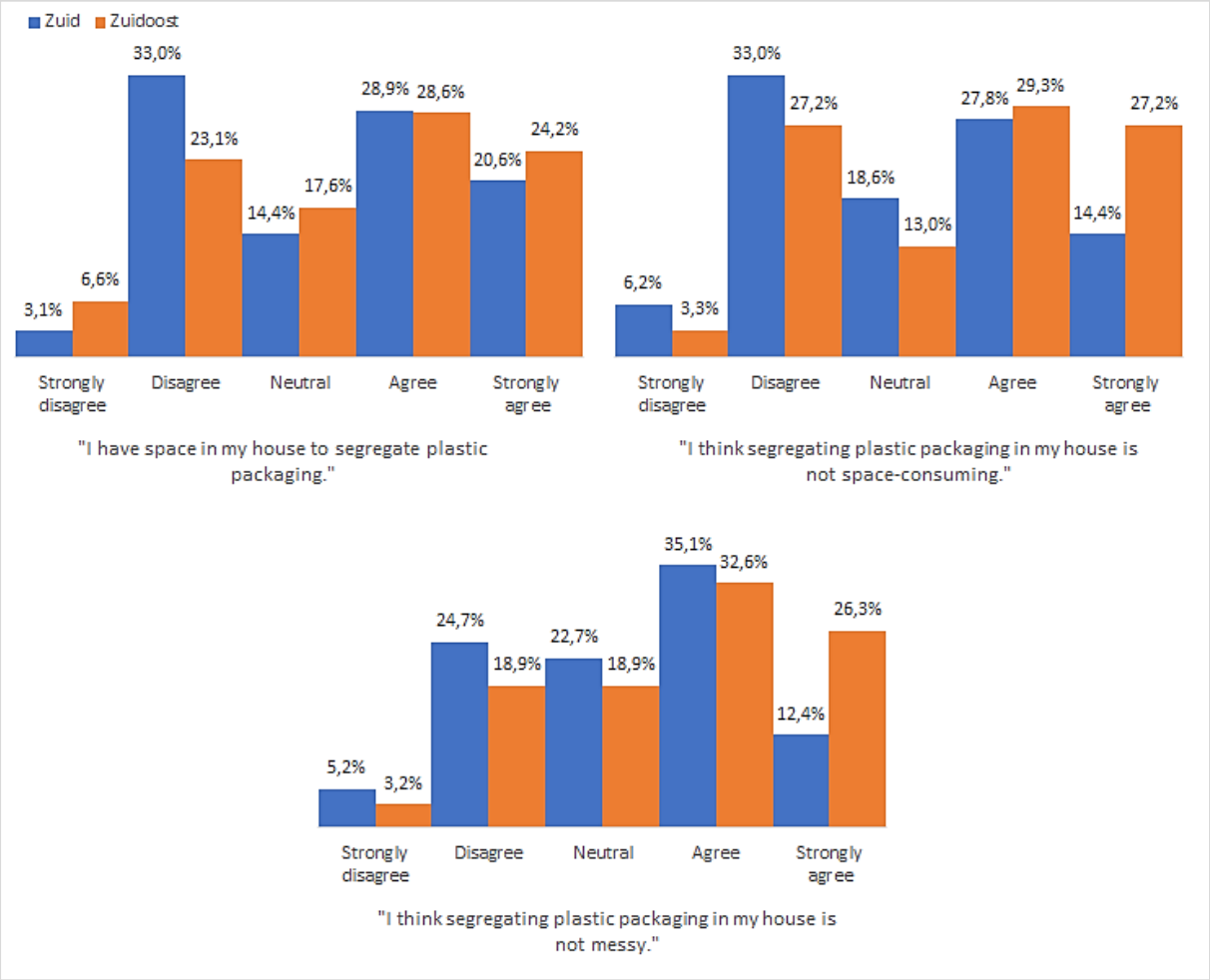
> *"There was never any event or mention to plastic recycling in the buurthuis. That should be a good idea. You have to begin small in a community centre like this. And then you spread it around." (Respondent G, Zuidoost)*

Having a more active participation of these community centres in waste management and community engagement can help build subjective norm, as stated by Cheung, Chan et. al (1999). This fact might also explain the lack of importance given by the interviewees (little mention) and questionnaires (mean closer to "neutral").

4.5.3 Perceived Behavioural Control

When studying perceived behavioural control, two aspects were investigated which are space and time to segregate plastic packaging waste. In the questionnaires, three questions were made for each and the results are presented in Chart 10 and Chart 11, consequently.

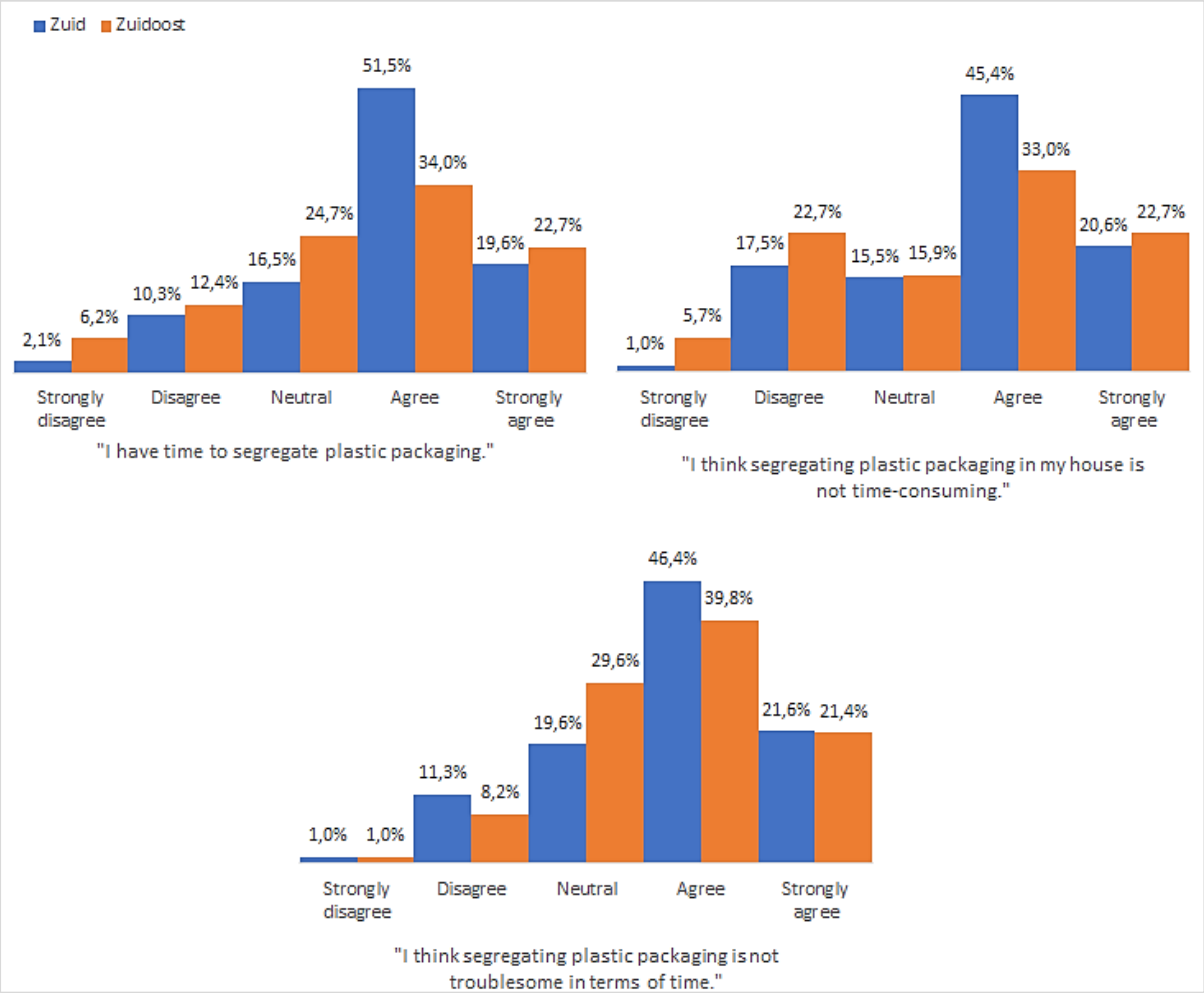
Chart 10 - Responses for questions regarding "perceived behavioural control" – space to segregate



(Source: author, 2017)

The graphs show that in all questions, the pattern of responses was similar regarding space to segregate. Respondents seemed to have opinions well-distributed among all options, expect "Strongly disagree", which was the one that had a fairly smaller percentage of responses. In the first question, the majority of respondents of Zuid chose "Disagree" regarding having enough space in their house to segregate with 33%. The second question had practically the same pattern as in the first one. In the last question, though, respondents from both districts seemed to have compatible opinions as the majority chose "Agree" with regards to segregating plastic packaging not being messy.

Chart 11 - Responses for questions regarding "perceived behavioural control" - time to segregate



(Source: author, 2017)

Similar to the graphs regarding space to segregate, these ones portraying opinions about time to segregate were also analogous among each other. It was observed that the majority of people replied “Agree” for all the statements either in Zuid and Zuidoost. In fact, all three graphs have a similar peak around 45%-50% of respondents in Zuid agreeing with the questions and in Zudoost with 33%-40%.

For this variable, the same steps were followed to analyse the data (Table 14). The complete statistical test is annexed in the end of this document as Annex 13.

Table 14 - Statistical analysis of variable "perceived behavioural control"

α	Zuid			Zuidoost			t	p
	N	M	SD	N	M	SD		
0,850	97	3,4777	0,83598	98	3,5461	0,85487	-0,565	0,573

(Source: author, 2017)

In the first column of the table, one can observe that the value of Crombach’s alpha obtained was higher than 0,850, meaning there is enough reliability in the combination of the responses to represent the variable.

In Zuid, the mean was M=3,4777 (SD=0,83598) and in Zuidoost, the mean obtained was M=3,5461 (SD=0,85487). The value of p calculated was 0,573 (p > 0,05), which means there is no significant difference between the means of the two groups.

In the interviews, there was little mention of availability of time and space with two of the respondents stating as follows:

> *"I think it is really important so, although it occupies a considerable space in my house, I create the space. Same with the time, if you care you create time to do it." (Respondent B, Zuid)*

> *"I think that plastic recycling in other cities was much better but in my opinion the problem in Amsterdam is that people live in small houses and apartments and don't have that much space." (Respondent F, Zuid)*

The first quote shows that even thinking that plastic packaging waste consumes a considerable space, she is motivated enough to overcome this challenge. Nevertheless, none of the respondents from Zuidoost mentioned space or time to segregate as a barrier for not recycling plastic packaging. The second quote emphasizes the fact that in a city like Amsterdam, people have small houses and therefore space could be a barrier to recycling.

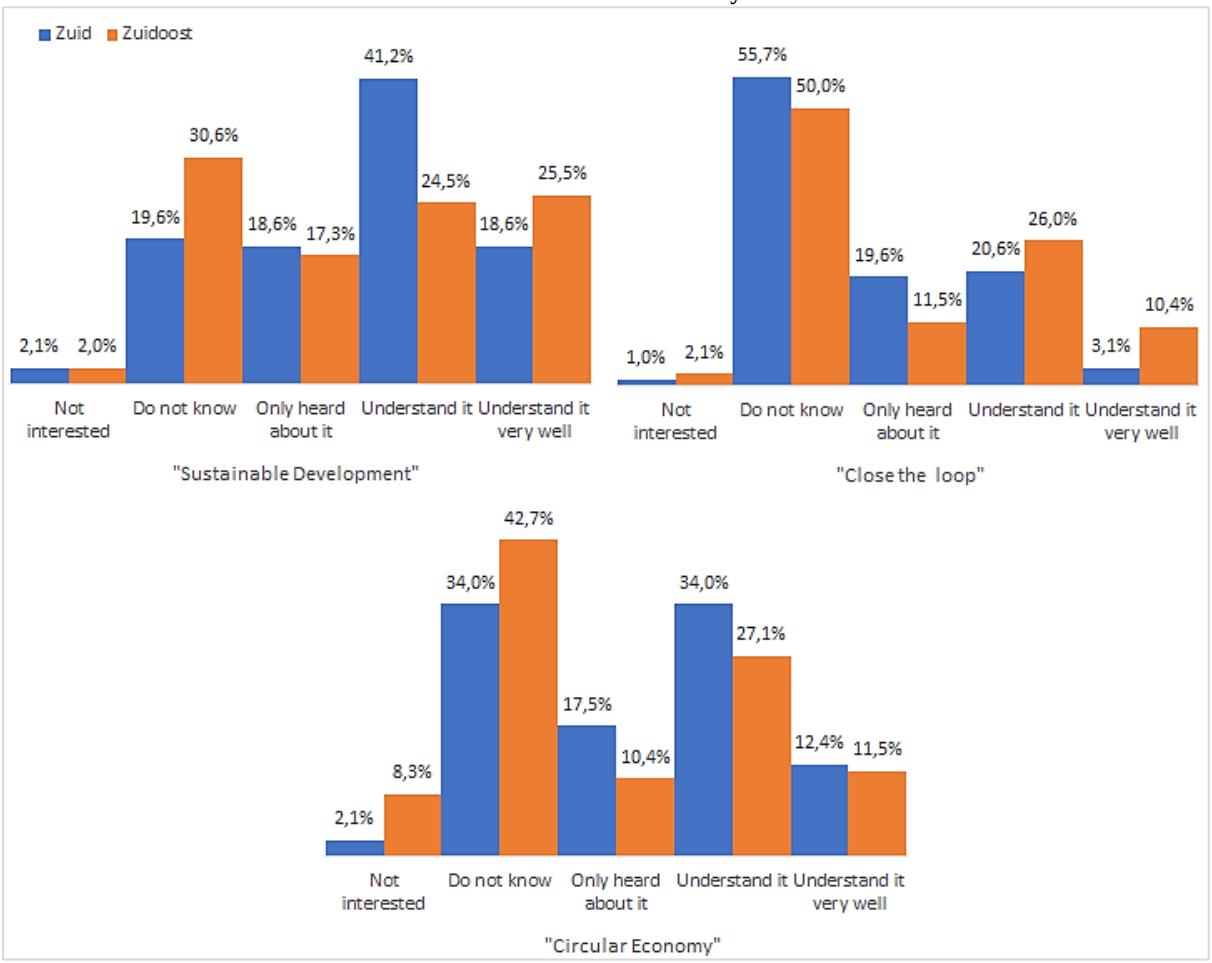
4.6 Awareness of Circular Economy

The next section investigates how the awareness of circular economy differs between Zuid and Zuidoost. The same procedure for statistical analysis was followed as already done for the other variables.

4.6.1 Understanding of Circular Economy

To measure this variable, two indicators were considered as explained in the operationalization in Table 1 in Chapter 3 which are acquaintance of terms related to CE and knowledge about the concept. The frequency of responses for the former are presented in Chart 12.

Chart 12 - Responses for questions regarding "understanding of circular economy" - Acquaintance of the terms related to circular economy

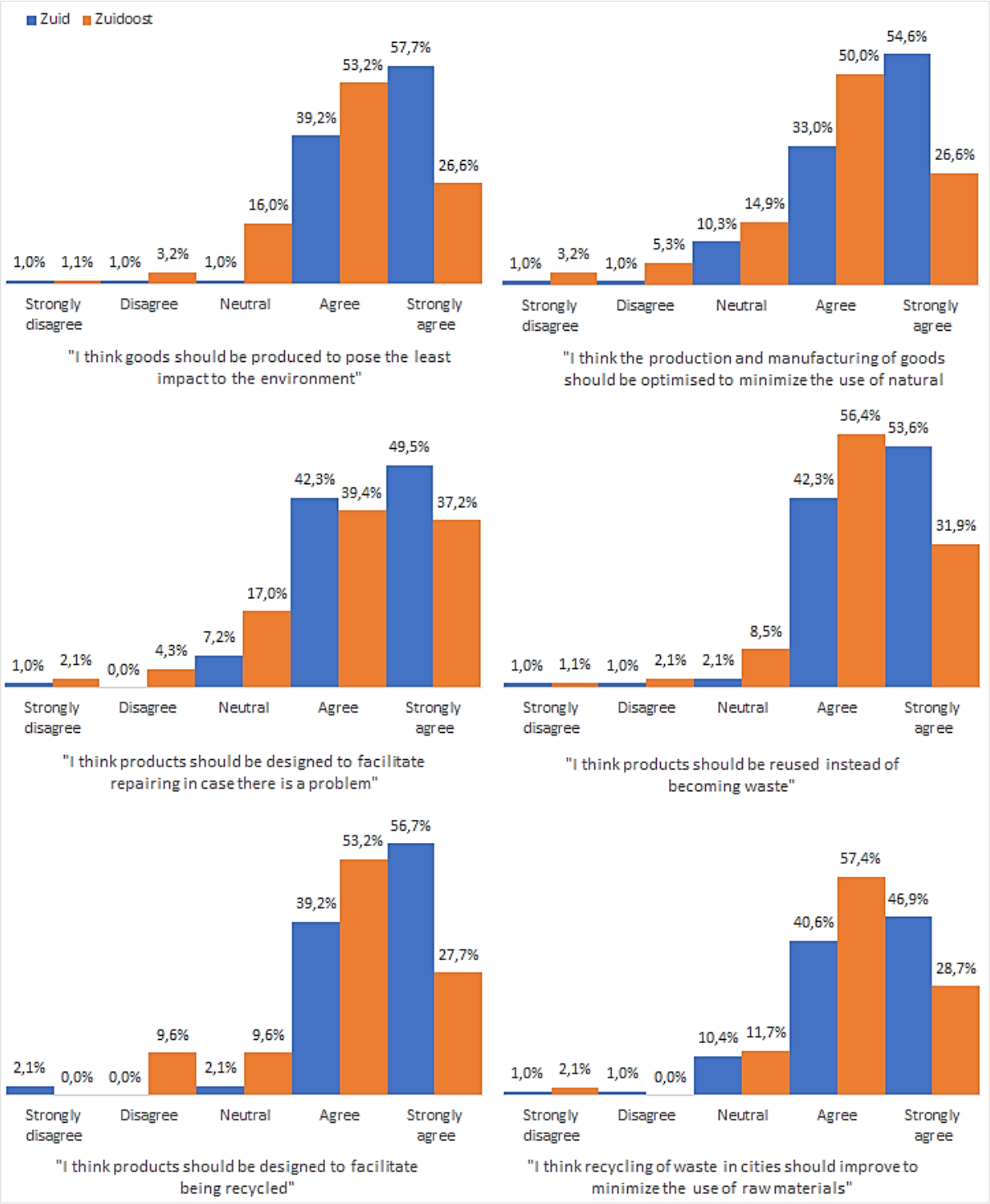


(Source: author, 2017)

Chart 12 shows that there was no clear pattern regarding the acquaintance of respondents to the selected terms. In the first question, the majority of respondents from Zuid (41,2%) replied "Understand it" while from Zuidoost it was "Do not know" (30,6%). The second question demonstrates that, for both districts, around half of respondents declared not knowing the concept of "close the loop". The last question had even more different results, because in Zuid, an equal percentage of respondents (34,0%) chose the option "Understand it" as well as "Do not know". In Zuidoost, repeatedly, the main reaction of respondents was to select "Do not know" (42,7%).

Additionally, Chart 13 portrays the responses for questions that tested the respondents' knowledge about the concept.

Chart 13 - Responses for questions regarding "understanding of circular economy" - Knowledge about CE



(Source: author, 2017)

All six graphs showed previously present the same arrangement of responses among each other, because the great majority of people replied to the statements with “Agree” and “Strongly agree”. A much smaller percentage chose the three other possibilities, which is already an indication of people’s knowledge about the concept. Nonetheless, in Zuid, the majority of responses concentrated in “Strongly agree” for all the questions whereas in Zuidoost, the majority chose “Agree” in all six statements.

From the statistical test, it was obtained the Crombach's alpha of above 0,70 (0,829), which means grouping the responses of the questionnaires to represent the variable is reliable (Table 15).

Table 15 - Statistical analysis of variable "understanding of circular economy"

α	Zuid			Zuidoost			t	p
	N	M	SD	N	M	SD		
0,829	97	4,007	0,54841	98	3,6945	0,69220	3,426	0,001

(Source: author, 2017)

The results of the independent t-test demonstrate that there is a significant difference in the means of the responses between Zuid and Zuidoost. In Zuid, the mean was M=4,007 with SD=0,54851, while in Zuidoost, M=3,6945 (SD=0,69220). The value of p obtained was 0,001 which is $p < 0,05$ and, therefore, is significant. In other words, these results indicate that, in Zuid, people have a better understanding of circular economy than in Zuidoost.

In the interviews, none of the respondents showed being acquainted with the term "circular economy". However, two out of the ten interviewees mentioned the excessive amount of plastic packaging in some products, like vegetables, which might be an indication of having some understanding of the idea. The following quotes were extracted from the interviews.

> *"I think the whole problem is that it is just easy for people to remove the package of a product and throw it away. Maybe the right approach should be to have less packaging. (…) I think it is absurd that some products still come with so much packaging in the Netherlands. I was in France a couple of weeks ago and they have a lot less packaging than here. It is so weird that we have package for a cucumber or a broccoli. They say it is supposed to make food last longer, but then is it still fresh as supermarkets say it is?" (Respondent A, Zuid)*

> *"Plastic packaging is terrible, I don't like it. In the past, we never had that and I don't see the need of it. Why would you wrap a cucumber in plastic? Or the broccoli in plastic. For what? I don't know the reason for that. I hate it, I hate plastic." (Respondent G, Zuidoost)*

One of the interviewees in Zuidoost, however, reported the complete opposite opinion by mentioning that the economy needs society to consume products to keep "moving" or developing.

> *"The economy needs us to consume this product. If you recycle this bottle and make a new one, they don't want you to do that. They want to buy more, move the economy… why are you wasting your time with this?" (Respondent J, Zuidoost)*

The quote represents the idea of linear economy, which is the current economic scenario (explained in section 2.3.1 in Chapter 2) and from which the Netherlands is transitioning into circular economy. This response from someone from Zuidoost might help explain why in Zuid people presented a better understanding of the concept.

4.7 Situational Factors

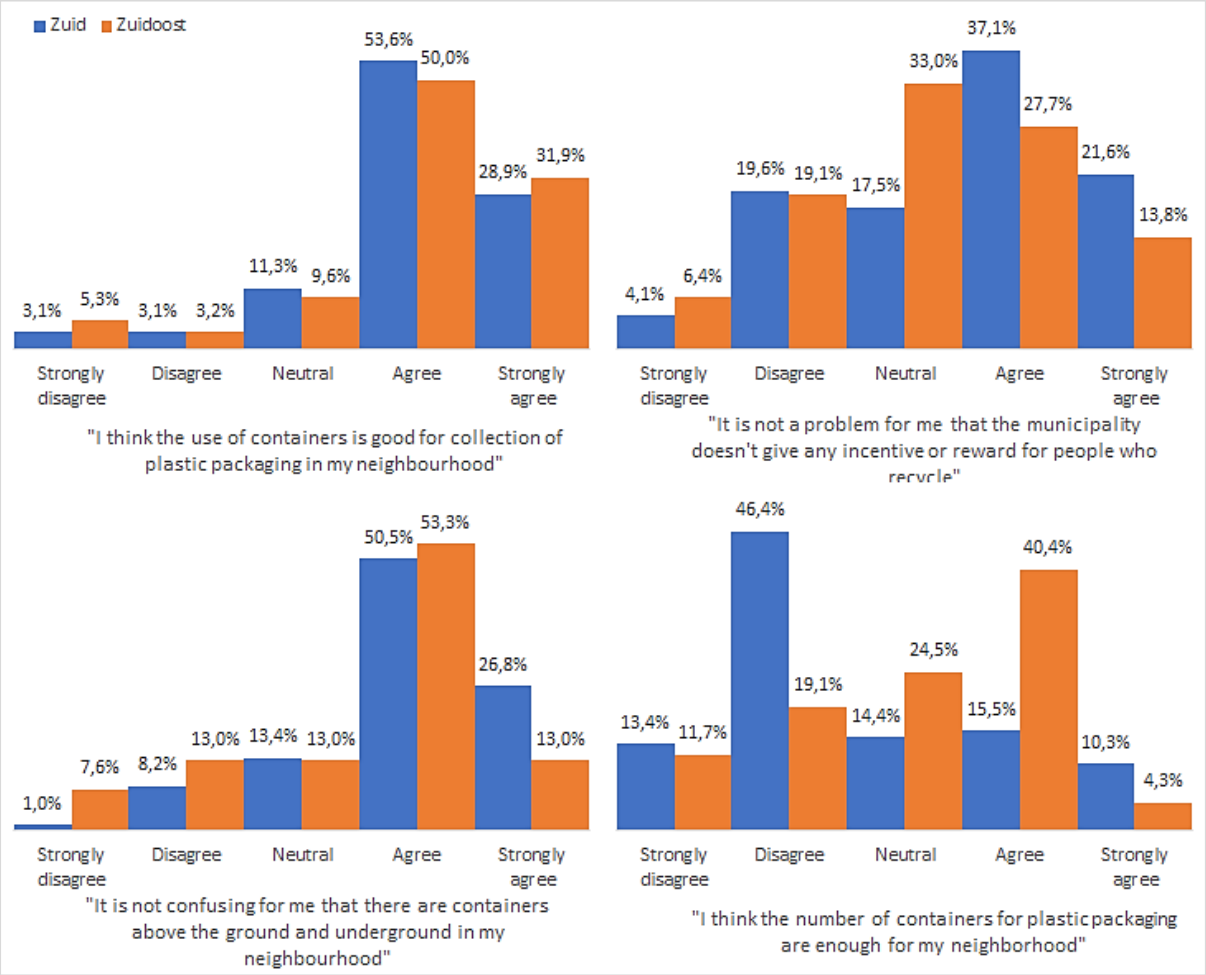
The following sections illustrate the results obtained regarding the situational factors, for which two variables were considered: infrastructure provision and information about the program.

4.7.1 Infrastructure Provision

For the variable "infrastructure provision", many indicators were used to measure the perception of the population regarding the quality of infrastructure. As presented in the operationalization (Table 1), the indicators used were satisfaction with the type of collection method used, the frequency of collection, the location of containers and the maintenance of them.

The responses for the questions regarding the indicator "satisfaction with the type of collection method" are exhibited in Chart 14.

Chart 14 - Responses for questions regarding "infrastructure provision" - perception of type of collection method

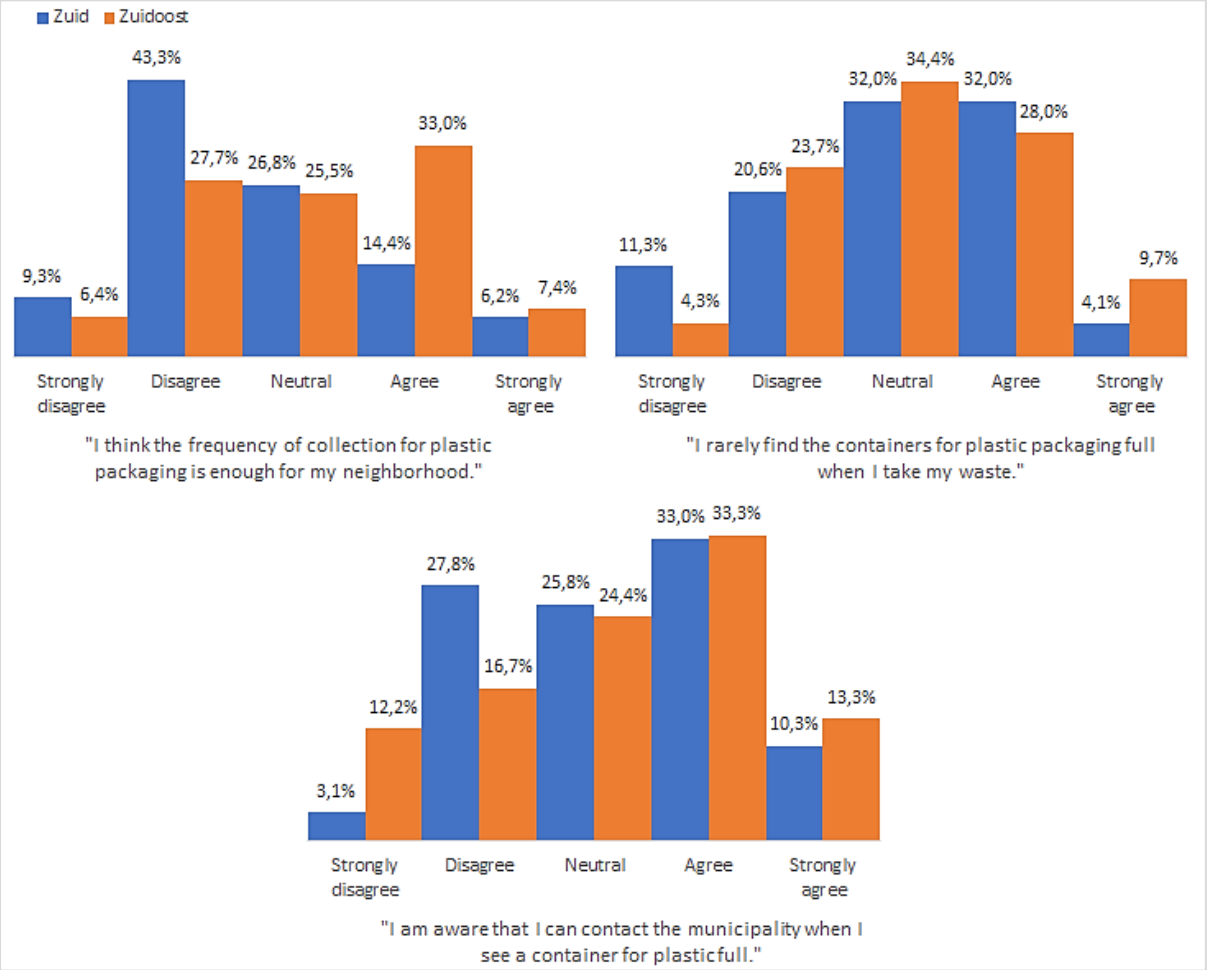


(Source: author, 2017)

The charts show that around half of respondents in both districts agree or strongly agree that using containers for plastic packaging waste collection is a good method. Similar results were also obtained when asking if people think it is confusing that there are containers underground and above ground within the same neighbourhood. However, Zuid and Zuidoost had opposite results regarding the satisfaction with number of containers. Zuid had the majority of people disagreeing (46,8%) that the number of containers is enough, while in Zuidoost, most people are satisfied (40,4%).

The responses for the questions regarding the indicator “perception of the type of collection method” are exhibited in Chart 15.

Chart 15 - Responses for questions regarding “infrastructure provision” - Frequency of collection

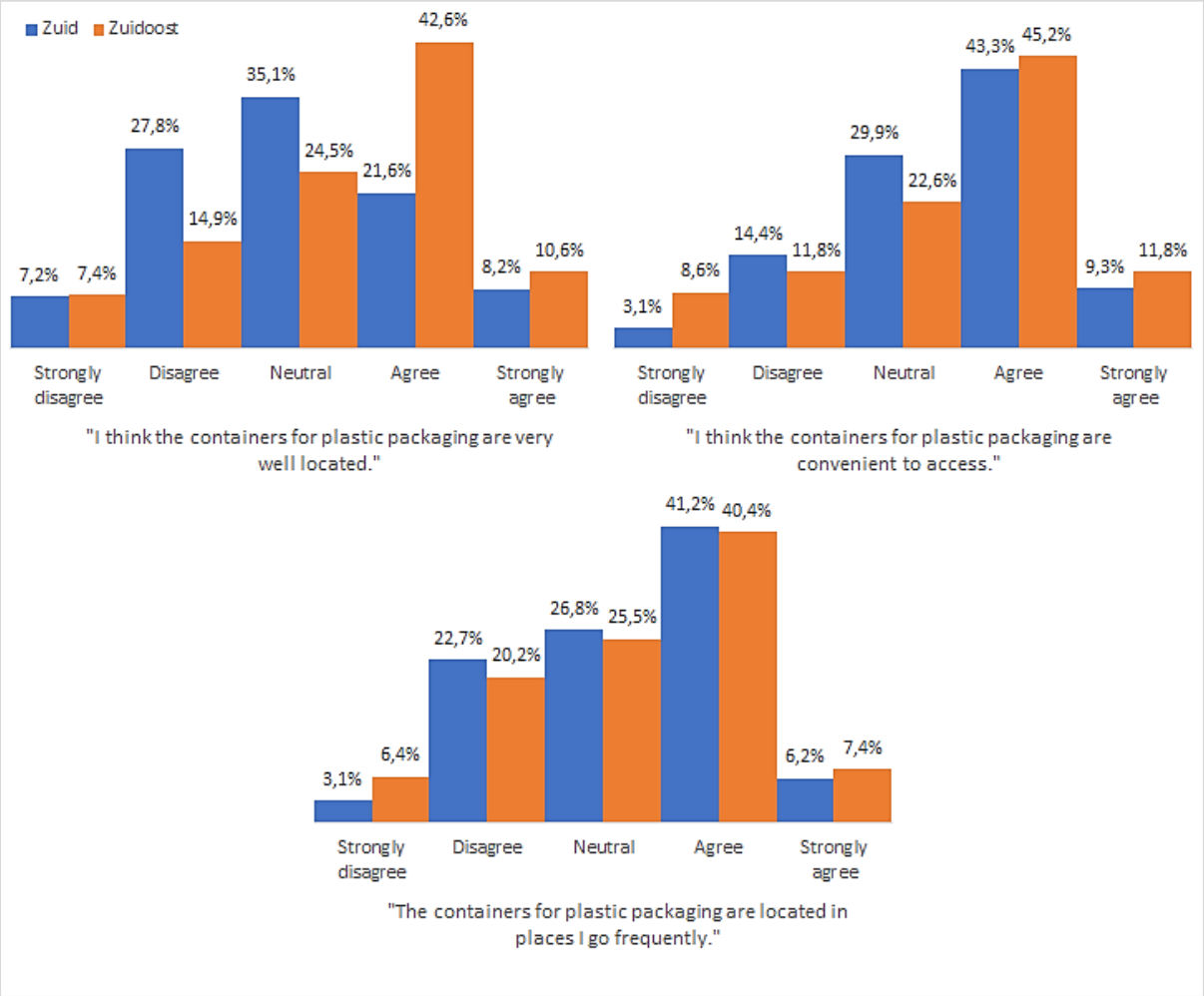


(Source: author, 2017)

The chart shows a large variety of responses for each question, both in Zuid and Zuidoost. The first statement indicates that approximately 43% of respondents in Zuid disagree that the frequency of collection is enough. In Zuidoost, however, the majority of people think the opposite, as 33% of them chose “Agree” for this statement. With regards to the second question, there is a clear concentration of responses in the middle part of the graph, due to smaller percentages of people who chose “Strongly disagree” and “Strongly agree”. In Zuid, an equal percentage of 32% of people replied “Neutral” or “Agree”, while in Zuidoost, the majority selected “Neutral” as their opinion. The last question presents both Zuid and Zuidoost with the biggest percentage of people agreeing that they are aware of the possibility of contacting the municipality in case of a container being full. In Zuid, however, there was also a peak of responses “Disagree”, which shows almost 1/3 of the respondents were not fully aware of that information.

Regarding the indicator “satisfaction with location of containers” the following responses were obtained as showed in Chart 16.

Chart 16 - Responses for questions regarding "infrastructure provision" - Location of containers



(Source: author, 2017)

In the previously portrayed graphs, it is possible to observe a pattern as in all graphs. In the totality of diagrams, the majority of people from Zuidoost replied that they agreed with the statements, with around 40%-45%. When it comes to Zuid, in the first question, the majority selected "Neutral" while in the other two questions, the great percentage chose "Agree" as the best option to represent their opinion.

Besides the previous inquiries, it was also investigated which location of containers are most convenient for the population to access. A ranking with locations was generated through the average of the responses and Zuid and Zuidoost had almost the same order, being the only difference the locations "close to parking lots" and "close to public/green spaces", as shown in Table 16.

Table 16 - Ranking of most convenient locations for containers

Locations	Ranking Zuid	Ranking Zuidoost
Close to my house	**1**	**1**
Close to the containers for other types of materials	**2**	**2**
Close to supermarkets or other commercial areas	**3**	**3**

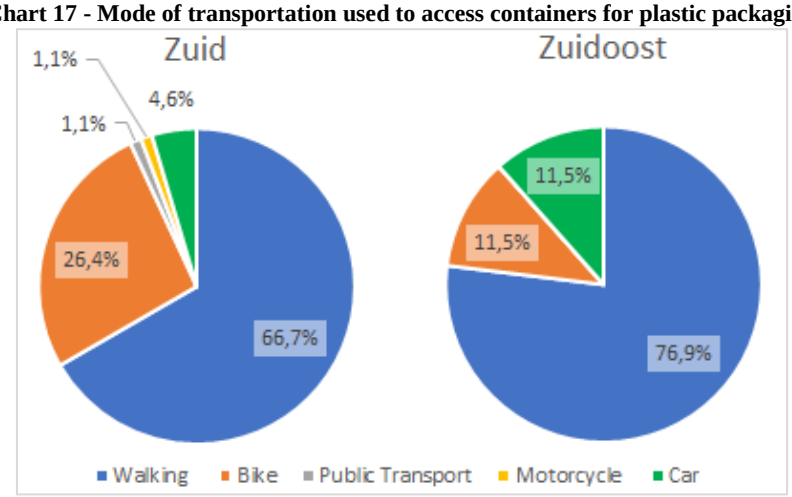
Close to schools	4	4
Close to trains/metro stations/bus stops	5	5
Close to parking lots	**6**	**7**
Close to public/green spaces such as parks and playgrounds	**7**	**6**

(Source: author, 2017)

The table shows that the respondents in both districts agree on the most convenient locations for containers, being close to houses the best one, followed by close to containers of other materials like paper and glass. The third position is occupied by "close to supermarkets and other commercials areas".

The results from the ranking illustrate that regardless of the district, people have the same opinion of what locations are convenient to access the containers. Another interesting aspect related to the location of the containers is the mode of transportation that people who recycle use to access plastic packaging use to access them. The options provided in the questionnaire were walking, bike, motorcycle, car or public transport. Chart 17 depicts these findings.

Chart 17 - Mode of transportation used to access containers for plastic packaging

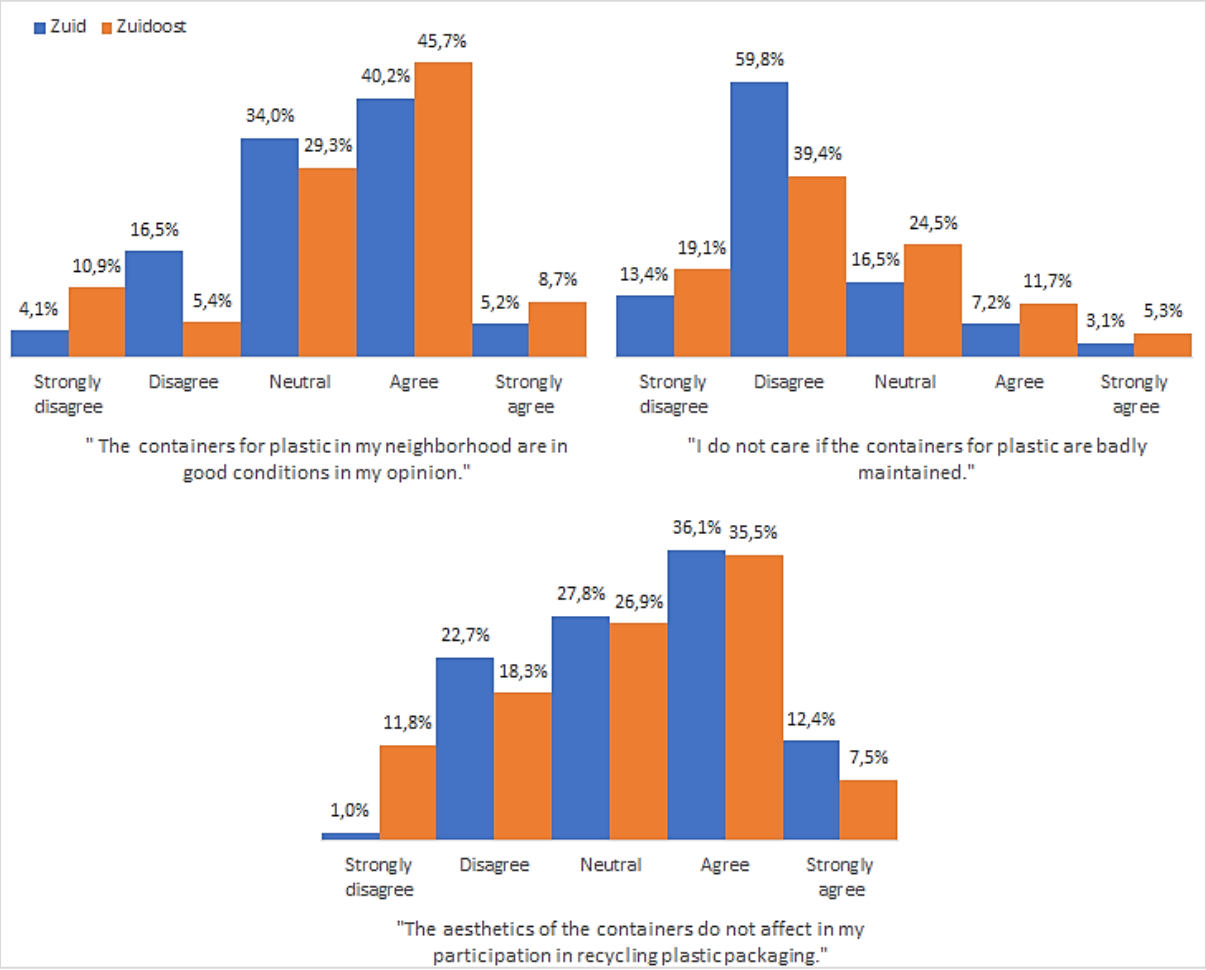


(Source: author, 2017)

Based on the graphs, one can observe that the most common mode of transportation for accessing the containers is walking (66,7% for Zuid and 76,9% for Zuidoost). In Zuid, bike had also a good representation with 26,4%, while in Zuidoost bike and car had the same percentage of 11,5%. These data might signify that the containers are located in places where people can easily access walking but can also mean that people's commitment is not so strong to encourage them to recycle when accessing the container require more than just a quick walk.

In addition, the last indicator used to measure infrastructure provision was maintenance of containers. This indicator was added after the observations, although being explicitly mentioned in the literature, because a large number of containers was in bad conditions as already showed in section 4.3.3. The results for the questions related to this indicator are illustrated in Chart 18.

Chart 18 - Responses for questions regarding "infrastructure provision" - Maintenance of containers



(Source: author, 2017)

In all three graphs, one can observe that Zuid and Zuidoost had comparable scenarios as the majority of people from both districts replied to the statements in the same way. In the first question, the greater percentage of people from both districts agreed that the containers in their neighbourhood are in good conditions. When it comes to the second question, again both districts had the majority of people with the same opinion, however Zuid had almost 60% of respondents choosing "Disagree" while in Zuidoost this number was almost 40%. Finally, the last question had Zuid and Zuidoost with around 36% of respondents choosing "Agree" as the best choice to represent their opinion regarding the influence of the aesthetics of containers in their participation in the program.

Following the same idea as the previous variables, statistical analysis was conducted to investigate if combining the responses from all these questions is reliable and also if the means of the variable "infrastructure provision" is significantly different between Zuid and Zuidoost (Table 17). The complete tables extracted from SPSS are shown in Annex 15.

Table 17 - Statistical analysis of variable "infrastructure provision"

α	Zuid			Zuidoost			t	p
	N	M	SD	N	M	SD		
0,872	97	3,1872	0,57434	94	3,2351	0,77085	-0,489	0,626

(Source: author, 2017)

The value of Crombach's alpha obtained was 0,872, which means the variable is reliable and, therefore, can be analysed. Regarding the t-test, Zuid presented M=3,1872 and SD=0,57434 whereas Zuidoost had M=3,2351 and SD=0,77085. In this case, the value of $p > 0,05$ as it was found p=0,626, which shows no significant difference between the means in Zuid and Zuidoost.

In other words, independently of the location, respondents had a similar opinion regarding the provision of infrastructure for plastic packaging recycling. In the interviews, the conditions of the infrastructure were thoroughly commented. Regarding the choice of collection system, there seemed to be an agreement between respondents from the two settlements that the infrastructure is good but there should be more containers available, as demonstrated in the following quotes.

> *"I think the infrastructure in Amsterdam is already really good. But there could be more containers, that is for sure." (Respondent B, Zuid)*
>
> *"Er kunnen meer container komen in Zuidoost" - There could be more containers in Zuidoost. (Comment in the questionnaire, Zuidoost)*
>
> *"I think the infrastructure for the plastic is good." (Respondent C, Zuid)*
>
> *"In my area it is good but it is not very good in all the neighbourhoods of Zuidoost." (Respondent G, Zuidoost)*

With regards to the frequency of collection, in the interviews and in the open question of the questionnaires, there seems to be people who are satisfied and who think it requires improvement.

> *"I often find the containers for plastic full when I take my waste so maybe put more containers." (Respondent B, Zuid)*
>
> *"The containers for plastic close to my house are always full!" (Comment in the questionnaire, Zuid)*
>
> *"I think the infrastructure for the plastic is good. It gets emptied quite some time... I think, people don't put it on the side so that's ok. But there are some people that put it in the rubbish bin, they don't care." (Respondent C, Zuid)*

When the frequency of collection is less than usual, it might lead to containers becoming full much easily. That can be a problem if people notice the containers are regularly in their highest capacity and start leaving bags on the floor or avoiding recycling. Due to that, it is important to improve the infrastructure as more people begin to participate. Another problem concerning the frequency of collection is the bad smell that might be originated from dirty packages that stay in the container for a few days before collection. However, only respondents from Zuid mentioned this factor, which unable the researcher to compare the opinions that appeared with the ones in Zuidoost.

The third indicator considered for infrastructure provision is the location of containers. Besides the need for more containers mentioned by interviewees in either Zuid and Zuidoost, respondents also spoke about the convenience of accessing them. The following quotes were extracted from the interviews.

> *"I don't understand why close to my house we have the bins for paper and glass but not for plastic. I don't know where I can find it, my friends said it's in the supermarket, but I don't know and it's annoying to have to take it to the supermarket while taking the others to another place. That's why I recycle paper and glass but not plastic." (Respondent E, Zuid)*

"Close to my house, you have the containers for paper and glass but not plastic. I need to take my plastic waste by car in the days that I go to the supermarket because that is closest. I don't understand why they don't put plastic together with the others." (Respondent H, Zuidoost)

In the extracted quotes, it is possible to observe that respondents from Zuid and Zuidoost agreed regarding the lack of coordination with the recycling facilities for other materials such as paper, cardboard and glass.

The third aspect mentioned was the maintenance of containers. During the observations, it was detected several problems with maintenance such as containers that had bad smell, were rusty, were covered with posters and had the information removed (See section 4.3.3). The first aspect was mentioned in a comment in the questionnaires, as follows.

"The containers smell a lot in the summer. I don't think use of containers is very efficient although I wouldn't know a better way." (Comment in the questionnaire, Zuid)

In Zuidoost, the information obtained contrasts the one from Zuid.

"I have the containers in front of my house, near the car park. I see sometimes a car coming to wash the containers." (Comment in the questionnaire, Zuidoost)

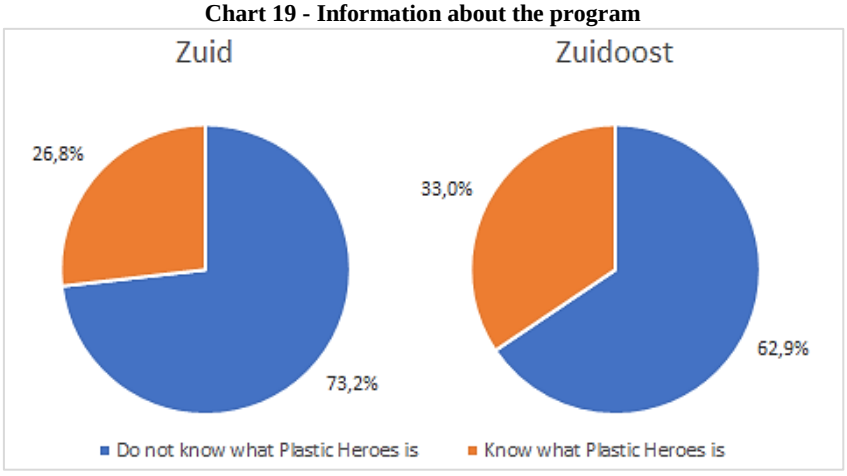
However, maintenance of containers was not mentioned in the interviews neither by Zuid or Zuidoost, which might mean that this factor is not relevant enough in none of the districts. It would be necessary, though, more information to make this conclusion specifically about this indicator of the variable "infrastructure provision".

4.7.2 Information about the program

For the variable "information about the program", two indicators were used to measure the perception of the population regarding the quality of the information. As presented in the operationalization (Table 1), the indicators used were knowledge about the program and perception of access to information.

Firstly, the indicator "knowledge about the program" was analysed. It was found that a great percentage of the respondents did not know about the program, as indicated in Chart 19 either in Zuid (73,2%) and Zuidoost (62,9%).

Chart 19 - Information about the program

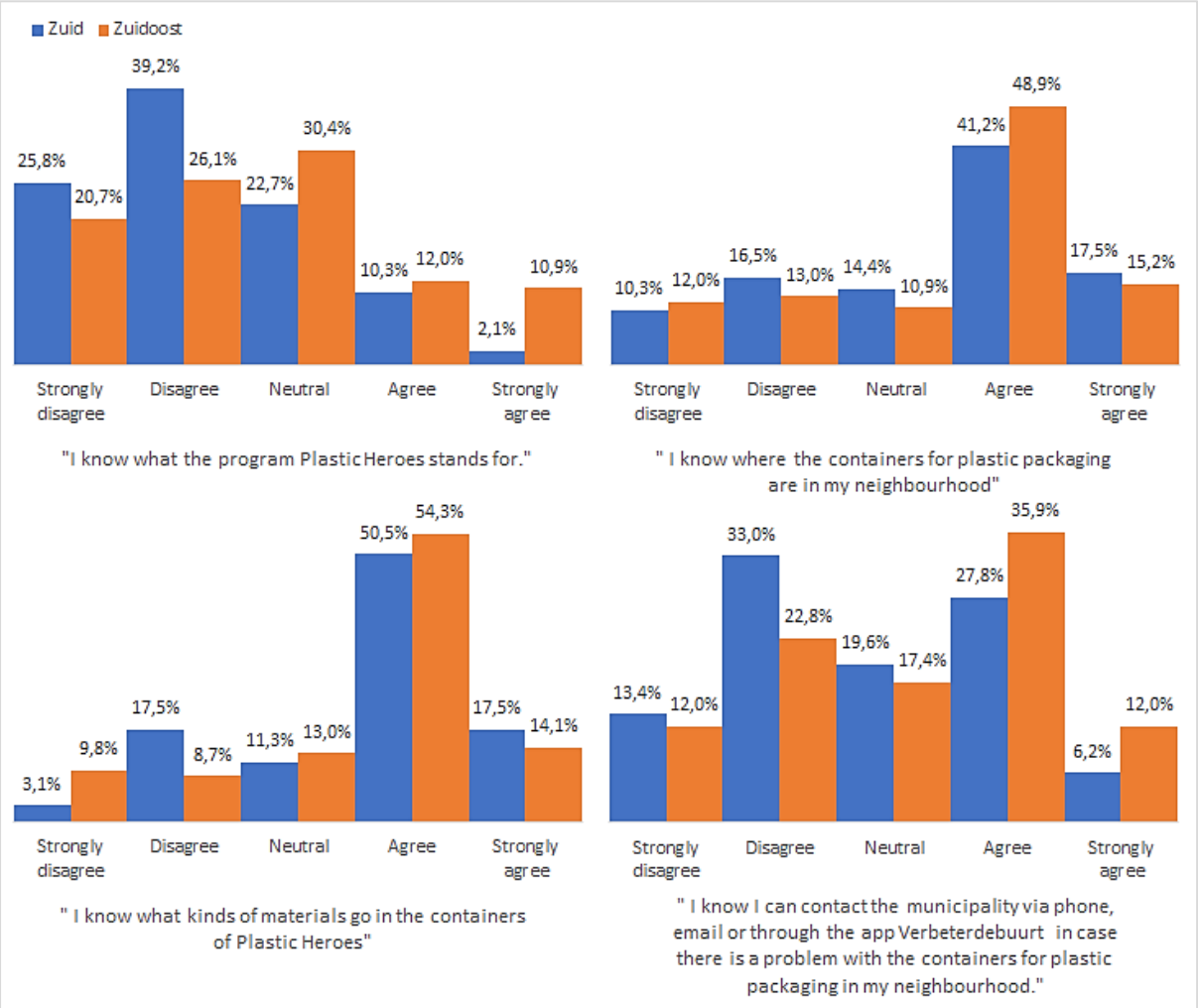


(Source: author, 2017)

Part of the respondents, however, do not know the program by its name but do know there is plastic recycling containers in their neighbourhood. Other questions were asked in the

questionnaire to understand how much people know about the program and the answers are provided in Chart 20.

Chart 20 - Responses for questions regarding "information about the program" - knowledge

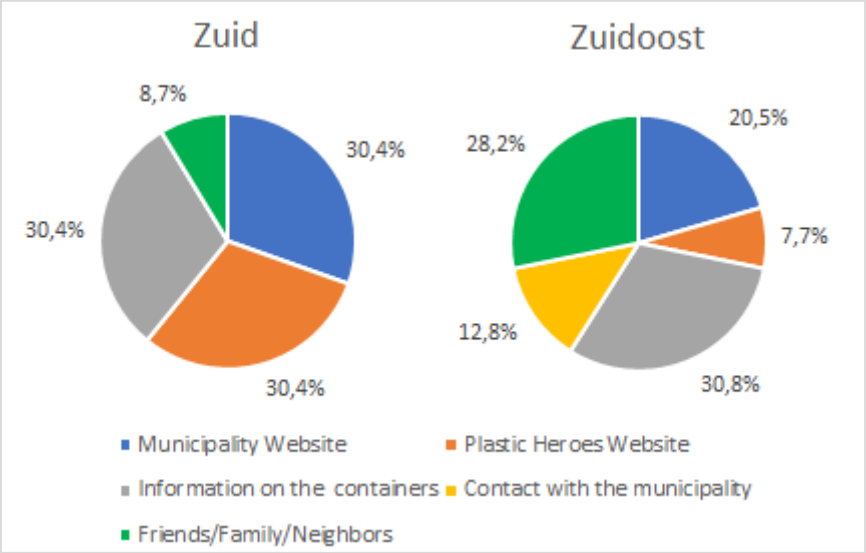


(Source: author, 2017)

From the charts, one can observe that for the first question, the majority of people from Zuid, almost 40% of respondents, replied “Disagree” to whether they knew about Plastic Heroes. Zuidoost, though, had the majority responding with “Neutral” to this question. For the second question, however, both districts had similar responses with the massive majority of “Agree” in around 41% and 49%. Same idea was observed in the third question, but in this case, the percentages varied from 50% to 54%. Finally, the last statement had controversial results from Zuid and Zuidoost as in the former, the majority disagreed with knowing they can contact the municipality in case of any problem with the containers whereas, in Zuidoost, the majority agreed with this idea.

Based on the population that is aware of Plastic Heroes, Chart 21 was made based on the responses of where they get information from.

Chart 21 - Sources of information per district

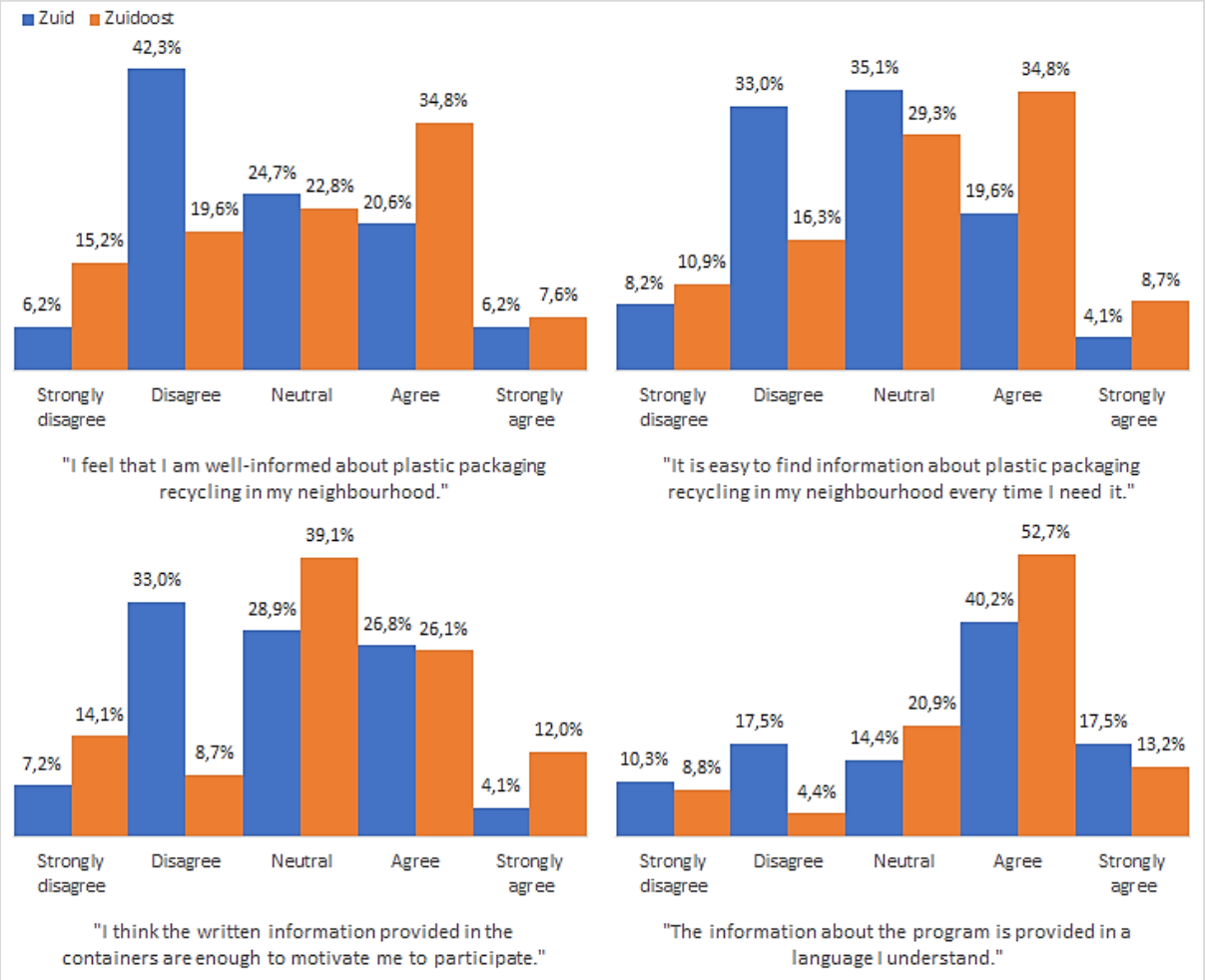


(Source: author, 2017)

Similarly, Zuid and Zuidoost had around 30% of people reporting they are informed about Plastic Heroes through the stickers attached to the containers. A very significant source was also the website of municipality for both districts. For Zuid, however, more respondents mentioned the website of Plastic Heroes as a source of information (30,4%), while for Zuidoost this source was only cited by 7,7%. Nevertheless, Zuidoost presented a large share of responses about friends, family and neighbours being the source of information, as well as the contact with the municipality. Both of these sources were not significant in Zuid (the latter was not even mentioned).

The last variable considered is the perception of access to information, in order words, it measures if people think they are well informed. Chart 22 illustrates the results for the questions related to this indicator in the questionnaire.

Chart 22 - Responses for questions regarding "information about the program" - perception of access to information



(Source: author, 2017)

From the charts, one can observe the results from the questions were very different among each other. In the first question. most people in Zuid reported not being well-informed about plastic packaging recycling (42,3%) whereas in Zuidoost most people said they are (34,8%). The second question showed an almost equal percentage of respondents from Zuid choosing “Disagree” and “Neutral”, while Zuidoost had a similar scenario but with “Neutral” and “Agree”. In the third question, related to the written information provided in the containers, the greater number of respondents from Zuid replied “Disagree” to thinking it is enough to motivate them to participate. In Zuidoost, however, the majority chose “Neutral” as the best option of response to represent their opinion. Lastly, the final question inquired if the information was provided in a language understood by the respondents, for which the majority of respondents from both districts replied as “Agree”.

Statistical tests were performed to compare the means from the results in the two districts, as demonstrated in Table 18 (complete test in Annex 16).

Table 18- Statistical analysis of "information about the program"

α	Zuid			Zuidoost			t	p
	N	M	SD	N	M	SD		
0,879	97	2,9832	0,76326	92	3,1991	0,91333	-1,767	0,079

(Source: author, 2017)

The value of Crombach's alpha was 0,879, which is higher than 0,70 and therefore means the variable is reliable. In Zuid the value of M=2,9832 (SD=0,76326) and in Zuidoost M=3,1991 (SD=0,91333). Based on that, the value of p from the t-test of 0,079 proves there is no significant difference between the two means, due to $p > 0,05$. In other words, respondents from Zuid and Zuidoost perceive the information about the program in significantly similar ways.

From the interviews, this idea is confirmed because interviewees from both districts agree there are problems with lack of proper information about plastic packaging recycling facilities. The following quotes were selected from the interviews and also from comments on the questionnaires.

> *"It could be more information, we don't see a lot in the neighbourhood. You should have in the local tv, or something in the buurthuis like this, or something you can read in the local newspaper. We have to know more about it. And also small children, we have to educate them. We know it, but we are not doing enough." (Respondent G, Zuidoost)*

> *"I am not aware of plastic recycling containers in my neighbourhood (only glass and paper). I only see containers for plastic in places such as shopping malls and airports." (Comment in the questionnaire, Zuid)*

> *"Since I have moved here I have not seen a plastic recycling bin anywhere. I need to look more but absolutely there should be more bins and information." (Comment in the questionnaire, Zuid)*

The residents of Zuid and Zuidoost are, according to the municipality, informed about the program via the website and the billboards in the containers. Using only these tools to instruct the people is not enough because it requires the individual to be already motivated to participate. One of the respondents mentioned this problem in the interview.

> *"The city is Zuid regularly have articles on the paper. I read books about it also but it's for people who want to know, want to see. That's always the problem." (Respondent C, Zuid)*

Some respondents mentioned not being aware about the existence of the program or had never heard of the name "Plastic Heroes", as already discussed in Chart 19. The fact that the large majority of the population do not know what Plastic Heroes is an indicator that the information is not reaching the desirable target. More people commented in the questionnaires that had never heard about the program, as shown in the following quotes.

> *"Never heard of it although I read the news coming from the municipality." (Comment in the questionnaire, Zuid)*

> *"Never heard about the project but maybe it is because I don't watch tv" (Comment in the questionnaire, Zuidoost)*

> *"There is no plastic recycling I knew in my neighbourhood. it is annoying." (Comment in the questionnaire, Zuid)*

> *"Do not know about recycling facilities available in my neighbourhood" (Comment in the questionnaire, Zuid)*

The previous quotes show more people in Zuid complaining about the information about Plastic Heroes, which agree with the means obtained as presented in Table 18 that Zuid had a lower score. However, as already discussed this difference is not statistically significant and, therefore, a broader sample of interviews would probably have similar results.

Nevertheless, when it comes to the perception of access to information, the qualitative data contrasts the statistical findings. For the last question in the questionnaire, Zuid and Zuidoost presented similar results both having most people agreeing that the project provides information in a language they understand (Dutch). However, in the questionnaires, some respondents from other countries stated their interest in having more information in English for internationals.

> *"More information about this topic preferably in English would be very helpful." (Comment in the questionnaire, Zuid)*
>
> *"Need English." (Comment in the questionnaire, Zuid)*
>
> *"Need information in English." (Comment in the questionnaire, Zuid)*

Miranda and Blanco (2010) stated the importance of considering people that do not speak the local language when studying and implementing projects in international cities.

4.8 Determinant of pro-environmental behaviour with Plastic Heroes

4.8.1 Statistical Regressions

In order to discover which factors are most determinant of recycling plastic packaging with Plastic Heroes, a Binary Logistic Regression was conducted in the software SPSS. According to Field (2009), this type of statistical analysis is used when the dependent variable is binary (0 or 1), being in this case 0=do not recycle plastic packaging (DRPP) and 1=recycles plastic packaging (RPP).

For this research, Binary Logistic Regression was conducted to investigate the likelihood of an individual to recycle plastic packaging based on the district they live in, on theoretical variables and on control variables. Table 19 presents three models conducted, being Model 1 with just the district, Model 2 with the district and control variables and Model 3 including also the theoretical variables.

Table 19 - Binary Logistic Regressions (Models 1 to 3)

	Model 1 - Only District (Annex 17)		**Model 2 - District + Control Var.* (Annex 18)**		**Model 3 - District + Control Var.* + Theoretical Var. (Annex 19)**	
Model						
N of observations	195		177		177	
Significance	0,008		0,031		0,000	
R^2	0,048		0,122		0,276	
Variable						
	B	**p**	**B**	**p**	**B**	**p**
District	0,773	0,008	0,633	0,092	0,470	0,284
Age	-	-	0,019	0,079	0,009	0,421
Gender - Female	-	-	0,197	0,559	0,706	0,068
Primary Education	-	-	0,919	0,148	-1,695	0,020
IncomeLessThan1000	-	-	0,097	0,843	-0,737	0,187
IncomeBetween1001and3500	-	-	0,335	0,337	-0,534	0,178
Migration Background	-	-	0,000	0,333	0,000	0,114
Migration Background - Dutch	-	-	0,523	0,139	0,784	0,044

Migration Background - Western	-	-	0,325	0,525	0,737	0,195
Attitude	-	-	-	-	0,365	0,259
SubjectiveNorm	-	-	-	-	0,353	0,205
PBC	-	-	-	-	0,311	0,236
InfraProvision	-	-	-	-	0,327	0,380
Information	-	-	-	-	0,597	0,045
UnderstandingCE	-	-	-	-	-0,537	0,177

(Source: author, 2017)

Model 1 showed the district as a significant variable in predicting the behaviour with p=0,008, which is significant. In other words, belonging to Zuid district is already a predictor of recycling plastic packaging with Plastic Heroes. However, the model had a R^2 of 4,8%, which shows the model is weak even being significant, with p=0,008. Due to that, other models were conducted to investigate the influence of control variables to the results.

While conducting the models, it was noticed that some variables were random and could, therefore, ruin the model. Due to that, they were removed leading to more strengthened models. Model 2 showed that the difference between districts disappear if the analysis is controlled for age, gender, low education, income of less than 1,000 euros, income of between 1,000 and 3,500 euros and migration background (R^2=12,2%, p=0,031). Similarly, these control variables were not significant in Model 2 either.

In Model 3, the theoretical variables were inserted to the model as well (R^2=27,6%, p=0,000). The regression indicates that the differences between the two settlements might be caused by differences in primary education (B=-1,695, p=0,020), Dutch background (B=0,784, p=0,044) and information (B=0,597, p=0,045). In the case of primary education, there is a negative relationship between having this level of education and the dependent variable. In redefined words, it means that people who have just primary education as less likely to recycle plastic packaging with Plastic Heroes than higher levels. With regards to having Dutch background, the regression showed that people who have Dutch background are more expected to participate on Plastic Heroes than other groups analysed. Same pattern was observed for information, meaning that people who are better informed about the program are more likely to recycle.

Nevertheless, in order to investigate more extensively the importance of the variables extracted from the theory, two more models were conducted as presented in Table 20.

Table 20 - Binary Logistic Regressions (Models 4 and 5)

	Model 4 - Only Theoretical Var. (Annex 20)		**Model 5 - Theoretical Var. + Control Var.* (Annex 21)**	
Model				
N of observations	187		177	
Significance	0,003		0,000	
R square	0,133		0,269	
Variable				
	B	**p**	**B**	**p**
Attitude	0,328	0,253	0,368	0,253
SubjectiveNorm	0,122	0,591	0,372	0,176
PBC	0,146	0,526	0,317	0,227
InfraProvision	0,383	0,256	0,363	0,325

Information	0,284	0,271	0,544	0,063
UnderstandingCE	0,080	0,803	-0,432	0,260
Age	-	-	0,007	0,538
Gender - Female	-	-	0,834	0,023
IncomeLessThan1000	-	-	-0,938	0,076
IncomeBetween1001and3500	-	-	-0,586	0,134
Primary Education	-	-	-1,843	0,010
Migration Background	-	-	0,000	0,054
Migration Background - Dutch	-	-	0,891	0,018
Migration Background - Western	-	-	0,882	0,110

(Source: author, 2017)

Model 4 included only theoretical variables, however, none of them were significant (R^2=13,3%, p=0,003). When incorporating the control variables in the regression, it was found that primary education (B=-1,843, p=0,010) and Dutch background (B=0,891, p=0,018) were significantly predicting the behaviour in Model 5. Similar to Model 3, primary education had a negative relationship while having Dutch background showed a positive relationship with the dependent variable. Besides, in this model, being female was also found as a predictor of plastic packaging recycling, which did not appear in the other models and therefore is not a very strong finding (B=0,834, p=0,023).

Nevertheless, the variable Information that was shown as significant in Model 3 did not appear in Model 5, which proves that although these variables had a significant effect in the dependent variable, it is not a very robust finding when compared to the results obtained for Dutch background and primary education.

4.8.2 Discussion

The psychological factors considered in this research were based on the Theory of Planned Behaviour, which has three main components: attitude towards the behaviour, subjective norm and perceived behavioural control. The regressions conducted did not present any of these variables as significant in explaining differences between Zuid and Zuidoost in plastic packaging waste segregation. These findings are inconsistent with what is discussed in the TPB by Ajzen (1991).

With regards to the first component of the TPB, the lack of influence from attitude towards the behaviour in predicting recycling was conflicting with several analyses conducted a few years ago. Bamberg and Möser (2007) claimed in their study that this factor was indeed significant which was a similar result obtained years later by Botetzagias, Dima, et al. (2015) in an empirical study administered in Greece. However, it was not surprising for attitude towards the behaviour to present itself as not significant. Early studies conducted in the 90's by Schultz, Oskamp, et al. (1995) and Cheung, Chan, et al. (1999) that investigated psychological factors in relation to recycling already indicated this factor not being significant.

Additionally, a more recent study conducted in Hangzhou, China, had similar results based on a community-based survey that also did not find any significant influence of attitude in the behaviour (Xu, et al., 2017). A possible explanation for this scenario can be traced back to the idea presented by Kollmuss and Agyeman (2002) who stated that recycling is seen as a socially correct attitude, possibly leading people to claim it is important even they do not really believe on it.

Furthermore, the second factor of the TPB was also not significant according to the models discussed in the previous section. That result goes against what was found by previous researches such as Chu and Chiu (2003) and Schultz, Oskamp et al. (1999). However, there seems to be mixed opinions in the academic setting because more recent researches such as the one in China by Xu, Lin, et al. (2017) and in Greece by Botetzagias, Dima, et al. (2015) and by Ioannou, Zampetakis, et al. (2013) did not find subjective norm as statistically significant as well.

A possible explanation for these results was offered by Schwartz (1977), who mentioned that if social norms are personally adopted by individuals, it is not perceived as pressure anymore but rather an internal motivation. Another possible explanation is the lack of interest or knowledge about other people's opinions about the topic, which can be partly affirmed by the fact that only one respondent mentioned her neighbours in the interviews regarding this issue.

> *"I see my neighbours do it but maybe half of the people, not many. Sure not all of them" (Respondent C, RPP, Zuid)*

In respect to perceived behavioural control, the third element of the TPB, the regressions also did not return as significant. In other words, the availability of time and space was not a significant influence in the difference of plastic packaging recycling rates among Zuid and Zuidoost. This result was inconsistent with the literature being that all the authors thoroughly studied found perceived behavioural control as a significant predictor of household waste separation. Timlett and Williams (2011) and Chu and Chiu (2003) discussed about the fact that lack of time and space might make people perceive recycling as a demanding activity. However, the following quotes from an interview can help support a possible explanation for this variable not being significant.

> *"I think it is really important so, although it occupies a considerable space in my house, I create the space. Same with the time, if you care you create time to do it." (Respondent B, RPP, Zuid)*

From the interview, one can claim that a possible reason for this scenario is that people who are truly motivated can create time and space when those aspects are an issue, which would make these factors not as important.

The second concept investigated was understanding of CE, which was also not significant in any of the regressions as well. Including this variable in an analysis of predictors for pro-environmental behaviour was rather new. Empirical researches conducted in China by Liu, Li, et al. (2009) and Guo, Geng, et al. (2017) observed the fact that people might not be acquainted of concepts related to CE but might still know the general idea about it. In that scenario, the results from this study were consistent to the Chinese authors because most people replied the questionnaires in similar way.

With regards to situational factors, two aspects were thoroughly investigated: infrastructure provision and information about the program. The former, however, was not significant in any of the models, which means this factor does not explain the differences between two settlements. This idea disagrees with what was presented by Miranda and Blanco (2010) that the infrastructure such as the number and the location of recycling containers can work as a facilitator or an inhibitor of behaviour. Schultz, Oskamp et al. (1995) and Timlett and Williams (2011) studied situational factors in different decades but both claimed that the infrastructure should be provided in a way to make it more convenient for people and therefore require less effort.

From the interviews and observations, one cannot conclude that the reason for this factor to not being significant is that the infrastructure is already convenient. Accordingly, another possible

explanation could be that both districts perceive the quality of the infrastructure in a similar way, which would therefore lead to this factor not being responsible for the difference. That can be confirmed with the results from the independent t-tests that did not show significant differences in the means of this variable regarding the responses in the questionnaires. Considering the interviews, analogous conclusions can be made because it was also observed similar opinions regarding especially the satisfaction with type of collection method, because in both areas respondents seemed satisfied with the infrastructure although they claimed there should be more containers.

> *"I think the infrastructure in Amsterdam is already really good. But there could be more containers, that is for sure." (Respondent B, RPP, Zuid)*

> *"Er kunnen meer container komen in Zuidoost" - There could be more containers in Zuidoost. (Comment in the questionnaire, RPP, Zuidoost)*

> *"In my area it is good but it is not very good in all the neighbourhoods of Zuidoost." (Respondent G, RPP, Zuidoost)*

Additionally, the location of containers was also mentioned in a similar way by interviewees from both areas, which do not agree with the containers from plastic being far from containers for other materials such as paper and glass.

> *"I don't understand why close to my house we have the bins for paper and glass but not for plastic. I don't know where I can find it, my friends said it's in the supermarket, but I don't know and it's annoying to have to take it to the supermarket while taking the others to another place. That's why I recycle paper and glass but not plastic." (Respondent E, DRPP, Zuid)*

> *"Close to my house, you have the containers for paper and glass but not plastic. I need to take my plastic waste by car in the days that I go to the supermarket because that is closest. I don't understand why they don't put plastic together with the others." (Respondent H, RPP, Zuidoost)*

With regards to the observations, the results endorse the same idea as the conditions of infrastructure in both districts were comparable, although more developed in Zuid than in Zuidoost.

The last theoretical variable analysed was the information about the program, which was the only significant one in the regressions along with some of the control variables that were further discussed. These results comply with the idea articulated by Miranda and Blanco (2010) that people who are well-informed about recycling programs in their cities are more likely to commit to participating and to feel satisfying while doing it. In that scenario, the fact that the large majority of the population do not know Plastic Heroes is already an indicator that the information is not reaching the final target, the population.

Based on the questionnaires, interviews and observations, one can conclude there are two barriers for the population regarding information. The first is in fact having access to the information as it was observed many respondents have never heard about the program or did not know there was plastic recycling in their neighbourhood, as stated in the quote extracted from an interview.

> *"Is there a program for recycling in Amsterdam? … I don't know where the containers are, had no idea about this project. I've never heard about any program for plastic recycling in Zuid of Amsterdam." (Respondent D, DRPP, Zuid)*

An explanation for this issue might be the fact that the population is only informed through the website and the stickers on the containers, which require the user to already know about the program prior to participating. One of the interviewees in Zuid testified this idea through the following comment.

> *"The information is provided in a way that you have to be already motivated to recycle plastic to see it, because they are only in the containers." (Respondent B, RPP, Zuid)*

Additionally, the second barrier was regarding the quality of information. After obtaining the information, the user might find it not sufficient or clarifying enough. When it concerns to the locations of containers, a possible explanation is the lack of coherence between the information provided by the municipality's website and the real infrastructure provided, which was noticed during the observations, although not mentioned in the interviews.

Nevertheless, a possible difference reason for the lack of clear information to the user is the fact that all the orientations in Amsterdam are provided in Dutch, which was perceived during the observations. Considering the number of respondents who were not Dutch, it is not surprising that several people complained about this matter in interviews and questionnaires as well. An example is shown through the following extraction.

> *"I was not informed at all about the program, where the containers are. If I go to the website, it's everything in Dutch. In a city like Amsterdam, they should provide information in English as well." (Respondent E, DRPP, Zuid)*

With regards to the control variables, most of the demographic characteristics included in the regressions did not produce any significant result: age, gender and income. Regarding the first indicator, Babaei, Alavi, et al. (2015) and Botetzagias, Dima, et al. (2015) also did not find age as significant when studying recycling behaviour in settlements in Iran and Greece.

When it comes to gender, Model 5 found that being female was significantly predicting recycling plastic packaging with Plastic Heroes and explained differences between Zuid and Zuidoost. Previous investigations are consistent with what was found in this research because they affirmed that the portion of the population who perform more pro-environmental behaviour are usually female (Kollmuss and Agyeman, 2002, Schutlz, Oskamp, et al., 1995).

However, in the case of this research, it is important to consider that the sample of the questionnaire was bias regarding gender as 61,5% of respondents in Zuid were women, while in Zuidoost only 30,1%. This finding is not very robust, though, because it only appears in one of the models. Similarly, in the study conducted in 2015 by Botetzagias, Dima, et al. (2015), although finding a significant influence of gender (female) in recycling, it was minuscule and, therefore, was unvalued by the authors.

In this research, income was also another control variable that was not significant. This finding was incompatible with authors in the literature such as Saphores and Nixon (2014) and Viscusi, Huber, et al. (2014). According to their studies, higher-income households showed higher recycling rates, however, Nixon and Saphores (2009) also mentioned the level of formal education as positively associated with recycling behavior. In the questionnaires, however, a great number of respondents were not comfortable to share their income which might have sabotaged this finding.

Education was, indeed, one of the determinants of the difference between Zuid and Zuidoost regarding recycling of plastic packaging with Plastic Heroes. In other words, one of the reasons Zuid has more people participating in the program might be because in this settlement, the population has a higher level of education. This finding is, in fact, very coherent with previous studies as Kollmuss and Agyeman (2002) and Schultz, Oskamp, et al. (1995), who found that

people who perform pro-environmental behaviour are usually highly educated. A more recent study by Babaei, Alavi, et al. (2015) also presented the same pattern. The differences of level of education might be an explanation of why the two districts had such different levels of plastic packaging recycling after the implementation of Plastic Heroes as people might be less aware of environmental problems and therefore less motivated. The following phrase were extracted from one of the interviews conducted with a man that resides in Zuidoost.

> *"I think it's stupid, why would you do that? Why would you waste your time? So if I recycle this plastic bottle, then what?" (Respondent J, DRPP, Zuidoost)*

The other significant demographic characteristic was migration background, being that people with Dutch background are more likely to recycle plastic packaging than people with a different history. In the case of Zuid and Zuidoost of Amsterdam, this scenario can relate directly to education level. The Dutch are taught about environmental issues since an early age, which might cause the population in Zuid to be more environmentally aware and to pass these ideas along to their children and grandchildren. The subsequent comment from one interviewee from Zuid supports this idea.

> *"I see that families with children are more aware of things, for the future of their children. They are quite busy with it... they think more about it. Before they used to say 'we don't have time for this, don't have time for that'. But now they realise their children need a future and clean air and so… it's a good thing." (Respondent C, RPP, Zuid)*

The population that come from other countries, especially developing ones, might not have had the chance to learn about environmental issues that much and, consequently, the children of migrants might not have had the same access to this kind of information when compared to the children of a Dutch person. The consequent quote was extracted from one of the interviews conducted with a woman born in the Netherlands but with Nigerian background.

> *"I don't know anything about recycling. You can just put the answers that you want." (Respondent I, DRPP, Zuidoost)*

Nevertheless, another possible explanation for migration background to be significant in explaining different between settlements is the fact that groups of foreigners or migrants not rarely have much more intensive labour conditions or busier working lives. Therefore, not surprisingly they might have other worries and responsibilities, prioritizing more essential aspects of their lives instead of the environment.

Chapter 5: Conclusions and recommendations

5.1 Conclusion

In order to improve the plastic chain in the Netherlands, the Dutch government created Plastic Heroes: a national program for collection and recycling of plastic packaging that focuses on avoiding plastic to get lost in the chain. Most of the municipalities in the Netherlands already put the program into action and Amsterdam was not any different. When Plastic Heroes was implemented in 2013 practically 0% of the plastic packaging was recycled in the city. However, in 2015, after two years of implementation, the seven districts had different results from the project. The best results were found in Zuid, where 11% of plastic packaging was recycled, while in Zuidoost only 2%, the worst scenario. Therefore, this research intended to explain the factors that led these two districts to have such different results for the same program.

The first aspect investigated was the implementation of Plastic Heroes in Zuid and Zuidoost to verify whether it happened in similar or disparate ways (first sub-question). Several features were considered such as type of collection method, maintenance of containers, information about the program and number and location of containers. From data obtained through secondary sources and observations, one can conclude the three first criteria analysed were comparable. Both areas have the collection done by the majority of containers above ground but also underground. Besides, either in Zuid and Zuidoost the containers had maintenance conditions very alike, with around 20% of containers in good conditions while the rest had posters glued on it, were rusty, with graffiti, among other problems. In terms of information about the program, a similar pattern was also observed as the municipality uses the same website for all the districts and the data provided in the page was outdated regarding the location of containers. Also, the second source of information was billboards in the containers, which not rarely were compromised or removed in both areas.

In terms of psychological factors, Zuid and Zuidoost had comparable results in the three variables analysed, as based on the Theory of Planned Behaviour (Ajzen, 1991): attitude towards the behaviour, subjective norm and perceived behavioural control (second sub-question). When comparing the means of responses from both settlements, it was found that for neither of the components of the TPB there was a significant difference between them. The qualitative data obtained through interviews and comments in the questionnaires also helped support these findings. Additionally, according to the results of the models of binary logistic regression, none of the elements of TPB were significant in predicting pro-environmental behaviour, which is inconsistent with the theory created by Ajzen (1991).

With regards to attitude towards the behaviour, the results agree with studies conducted in the 90's by Schultz, Oskamp, et al. (1995) and Cheung, Chan, et al. (1999) and a recent study by Xu, et al. (2017). However, the academic setting has controversial findings regarding this variable because Bamberg and Möser (2007) and Botetzagias, Dima, et al. (2015) claimed in their study that this factor was indeed significant in explaining recycling behaviour. It is likely that these results can be explained by the idea discussed by Kollmuss and Agyeman (2002), who said that as recycling is considered socially correct, people might respond to questionnaires and interviews saying they perform the behaviour when, in fact, they do not.

The second element of the TPB is subjective norm, which was also not significant in the regressions, as already stated. This outcome is coherent with the findings of Xu, Lin, et al. (2017), Botetzagias, Dima, et al. (2015) and Ioannou, Zampetakis, et al. (2013), who also did not find subjective norm as statistically significant. The most probable explanation for this variable not being significant to explain differences between Zuid and Zuidoost is the lack of

knowledge or interest in the neighbours and housemates' opinions, as supported by the interviews.

Likewise, the third item of the TPB was also not significant in the statistical regressions. This result was inconsistent with literature in the studies of Xu, Lin, et al. (2017) and Botetzagias, Dima, et al. (2015). Timlett and Williams (2011) and Chu and Chiu (2003) found that the lack of availability of time and space might cause people to see recycling as a demanding activity. A possible explanation for this variable to not be significant is the likelihood of other factors being much more important in determining the behaviour. Also, other reason might be that people who are motivated enough find a solution for the lack of time and space. Both interpretations are partly supported by the fact that PBC was only mentioned in one interview where the respondent said she does not have enough time and space in her residence, but she recycles plastic packaging anyway.

The third sub-question aimed at understanding residents' awareness of circular economy, by investigating their acquaintance of terms related to CE and knowledge about the concept. Including this variable in an analysis of predictors for pro-environmental behaviour was rather new, being only done by Liu, Li, et al. (2009) and Guo, Geng, et al. (2017) in empirical research conducted in China. From the independent t-tests, it was found that there is a significant difference between the two settlements with regards to this variable. However, in the models of binary logistic regression, awareness of circular economy was not found as a significant factor explaining differences in recycling rates of plastic packaging in Zuid and Zuidoost.

When it concerns to the last sub-question, situational factors were deeply investigated to explain their influence in pro-environmental behaviour through Plastic Heroes. The two variables considered to make the analysis were infrastructure provision and information about the program.

Schultz, Oskamp et al. (1995) and Timlett and Williams (2011) studied situational factors in different decades but both claimed that the infrastructure should be provided in a way to make it more convenient for people and therefore require less effort. Based on results from the independent t-tests, the means of the responses from both settlements were not significantly different. In the binary logistic regression models, infrastructure provision was not significant in explaining differences in recycling rates in the two studied districts. A reasonable explanation for these results is that either in Zuid and Zuidoost, the infrastructure was perceived in a similar way by respondents of questionnaires, which would lead to this variable not being significant in explaining difference between the two settlements. This idea can be supported also by findings of observations and secondary, which showed the program was implemented in similar ways when it comes to frequency of collection, maintenance of containers and number and location of containers. Also, in the interviews, respondents had similar comments concerning the quality of infrastructure regardless of the district they lived.

Similarly, the influence of information about the program on the behaviour of people was also thoroughly investigated in both districts. In the independent t-test, it was found that there was no significant difference between the means of responses of Zuid and Zuidoost. The binary logistic regression, however, found this variable as significant in explaining the differences between two settlements. In other words, people who are better informed about Plastic Heroes are more willing to participate by recycling plastic packaging. These results comply with the idea articulated by Miranda and Blanco (2010) and are not surprising, though, considering the great majority of respondents did not know the program in Zuidoost and Zuid.

The most suitable explanation for the information about the program to explain differences between Zuid and Zuidoost might be that, in the former district, people are more

environmentally aware than Zuidoost. Based on the data collected through different sources, the information fails to be transmitted to the user due to two main barriers. The first would be accessing the information, because the communication tools been used require motivation from the user to look for them. Besides, when the user finally encounters instructions about the program, it might be outdated, incoherent or provided in a language that the user do not understand.

With regards to the demographic characteristics, Zuid and Zuidoost presented significant differences in all control variables analyzed, apart from nationality, based on the results from independent t-tests. In the regressions, Dutch background and primary education were significant although the former showed a positive relationship while the latter, a negative. In other words, people with Dutch background resulted in more likely to recycle plastic packaging whereas people with primary education are less likely to do so.

Similarly, previous studies also found that people who perform pro-environmental behaviour are usually highly educated (Kollmuss and Agyeman, 2002, Schultz, Oskamp, et al., 1995, Babaei, Alavi, et al., 2015). Therefore, the results from this research are consistent with the literature. Differences in education level among Zuid and Zuidoost probably explain differences in recycling rates because people with higher education status might be more aware of environmental issues and therefore more motivated to help.

Following the same pattern, having Dutch migration background was also significant in the regressions possibly because the Dutch are taught about environmental issues since an early age, which might cause the population in Zuid to be more environmentally aware and to pass these ideas along to their children and grandchildren. People originally from other countries, especially ones in development, might not have had the chance to learn about environmental issues that much and, consequently, the children of migrants might not have had the same access to this kind of information when compared to the children of a Dutch person. In addition, other reasonable explanation for these results is that families of migrants possibly have more intensive labour conditions or busier working lives. Therefore, having to prioritize more essential aspects of their lives instead of the environment.

The variable gender was also significant in one of the models, meaning that being a woman was a predictor of behaviour. Previous studies found similar results such as the ones by Schultz, Oskamp, et al. (1995) and Kollmuss and Agyeman (2002). However, this finding was not very robust considering it only appeared significant in one of the models. Additionally, it is important to emphasize that the sample of the questionnaire was very biased in terms of gender, with Zuid having 61,5% of women respondents and Zuidoost 30,1%.

In conclusion, although having adequate information about the program was significantly explaining differences between Zuid and Zuidoost, one can deduce that demographic characteristics of migration background and level of education appeared to be far more important. Consequently, these results indicate that theory does not significantly apply to the context of Plastic Heroes in Zuid and Zuidoost in Amsterdam and, therefore, theory seems to be falsified. In this scenario, it might be possible that other factors discussed in theory that were not included in the research would have shown a much stronger impact.

Therefore, it would be interesting to extend this research with the incorporation of other theoretical variables that might be influencing people to recycle plastic packaging with the program. Investigating each district individually might also lead to discovering which factors are more determinant of the behaviour in that specific scenario leading to recommendations suited to local conditions. Additionally, it might be thought-provoking to include the other districts of Amsterdam in the analysis or even other cities. Comparing cities in the Netherlands

that have implemented Plastic Heroes using different collection methods might also be enriching, leading to exchanging information and learning from each other's best practices.

Nevertheless, theory could also see adjustment and development with further research regarding how local conditions or cultural peculiarities of people and settlements can affect in pro-environmental behaviour. It would be rather compelling to contemplate in future studies the situation of people who migrate to countries with a totally different culture and investigate how to better engage them in waste management programs. Considering the huge number of migrants moving to Europe due to the present worldwide political situation, it will be essential for not only the Netherlands but other countries in the EU to take these future residents into consideration, in order to unable the achievement of the targets set plastic recycling and circular economy.

Apart from that, it is critical to emphasize the importance of also improving the plastic chain beyond the work of Plastic Heroes. Stimulating better design of products and reducing plastic packaging might have a much stronger impact. The perception of consumers regarding circular economy is still an obscure and unclear concept in the literature, which should thus be studied in more detail by academic knowledge professionals.

5.2 Recommendations

Several recommendations can be addressed to improve recycling rates of plastic packaging with Plastic Heroes in the context of Zuid and Zuidoost.

With regards to information availability, it is possible that informing people using other communication tools other than just the website and the containers might increase the participation in the program. Examples of ways of doing that more effectively can be using social media, such as Facebook and Instagram, or partnering with content creators in the internet such as youtubers or bloggers to talk about the program.

Furthermore, with regards to the quality of existing information, the program should concentrate in updating the information on the website, especially the list of locations of containers. Another simple action that might lead to positive results is translating the content of the website and the posters in the containers to English, to assist the parcel of the population who do not speak Dutch yet. Additionally, another possible operation to improve the quality of information is investigating the containers that had the information compromised in some way and work on the maintenance of them.

When it concerns to education and migration background, one possible idea for tackling this issue is engaging community centres in increasing awareness among the residents. All the community centres in the district were contacted for this research and none of them claimed playing any role on providing orientations about waste segregation in the area. This shows itself as an opportunity for hosting activities for children to learn about environmental issues or forming group discussions about the topic among adults, for example.

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Annex 1: List of files - demographic characteristics of Zuid and Zuidoost

Date	Name	Source	Information
2015	Education System The Netherlands	EP-Nuffic	Explanation of how the education system works in the Netherlands
2017	Amsterdam city districts	I amsterdam	Map with location of the districts in Amsterdam
2017	Education level per district in 2014	OIS Gemeente Amsterdam[32]	Education level per district divided in low, medium and high education level
2017	Housing occupancy per district from 2014 to 2017	OIS Gemeente Amsterdam	How many people existed per household in average from 2014 to 2017
2017	Income per household 2014 by district	OIS Gemeente Amsterdam	Income per district and growth rate from 2011 to 2014
2017	Migration Background 2017 by district	OIS Gemeente Amsterdam	Total and percentage of people living per distrcit of Amsterdam according to migration background
2017	Population 2017 per district - percentages	OIS Gemeente Amsterdam	Population of the disctricts of Amsterdam in percentages according to being Dutch, Western and Non-Western. Includes data from 2017 and projections for 2020 and 2030.
2017	Population 2017 per district - total number	OIS Gemeente Amsterdam	Total number of people living in each district
2017	Population by gender and age 2017 per district - total number	OIS Gemeente Amsterdam	Total population according to age and gender per district
2017	Stadsdeel Zuid [South District]	I amsterdam	Area of the district Zuid + contact + address
2017	Stadsdeel Zuidoost [Southeast District]	I amsterdam	Area of the district Zuidoost + contact + address

[32] *OIS Gemeente Amsterdam* stands for *Onderzoek, Informatie en Statistie Gemeente Amsterdam.* Translating to English, it would be Research, Information and Statistics of the municipality of Amsterdam.

Annex 2: List of files – Implementation of Plastic Heroes in Zuid and Zuidoost

Date	Name	Source	Information
2011	[Correspondence on plastic collection costs in Amsterdam]	SRGA[33]	Follow up on the costs for plastic collection in Amsterdam
2011	[Correspondence on plastic collection in Amsterdam]	SRGA	Follow up on the situation of plastic collection and recycling in the city after the implementation of pilot projects between 2010 - 2011
2011	[Correspondence on the assessment of results of plastic materials collection pilots in Amsterdam]	MWH[34]	Evaluation of the results of pilots projects implemented in four different areas of Amsterdam in 2010
2015	Factsheet Dutch Legislation	Kennisinstituut Duurzaam Verpakken	Objective explanation of the legislation for packaging not only in the Netherlands but in the European Union
2015	*Van statiegeld naar Plastic Heroes* [From deposit system to Plastic Heroes]	TNS NIPO[35]	Study conducted to understand the process of transition from the *Statiegelds* to Plastic Heroes.
2016	*Kunststofinzameling Stadsdelen Amsterdam* [Plastic Collection Districts Amsterdam]	Boon, Eus	Information about weight of plastic recycled in each container in each area since the implementation in the whole city that started in 2013.
2016	Stimulus Project: Smart Wasting in Amsterdam	Amsterdam Institute for Advanced Metropolitan Solutions	Previous research done about waste recycling in one area of Amsterdam. The document is focused on the location of containers and how it impacts in the participation of the population. Interesting to have insights for the questionnaires.
2017	About the Packaging Waste Fund	Afvalfonds Verpakkingen	Explanation of how the fund works
2017	District of Zuid refuse collection	I amsterdam	Basic information about recycling for people who live in Zuid district
2017	District of Zuidoost refuse collection	I amsterdam	Basic information about recycling for people who live in Zuidoost district
2017	Legislative Framework	Afvalfonds Verpakkingen	Explanation of the legal requirements of the fund
2017	*Milieustraat de restafval* [Recycling of waste]	Afvalscheidingswijzer	What to do with other materials that are not packaging

[33] SRGA stands for *Samenwerkende Reiningingsdiensten Gementee Amsterdam*, which translates to english as Cooperative for cleaning services of the municipality of Amsterdam.
[34] MWH is the company hired by the municipality to conduct the research. http://www.mwhglobal.com
[35] TNS NIPO is the organization hired by the *Afvalfonds Verpakkingen* to conduct this research. http://www.tns-nipo.com

2017	*Over Plastic Heroes* [About Plastic Heroes]	Plastic Heroes	Explanation of what the program is and how it works (in general, not specifically in Amsterdam)
2017	*Plastic afval en drankkarton*]Plastic waste and beverage carton]	Gemeente Amsterdam	Complete list with materials that should and should not go to the containers
2017	*Plastic Avfal en drankkarton: Specifieke informatie voor stadsdeel Zuid* [Plastic waste and drink karton: Specific information for South district]	Gemeente Amsterdam	Location of containers in Zuid district - one of the lists
2017	*Plastic Avfal en drankkarton: Specifieke informatie voor stadsdeel Zuidoost* [Plastic waste and drink karton: Specific information for Southeast district]	Gemeente Amsterdam	Location of containers in Zuidoost district - one of the lists
2017	*Plastic recycling met Plastic Heroes* [Plastic recycling with Plastic Heroes)	Plastic Heroes	Information about the whole process of recycling from the moment the waste gets to the sorting instalation until its recycled.
2017	Responsibilities for producers and importers	Afvalfonds Verpakkingen	Details of the responsibilities of producers and importers of packaging based on the Packaging Agreement.
2017	*Waar kan ik plastic verpakkingen inleveren voor recycling?* [Where can I drop off plastic packaging for recycling?]	Plastic Heroes	Information about the collection method(s) used in Amsterdam and other Dutch cities

Annex 3: List of locations - containers visited in the observations

The table shows all the addresses followed by an "X" according to if the location was presented in the list of the municipality or of the treatment company or both. Some containers were not found, which are:

- In Zuid: 11, 28, 40, 43, 48, 49, 56, 59, 66, 67, 68, 71 and 72.
- In Zuidoost: 23, 24, 35 and 36.

Container nº	District	Address	Municipality Website	Data from treatment company
1	Zuid	De Boelelaan t/o 769	X	X
2	Zuid	A.J. Ernstraat 1013	X	X
3	Zuid	Groot-Essenburg t/o 1	X	X
4	Zuid	Van Nijenrodeweg 795	X	X
5	Zuid	Van der Boechorstsraat 102	X	X
6	Zuid	Doornburg 128	X	X
7	Zuid	Bolestein	X	X
8	Zuid	Buitenveldertselaan 184	X	X
9	Zuid	Van Boshuizenstraat/Walborg	X	X
10	Zuid	Arenborg t/o 2		X
11	Zuid	Nieuw Herlaer		X
12	Zuid	Van Heenvlietlaan by Jumbo	X	X
13	Zuid	Van Nijenrodeweg 363	X	X
14	Zuid	Van Nijenrodeweg 579	X	X
15	Zuid	Van Nijenrodeweg 147	X	X
16	Zuid	Beysterveld 83	X	X
17	Zuid	Weerdestein 96	X	X
18	Zuid	Weerdestein nr	X	X
19	Zuid	A.J. Ernststraat/Weerdestein	X	X
20	Zuid	Weerdestien - extra container	Found during visit, not in any list	
21	Zuid	Mensinge 78	X	X
22	Zuid	A.J. Ernststraat/Havikshorst	X	X
23	Zuid	Geervliet 165	X	
24	Zuid	Van Leijenberglaan 2-4	X	X
25	Zuid	Frieslandstraat t/o 49	X	X
26	Zuid	Hogewerf	X	
27	Zuid	Willem van Weldammelaan	X	X
28	Zuid	Parnassusweg	X	
29	Zuid	Dina Appeldoornstraat	X	X
30	Zuid	Johannes Worpstraat		X
31	Zuid	Olympiaplein 29	X	X
32	Zuid	Bertelmanplein	X	X
33	Zuid	Hygieaplein	X	X

34,35	Zuid	Stadionweg 159	X	X
36	Zuid	Eosstraat / Hestiastraat	X	X
37	Zuid	Legmeerplein 6	X	X
38	Zuid	Rietwijkerstraat 16	X	X
39	Zuid	Aalsmeerplein		X
40	Zuid	Saxen Weimarlaan		X
41	Zuid	Emmaplein, at Oranje Nassau Avenue	X	
42	Zuid	Johannes Verhulststraat	X	X
43	Zuid	Minervalaan com Apollobuurt	X	X
44	Zuid	Minervaplein 43	X	X
45	Zuid	Gerrit v/d Veenstraat 57	X	X
46	Zuid	Roelof Hartplein	X	X
47	Zuid	Johannes Vermeerplein	X	X
48	Zuid	Museum Quarter, Van Eeghenstraat	X	
49	Zuid	Alexander Boersstraat		X
50,51	Zuid	Marie Heinekenplein	X	X
52	Zuid	Gerard Doustraat	X	X
53	Zuid	Hemonylaan 125	X	X
54	Zuid	Sint Willibrordustraat / Sarvaes Noutsstraat	X	X
55	Zuid	Van Woustraat - Carillonstraat	X	X
56	Zuid	Rijnstraat 25		X
57	Zuid	Rijnstraat 41	X	X
58	Zuid	Victorieplein t.o.v 2	X	X
59	Zuid	Rijnstraat 152		X
60	Zuid	Uiterwaardestraat 88A		X
61	Zuid	Uiterwaardenstraat nr		X
62	Zuid	Kennedyplantsoen	X	X
63	Zuid	Betuwestraat/Veluwestraat	X	X
64	Zuid	Gelrestraat	X	X
65	Zuid	Niersstraat	X	X
66	Zuid	Maasstraat 36		X
67	Zuid	Churchilllaan 77		X
68	Zuid	Jekerstraat 108		X
69	Zuid	Deurloostraat t.o.v 14	X	X
70	Zuid	Wielingenstraat 16	X	X
71	Zuid	Wielingenstraat 30 C	X	X
72	Zuid	Amstelkade t.o.v 142	X	X
73	Zuid	Van Hilligaertstraat BY Aldi	X	X
74,75	Zuid	Cornelis Troostplein 4	X	X
76	Zuid	Eerste Jan Steenstraat t/o 66	X	X
77	Zuid	Sarphatipark	X	X
1	Zuidoost	Hoogoord 136		X
2	Zuidoost	Claus van Amsbergstraat 46	X	X
3	Zuidoost	Daalwijk 908		X

4	Zuidoost	Berthold Brechtstraat 239-241		X
5	Zuidoost	Agatha Christie Singel		X
6	Zuidoost	Albert Camuslaan	X	X
7	Zuidoost	Egoli 40	Found during visit, not in any list	
8	Zuidoost	Bijlmerdreef 790		X
9	Zuidoost	Annie Romeinplein 36	X	X
10	Zuidoost	Bijlmerdreef 1243		X
11	Zuidoost	Grubbehoeve	X	X
12	Zuidoost	Geerdinkhof 581	Found during visit, not in any list	
13	Zuidoost	Geerdinkhof 1103	X	X
14	Zuidoost	Kantershofstraat 40	X	X
15	Zuidoost	Kleiburg - behind metro station	Found during visit, not in any list	
16	Zuidoost	Kempering by Albert Heijn	Found during visit, not in any list	
17	Zuidoost	Kempering - extra container	Found during visit, not in any list	
18	Zuidoost	Kraaiennest	X	X
19	Zuidoost	Leusdenhof 7		X
20	Zuidoost	Maldenhof 172		X
21	Zuidoost	Hakfort	X	X
22	Zuidoost	Holendrechtplein	X	X
23	Zuidoost	Niftrikhof	X	X
24	Zuidoost	Holendrechtdreef/Nieuwegeinlaan	X	X
25	Zuidoost	Tefelenstraat 45-57		X
26	Zuidoost	Tekkopstraat t/o 110		X
27	Zuidoost	Terletstraat t/o 80-86		X
28,29	Zuidoost	Parkeerplaats Renooiplein / Reigersbos	X	X
30	Zuidoost	Renooiplein - extra container	Found during visit, not in any list	
31,32	Zuidoost	Wisseloord	X	X
33	Zuidoost	Wethouder de Roosplein	X	X
34	Zuidoost	Veenendaalplein	X	X
35	Zuidoost	Parkeergarage Liendenhof	X	X
36	Zuidoost	Seizoenenhof	X	X

Annex 4: Interview guide

1. What is your opinion about plastic packaging recycling?
2. What motivates you/barriers you to do it?
3. What do you understand by the term “circular economy”?
4. What is your opinion about the infrastructure for plastic packaging recycling in your neighbourhood?
5. What do you think about the information that is provided about the program Plastic Heroes for plastic packaging recycling?
6. How do you think the program could improve?
7. Do you have any other comments?

Annex 5: Questionnaire conducted with the population

Hello! My name is Lucianna! I am a master's student in Urban Management and Development at Erasmus University Rotterdam. My research is about plastic packaging recycling with the project Plastic Heroes in the districts of Zuid and Zuidoost of Amsterdam. I would appreciate if you could answer the questions in this questionnaire! The data collected is confidential and will only be used for academic purposes. Thank you for answering the questions and for contributing to positive change in your neighbourhood!

1. **What part of Amsterdam do you live?**

[ ] Zuid [ ] Zuidoost

2. **Do you recycle plastic packaging in your neighbourhood?**

[ ] No [ ] Yes

3. **Do you agree with the following statements? Please reply with the scale to which you agree.**

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Recycling plastic packaging is worthwhile.	[ ]	[ ]	[ ]	[ ]	[ ]
Recycling plastic packaging is good for the environment.	[ ]	[ ]	[ ]	[ ]	[ ]
Recycling plastic packaging is necessary.	[ ]	[ ]	[ ]	[ ]	[ ]
The people that live with me think I should recycle plastic packaging (if you live by yourself, skip this one).	[ ]	[ ]	[ ]	[ ]	[ ]
My neighbours think I should recycle plastic packaging.	[ ]	[ ]	[ ]	[ ]	[ ]
If more people recycle plastic packaging, I will be more willing to do that too.	[ ]	[ ]	[ ]	[ ]	[ ]
I have space in my house to segregate plastic packaging	[ ]	[ ]	[ ]	[ ]	[ ]
I think segregating plastic packaging in my house is NOT space-consuming.	[ ]	[ ]	[ ]	[ ]	[ ]
I think segregating plastic packaging in my house is NOT messy.	[ ]	[ ]	[ ]	[ ]	[ ]
I have enough time to recycle plastic packaging.	[ ]	[ ]	[ ]	[ ]	[ ]
I think recycling plastic packaging is NOT time-consuming.	[ ]	[ ]	[ ]	[ ]	[ ]
I think recycling plastic packaging is NOT troublesome in terms of time.	[ ]	[ ]	[ ]	[ ]	[ ]

4. **Do you know these concepts? Please reply with your level of knowledge about them.**

	Not interested	**Do not know**	**Only heard of it**	**Understand it**	**Understand it very well**
"Sustainable Development"	[ ]	[ ]	[ ]	[ ]	[ ]
"Close the loop"	[ ]	[ ]	[ ]	[ ]	[ ]
"Circular Economy"	[ ]	[ ]	[ ]	[ ]	[ ]

5. Do you agree with the following statements? Please reply with the scale to which you agree.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I think goods should be produced to pose the least impact to the environment.	[ ]	[ ]	[ ]	[ ]	[ ]
I think the production and manufacturing of goods should be optimized to minimize use of raw natural resources.	[ ]	[ ]	[ ]	[ ]	[ ]
I think products should be designed to facilitate repairing in case there is a problem (instead of buying a new one).	[ ]	[ ]	[ ]	[ ]	[ ]
I think products should be reused instead of becoming waste.	[ ]	[ ]	[ ]	[ ]	[ ]
I think products should be designed to facilitate recycling.	[ ]	[ ]	[ ]	[ ]	[ ]
I think recycling waste collection in cities should improve to minimize the use of raw materials.	[ ]	[ ]	[ ]	[ ]	[ ]

6. Do you agree with the following statements? Please reply with the scale to which you agree.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I think the use of containers is good for collection of plastic packaging in my neighbourhood.	[ ]	[ ]	[ ]	[ ]	[ ]
It is not a problem for me that the municipality doesn't give any incentive or reward for people who recycle plastic.	[ ]	[ ]	[ ]	[ ]	[ ]
It is NOT confusing for me that there are containers above ground and underground in my neighbourhood.	[ ]	[ ]	[ ]	[ ]	[ ]
I think the number of containers for plastic packaging are enough for my neighbourhood.	[ ]	[ ]	[ ]	[ ]	[ ]
I think the frequency of collection for plastic packaging is enough for my neighbourhood.	[ ]	[ ]	[ ]	[ ]	[ ]
I rarely find the containers for plastic packaging full when I take my waste.	[ ]	[ ]	[ ]	[ ]	[ ]
I am aware that I can contact the municipality when I see a container for plastic full.	[ ]	[ ]	[ ]	[ ]	[ ]
I think the containers for plastic packaging are very well located.	[ ]	[ ]	[ ]	[ ]	[ ]
I think the containers for plastic packaging are convenient to access.	[ ]	[ ]	[ ]	[ ]	[ ]
The containers for plastic packaging are located in places I go frequently.	[ ]	[ ]	[ ]	[ ]	[ ]
The containers for plastic in my neighbourhood are in good conditions in my opinion.	[ ]	[ ]	[ ]	[ ]	[ ]
I do not care if the containers for plastic are not regularly maintained.	[ ]	[ ]	[ ]	[ ]	[ ]

The aesthetics of the containers do not affect in my participation in recycling plastic packaging.	[ ]	[ ]	[ ]	[ ]	[ ]

7. In your opinion, what are the best locations for plastic containers? Rank them 1 to 5 being 1=least convenient location and 5=most convenient location.

	1	**2**	**3**	**4**	**5**
Close to my house	[ ]	[ ]	[ ]	[ ]	[ ]
Close to supermarkets or other commercial areas	[ ]	[ ]	[ ]	[ ]	[ ]
Close to schools	[ ]	[ ]	[ ]	[ ]	[ ]
Close to train/metro stations/bus stops	[ ]	[ ]	[ ]	[ ]	[ ]
Close to parking lots	[ ]	[ ]	[ ]	[ ]	[ ]
Close to the containers for other types of materials	[ ]	[ ]	[ ]	[ ]	[ ]
Close to public/green spaces such as parks and playgrounds	[ ]	[ ]	[ ]	[ ]	[ ]

8. What is the transportation you use to access the closest container?

[ ] Walking	[ ] Motorcycle	[ ] Car
[ ] Bike	[ ] Public Transportation	[ ] Other_____

9. Do you agree with the following statements? Please reply with the scale to which you agree.

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
I know what the program Plastic Heroes stands for.	[ ]	[ ]	[ ]	[ ]	[ ]
I know where the containers for plastic packaging are located in my neighbourhood.	[ ]	[ ]	[ ]	[ ]	[ ]
I do not have any trouble in understanding what kind of materials should go in the plastic packaging container.	[ ]	[ ]	[ ]	[ ]	[ ]
I know I can contact the municipality via phone, email or through the app *Verbeterdebuurt* in case there is a problem with the containers for plastic packaging in my neighbourhood.	[ ]	[ ]	[ ]	[ ]	[ ]
I feel that I am well informed about plastic packaging recycling in my neighbourhood.	[ ]	[ ]	[ ]	[ ]	[ ]
It is easy to find information about plastic packaging recycling in my neighbourhood every time I need it.	[ ]	[ ]	[ ]	[ ]	[ ]
I think the written information provided in the containers are enough to motivate me to participate in the program.	[ ]	[ ]	[ ]	[ ]	[ ]
The information about the program is provided in a language I understand.	[ ]	[ ]	[ ]	[ ]	[ ]

10. How do you get information about Plastic Heroes?

[ ] I do not know what Plastic Heroes is
[ ] Municipality Website
[ ] Plastic Heroes Website
[ ] Information provided in the containers
[ ] Contact with the municipality via phone/email
[ ] Friends/family/neighbours
[ ] Using the app *VerbeterdeBuurt*
[ ] Other _____

11. What is your age? _____

12. What is your gender? [ ] Female [ ] Male [ ] Other

13. What is your nationality? _____

14. What is your migration background?

[ ] Dutch [ ] Antilian [ ] Surinamese [ ] Moroccan [ ] Turkish [ ] Other _____

15. What is your education background?

[ ] Primary Education [ ] Secondary Education [ ] Undergraduate [ ] Postgraduate

16. What is your household's net monthly income?

[ ] 1,000 euros net a month or less
[ ] between 1,001 and 3,500 euros net a month
[ ] between 3,501 and 6,000 euros net a month
[ ] more than 6,001 euros net a month
[ ] I don't know
[ ] Prefer not to say

Any more comments about plastic recycling in your neighbourhood?

_____
_____
_____

I am also going to do individual interviews about the topic. If you are interested in participating in any of them, please leave your email.

_____

Thank you! I really appreciate your participation! If you want to receive results from my research, write your email here.

_____

Annex 6: List of plastic packaging materials for Plastic Heroes containers

In the containers of plastic waste can only go only empty packaging material. See the examples below**.**

Plastic bags, sacks and films:

- Bags and purses
- Bread bags
- Bags for pasta and rice
- Candy packaging
- Meat and cheese packaging
- Films for brochures and magazines

Drink cartons:

- Beverage packs of fruit juices, water and wine
- Milk, yogurt containers and VLA
- Soup suits
- Pasta sauce packs

Bottles:

- Bottles of, for instance soft drink, water or milk
- Detergent bottles, shampoo and soap
- Squeeze bottles for sauce
- Bottles for oil and vinegar

Tubs, cups and containers:

- Cups of yogurt, custard and ice
- Trays of fries, salad, fruit and vegetables
- Tubs for butter, sauces and toppings
- Containers and bags for fruit, vegetables and salad
- Tubes for toothpaste, cream and lotion
- Jars for gel and vitamins
- Plant pots
- Plastic lids of, for example, peanut butter jars

This should not be in the containers (should be taken to the recycling centres)

- Packaging content
- Containers of chemical waste such as white spirit bottles
- Packaging foam, such as meat trays
- Styrofoam
- Packages with aluminum foil, such as potato chip bags and blister packs
- Other plastic products and consumer goods such as toys and garden furniture (Gemeente Amsterdam, 2017).

Annex 7: List of cities in the Netherlands by method for plastic packaging collection

City	Collection Method		
	Door to door	**Containers**	**Post-separation**
Tilburg	X	X	
Utrecht	X	X	
Nijmegen	X		
Maastricht		X	
Almere	X	X	
Breda	X	X	
Amsterdam		X	
Amersfoort	X	X	
Lelystad		X	
Leiden		X	
Delft		X	
Schiedam		X	
Arnhem	X	X	
Gouda	X		
Zwolle		X	
Vlissingen		X	
Rotterdam		X	
Haarlem		X	
Den Haag		X	
Eindhoven		X	
Venlo	X		
Apeldoorn		X	
Dordrecht	X		
Enschede		X	
Groningen[36]			X
Leeuwarden[37]			

[36] The city of Groningen uses post-segregation to recycle plastic waste but it is not through Plastic Heroes.
[37] The city of Leeuwarden does not use any of these methods. It has only one station that people can take their plastic waste. Therefore, it is not part of Plastic Heroes.

Annex 8: Complete distribution of respondents – age

District	Age	Frequency	Percentage	Valid percentage	Cumulative percentage
Zuid	14	2	2,1%	2,1	2,1
	19	1	1,0%	1,0	3,1
	20	2	2,1%	2,1	5,2
	21	8	8,2%	8,2	13,4
	23	2	2,1%	2,1	15,5
	24	3	3,1%	3,1	18,6
	25	1	1,0%	1,0	19,6
	26	4	4,1%	4,1	23,7
	27	1	1,0%	1,0	24,7
	28	1	1,0%	1,0	25,8
	29	1	1,0%	1,0	26,8
	30	3	3,1%	3,1	29,9
	31	4	4,1%	4,1	34,0
	32	4	4,1	4,1	38,1
	33	3	3,1	3,1	41,2
	35	4	4,1	4,1	45,4
	37	2	2,1	2,1	47,4
	38	4	4,1	4,1	51,5
	39	5	5,2	5,2	56,7
	40	3	3,1	3,1	59,8
	41	2	2,1	2,1	61,9
	42	2	2,1	2,1	63,9
	43	4	4,1	4,1	68,0
	45	2	2,1	2,1	70,1
	46	1	1,0	1,0	71,1
	47	2	2,1	2,1	73,2
	48	1	1,0	1,0	74,2
	49	3	3,1	3,1	77,3
	52	1	1,0	1,0	78,4
	53	3	3,1	3,1	81,4
	58	2	2,1	2,1	83,5
	59	2	2,1	2,1	85,6
	60	1	1,0	1,0	86,6
	62	1	1,0	1,0	87,6
	63	1	1,0	1,0	88,7
	65	2	2,1	2,1	90,7
	66	3	3,1	3,1	93,8
	69	1	1,0	1,0	94,8
	70	1	1,0	1,0	95,9
	71	1	1,0	1,0	96,9
	77	1	1,0	1,0	97,9

	79	1	1,0	1,0	99,0
	84	1	1,0	1,0	100,0
	Total	97	100,0	100,0	
Zuidoost	16	2	2,0	2,2	2,2
	17	2	2,0	2,2	4,4
	19	2	2,0	2,2	6,7
	21	2	2,0	2,2	8,9
	23	2	2,0	2,2	11,1
	28	1	1,0	1,1	12,2
	29	2	2,0	2,2	14,4
	30	5	5,1	5,6	20,0
	31	2	2,0	2,2	22,2
	33	2	2,0	2,2	24,4
	34	1	1,0	1,1	25,6
	35	3	3,1	3,3	28,9
	36	1	1,0	1,1	30,0
	37	5	5,1	5,6	35,6
	38	2	2,0	2,2	37,8
	39	1	1,0	1,1	38,9
	41	1	1,0	1,1	40,0
	43	2	2,0	2,2	42,2
	44	4	4,1	4,4	46,7
	45	4	4,1	4,4	51,1
	47	3	3,1	3,3	54,4
	48	3	3,1	3,3	57,8
	49	3	3,1	3,3	61,1
	50	2	2,0	2,2	63,3
	52	2	2,0	2,2	65,6
	53	1	1,0	1,1	66,7
	54	2	2,0	2,2	68,9
	55	2	2,0	2,2	71,1
	56	3	3,1	3,3	74,4
	58	3	3,1	3,3	77,8
	59	2	2,0	2,2	80,0
	60	6	6,1	6,7	86,7
	62	3	3,1	3,3	90,0
	63	1	1,0	1,1	91,1
	64	2	2,0	2,2	93,3
	66	1	1,0	1,1	94,4
	68	2	2,0	2,2	96,7
	73	2	2,0	2,2	98,9
	77	1	1,0	1,1	100,0
	Total valid	90	91,8	100,0	
	Missing	8	8,2		
	Total	98	100,0		

Annex 9: Complete distribution of respondents – nationality

District	Nationality	Frequency	Percentage	Valid percentage	Cumulative percentage
Zuid	Dutch	73	75,3	75,3	75,3
	British	7	7,2	7,2	82,5
	Italian	1	1,0	1,0	83,5
	Brazilian	1	1,0	1,0	84,5
	Indian	2	2,1	2,1	86,6
	American	1	1,0	1,0	87,6
	Polish	2	2,1	2,1	89,7
	German	1	1,0	1,0	90,7
	Egyptian	1	1,0	1,0	91,8
	Lithuanian	1	1,0	1,0	92,8
	Romanian	1	1,0	1,0	93,8
	Icelandic	1	1,0	1,0	94,8
	Slovakian	1	1,0	1,0	95,9
	Belgium	1	1,0	1,0	96,9
	Australian	1	1,0	1,0	97,9
	Israeli	2	2,1	2,1	100,0
	Total	97	100,0	100,0	
Zuidoost	Dutch	64	65,3	71,1	71,1
	Surinamese	9	9,2	10,0	81,1
	British	4	4,1	4,4	85,6
	Ghanian	1	1,0	1,1	86,7
	Nigerian	5	5,1	5,6	92,2
	Italian	4	4,1	4,4	96,7
	Ugandan	1	1,0	1,1	97,8
	Mozambican	2	2,0	2,2	100,0
	Total valid	90	91,8	100,0	
	Missing	8	8,2		
	Total	98	100,0		

Annex 10: Distribution of respondents – migration background

District	Migration Background	Frequency	Percentage	Valid percentage	Cumulative percentage
Zuid	Dutch	62	63,9	63,9	63,9
	Antilian	3	3,1	3,1	67,0
	Surinamese	2	2,1	2,1	69,1
	Moroccan	1	1,0	1,0	70,1
	Turkish	2	2,1	2,1	72,2
	British	7	7,2	7,2	79,4
	Italian	1	1,0	1,0	80,4
	Indonesian	1	1,0	1,0	81,4
	Brazilian	1	1,0	1,0	82,5
	Indian	2	2,1	2,1	84,5
	American	1	1,0	1,0	85,6
	Polish	2	2,1	2,1	87,6
	German	1	1,0	1,0	88,7
	Egyptian	1	1,0	1,0	89,7
	Russian	1	1,0	1,0	90,7
	Romanian	1	1,0	1,0	91,8
	Icelandic	1	1,0	1,0	92,8
	Slovakian	1	1,0	1,0	93,8
	Ethiopian	1	1,0	1,0	94,8
	Australian	1	1,0	1,0	95,9
	Israeli	2	2,1	2,1	97,9
	African	2	2,1	2,1	100,0
	Total	97	100,0	100,0	
Zuidoost	Dutch	18	18,4	20,0	20,0
	Antilian	1	1,0	1,1	21,1
	Surinamese	37	37,8	41,1	62,2
	Moroccan	2	2,0	2,2	64,4
	British	4	4,1	4,4	68,9
	Ghanian	1	1,0	1,1	70,0
	Nigerian	6	6,1	6,7	76,7
	Pakistan	1	1,0	1,1	77,8
	Italian	5	5,1	5,6	83,3
	Indonesian	1	1,0	1,1	84,4
	Ugandan	1	1,0	1,1	85,6
	Indian	2	2,0	2,2	87,8
	Mozambican	2	2,0	2,2	90,0
	Chinese	1	1,0	1,1	91,1
	Phillipine	2	2,0	2,2	93,3
	African	6	6,1	6,7	100,0
	Total valid	90	91,8	100,0	-
	Missing	8	8,2	-	-
	Total	98	100,0	-	-

Annex 11: Independent t-test for “attitude towards the behaviour”

Group Statistics

District		N	Mean	Std. Deviation	Std. Error Mean
Attitude towards the behaviour	Zuid	97	4,4107	0,68383	0,06943
	Zuidoost	98	4,2041	0,87394	0,08828

Independent samples test

		Levene's test for Equality of Variances		t-test for equality of means						
		F	Sig.	t	DF	Sig. (t-tailed)	Mean difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Inferior	Superior
Attitute towards the behaviour	Equal variances assumed	1,810	0,180	1,837	193	0,068	0,20657	0,11245	-0,01522	0,42837
	Equal variances not assumed			1,839	183,265	0,067	0,20657	0,11231	-0,01502	0,42817

Annex 12: Independent t-test for “subjective norm”

Group Statistics

District		N	Mean	Std. Deviation	Std. Error Mean
Subjective Norm	Zuid	97	3,5326	0,82026	0,08328
	Zuidoost	96	3,5347	0,91859	0,09375

Independent samples test

		Levene's test for Equality of Variances		t-test for equality of means						
		F	Sig.	t	DF	Sig. (t-tailed)	Mean difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Inferior	Superior
Subjective Norm	Equal variances assumed	1,948	0,164	-0,017	191	0,987	-0,00208	0,12533	-0,24928	0,24513
	Equal variances not assumed			-0,017	188,149	0,987	-0,00208	0,12540	-0,24945	0,24530

Annex 13: Independent t-test for “perceived behavioural control”

Group Statistics

District		N	Mean	Std. Deviation	Std. Error Mean
PBC	Zuid	97	3,4777	0,83598	0,08488
	Zuidoost	98	3,5461	0,85487	0,08636

Independent samples test

		Levene's test for Equality of Variances		t-test for equality of means						
		F	Sig.	t	DF	Sig. (t-tailed)	Mean difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Inferior	Superior
PBC	Equal variances assumed	0,758	0,385	-0,565	193	0,573	-0,06843	0,12110	-0,30728	0,17043
	Equal variances not assumed			-0,565	192,972	0,573	-0,06843	0,12109	-0,30725	0,17040

Annex 14: Independent t-test for "understanding of circular economy"

Group Statistics

District		N	Mean	Std. Deviation	Std. Error Mean
Understanding of CE	Zuid	97	4,0007	0,54841	0,05568
	Zuidoost	98	3,6945	0,69220	0,06992

Independent samples test

		Levene's test for Equality of Variances		t-test for equality of means						
		F	Sig.	t	DF	Sig. (t-tailed)	Mean difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Inferior	Superior
Understanding of CE	Equal variances assumed	4,150	0,043	3,421	193	0,001	0,30619	0,08949	0,12969	0,48270
	Equal variances not assumed			3,426	184,191	0,001	0,30619	0,08939	0,12984	0,48254

Annex 15: Independent t-test for “infrastructure provision”

Group Statistics

District		N	Mean	Std. Deviation	Std. Error Mean
Infrastructure Provision	Zuid	97	3,1872	0,57434	0,05832
	Zuidoost	94	3,2351	0,77085	0,07951

Independent samples test

		Levene's test for Equality of Variances		t-test for equality of means						
		F	Sig.	t	DF	Sig. (t-tailed)	Mean difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Inferior	Superior
Infrastructure Provision	Equal variances assumed	2,623	0,107	-0,489	189	0,626	-0,04795	0,09816	-0,24157	0,14567
	Equal variances not assumed			-0,486	171,808	0,627	-0,04795	0,09860	-0,24257	0,14668

Annex 16: Independent t-test for “information about the program”

Group Statistics

District		N	Mean	Std. Deviation	Std. Error Mean
Information about the program	Zuid	97	2,9832	0,76326	0,07750
	Zuidoost	92	3,1991	0,91333	0,09522

Independent samples test

		Levene's test for Equality of Variances		t-test for equality of means						
		F	Sig.	t	DF	Sig. (t-tailed)	Mean difference	Std. Error Diference	95% Confidence Interval of the Difference	
									Inferior	Superior
Information about the program	Equal variances assumed	1,614	0,205	-1,767	187	0,079	-0,21590	0,12219	-0,45695	0,02516
	Equal variances not assumed			-1,759	177,611	0,080	-0,21590	0,12277	-0,45818	0,02638

Annex 17: Binary Logistic Regression – Model 1 (Only district)

Categorical Variables Codings

		Frequency	Parameter Codings (1)
District	Zuid	97	1,000
	Zuidoost	98	0,000

Bloco 0: Beginning Block

Classification Table[a,b]

Observed			Predicted		
			Behavior		Correct Percentage
			DRPP	RPP	
Step 0	Behavior	DRPP	0	91	0,0
		RPP	0	104	100,0
	Overall Percentage				53,3

a. The constant is included in the model

b. The cutting value is ,500

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	0,134	0,144	0,865	1	0,352	1,143

Variables not in the equation

			Score	df	Sig.
Step 0	Variáveis	District(1)	7,077	1	0,008
	Overal Statistics		7,077	1	0,008

Block 1: Method=Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	7,122	1	0,008
	Block	7,122	1	0,008
	Model	7,122	1	0,008

Model Summary

Step	-2 Log likelihood	Cox & Snell R square	Nagelkerke R square
1	262,338[a]	0,036	0,048

a. Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.

Classification Table[a]

Observed			Predicted		
			Behavior		Correct Percentage
			DRPP	RPP	
Passo 1	Behavior	DRPP	55	36	60,4
		RPP	43	61	58,7
	Porcentagem global				59,5

a. The cut value is ,500

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	District(1)	0,773	0,293	6,989	1	0,008	2,167
	Constant	-0,246	0,204	1,462	1	0,227	0,782

a. Variable(s) inserted in Step 1: District.

Annex 18: Binary Logistic Regression – Model 2 (District + Control Variables)

Categorical Variables Codings

		Frequency	Parameter Codings	
			(1)	(2)
Migration_New	Dutch	77	1,000	0,000
	Western	24	0,000	1,000
	Non-western	76	0,000	0,000
Gender	Female	85	1,000	
	Male	92	0,000	
PrimaryEducation	No	162	0,000	
	Yes	15	1,000	
IncomeLessThan1000	No	151	0,000	
	Yes	26	1,000	
IncomeBetween1001and3500	No	108	0,000	
	Yes	69	1,000	
District	Zuid	95	1,000	
	Zuidoost	82	0,000	

Bloco 0: Beginning Block

Classification Table[a,b]

Observed			Predicted		
			Behavior		Correct Percentage
			DRPP	RPP	
Step 0	Behavior	DRPP	0	82	0,0
		RPP	0	95	100,0
	Overall Percentage				53,7

a. The constant is included in the model

b. The cutting value is ,500

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	0,147	0,151	0,953	1	0,329	1,159

Variables not in the equation

			Score	df	Sig.
Step 0	Variables	District(1)	7,420	1	0,006
		Age	1,587	1	0,208
		Gender(1)	1,745	1	0,186

		PrimaryEducation(1)	4,807	1	0,028
		IncomeLess Than1000(1)	0,165	1	0,684
		IncomeBetween 1001e3500(1)	0,879	1	0,348
		Migration_New	5,747	2	0,057
		Migration_New(1)	4,116	1	0,042
		Migration_New(2)	0,243	1	0,622
	Overall Statistics		16,217	8	0,039

Block 1: Method=Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	16,914	8	0,031
	Block	16,914	8	0,031
	Model	16,914	8	0,031

Model Summary

Step	-2 Log likelihood	Cox & Snell R square	Nagelkerke R square
1	227,505[a]	0,091	0,122

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Classification Table[a]

Observed			Predicted		
			Behavior		Correct Percentage
			DRPP	RPP	
Passo 1	Behavior	DRPP	44	38	53,7
		RPP	31	64	67,4
	Porcentagem global				61,0

a. The cut value is ,500

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	District(1)	0,633	0,376	2,835	1	0,092	1,883
	Age	0,019	0,011	3,095	1	0,079	1,019
	Gender(1)	0,197	0,338	0,342	1	0,559	1,218
	PrimaryEducation(1)	-0,919	0,636	2,091	1	0,148	2,508

	IncomeLessThan 1000(1)	-0,097	0,490	0,039	1	0,843	1,102
	IncomeBetween 1001e3500(1)	-0,335	0,349	0,922	1	0,337	1,398
	Migration_New			2,200	2	0,333	
	Migration_New(1)	0,523	0,353	2,192	1	0,139	1,686
	Migration_New(2)	0,325	0,511	0,404	1	0,525	1,384
	Constant	-2,479	0,961	6,654	1	0,010	0,084

a. Variable(s) inserted in Step 1: District, Age, Gender, PrimaryEducation, IncomeLessThan1000, IncomeBetween1001and3500, Migration_New.

Annex 19: Binary Logistic Regression – Model 3 (District + Theoretical Variables + Control Variables)

Categorical Variables Codings

		Frequency	Parameter Codings (1)	(2)
Migration_New	Dutch	77	1,000	0,000
	Western	24	0,000	1,000
	Non-western	76	0,000	0,000
Gender	Female	85	1,000	
	Male	92	0,000	
PrimaryEducation	No	162	0,000	
	Yes	15	1,000	
IncomeLessThan1000	No	151	0,000	
	Yes	26	1,000	
IncomeBetween1001and3500	No	108	0,000	
	Yes	69	1,000	
District	Zuid	95	1,000	
	Zuidoost	82	0,000	

Bloco 0: Beginning Block

Classification Table[a,b]

Observed			Predicted Behavior DRPP	RPP	Correct Percentage
Step 0	Behavior	DRPP	0	82	0,0
		RPP	0	95	100,0
	Overall Percentage				53,7

a. The constant is included in the model

b. The cutting value is ,500

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	0,147	0,151	0,953	1	0,329	1,159

Variables not in the equation

			Score	df	Sig.
Step 0	Variables	District(1)	7,420	1	0,006
		Age	1,587	1	0,208
		Gender(1)	1,745	1	0,186
		PrimaryEducation(1)	4,807	1	0,028
		IncomeLessThan1000(1)	0,165	1	0,684

		IncomeBetween 1001and3500(1)	0,879	1	0,348
		Migration_New	5,747	2	0,057
		Migration_New(1)	4,116	1	0,042
		Migration_New(2)	0,243	1	0,622
		Attitude	6,716	1	0,010
		SubjectiveNorm	4,198	1	0,040
		PBC	6,304	1	0,012
		InfraProvision	9,649	1	0,002
		Information	9,816	1	0,002
		UnderstandingCE	5,505	1	0,019
	Overall Statistics		36,749	14	0,001

Block 1: Method=Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	40,954	14	0,000
	Block	40,954	14	0,000
	Model	40,954	14	0,000

Model Summary

Step	-2 Log likelihood	Cox & Snell R square	Nagelkerke R square
1	203,464[a]	0,207	0,276

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Classification Table[a]

Observed			Predicted		
			Behavior		Correct Percentage
			DRPP	RPP	
Passo 1	Behavior	DRPP	56	26	68,3
		RPP	18	77	81,1
	Porcentagem global				75,1

a. The cut value is ,500

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	District(1)	0,470	0,439	1,147	1	0,284	1,599
	Age	0,009	0,012	0,649	1	0,421	1,009
	Gender(1)	0,706	0,387	3,336	1	0,068	2,026
	PrimaryEducation(1)	-1,695	0,730	5,399	1	0,020	5,448
	IncomeLess Than1000(1)	-0,737	0,559	1,738	1	0,187	2,090
	IncomeBetween 1001and3500(1)	-0,534	0,396	1,818	1	0,178	1,706
	Migration_New			4,352	2	0,114	
	Migration_New(1)	0,784	0,390	4,045	1	0,044	2,191
	Migration_New(2)	0,737	0,569	1,679	1	0,195	2,090
	Attitude	0,365	0,324	1,273	1	0,259	1,441
	SubjectiveNorm	0,353	0,278	1,608	1	0,205	1,423
	PBC	0,311	0,262	1,407	1	0,236	1,365
	InfraProvision	0,327	0,373	0,770	1	0,380	1,387
	Information	0,597	0,298	4,015	1	0,045	1,817
	UnderstandingCE	-0,537	0,398	1,821	1	0,177	0,584
	Constant	-8,493	1,979	18,418	1	0,000	0,000

a. Variable(s) inserted in Step 1: District, Age, Gender, PrimaryEducation, IncomeLessThan1000, IncomeBetween1001and3500, Migration_New, Attitude, SubjectiveNorm, PBC, InfraProvision, Information, UnderstandingCE.

Annex 20: Binary Logistic Regression – Model 4 (Only Theoretical Variables)

Bloco 0: Beginning Block

Classification Table[a,b]

Observed			Predicted		
			Behavior		Correct Percentage
			DRPP	RPP	
Step 0	Behavior	DRPP	0	86	0,0
		RPP	0	101	100,0
	Overall Percentage				54,0

a. The constant is included in the model

b. The cutting value is ,500

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	0,161	0,147	1,201	1	0,273	1,174

Variables not in the equation

			Score	df	Sig.
Step 0	Variables	Attitude	8,405	1	0,004
		SubjectiveNorm	6,173	1	0,013
		PBC	8,690	1	0,003
		InfraProvision	12,061	1	0,001
		Information	11,894	1	0,001
		UnderstandingCE	7,306	1	0,007
	Overall Statistics		17,964	6	0,006

Block 1: Method=Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	19,609	6	0,003
	Block	19,609	6	0,003
	Model	19,609	6	0,003

Model Summary			
Step	-2 Log likelihood	Cox & Snell R square	Nagelkerke R square
1	238,424[a]	0,100	0,133

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Classification Table[a]

Observed			Predicted		
			Behavior		Correct Percentage
			DRPP	RPP	
Passo 1	Behavior	DRPP	53	33	61,6
		RPP	24	77	76,2
	Porcentagem global				69,5

a. The cut value is ,500

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Attitude	0,328	0,287	1,308	1	0,253	1,389
	SubjectiveNorm	0,122	0,226	0,288	1	0,591	1,129
	PBC	0,146	0,230	0,402	1	0,526	1,157
	InfraProvision	0,383	0,337	1,292	1	0,256	1,467
	Information	0,284	0,258	1,210	1	0,271	1,329
	UnderstandingCE	0,080	0,321	0,062	1	0,803	1,083
	Constant	-4,616	1,380	11,193	1	0,001	0,010

a. Variable(s) inserted in Step 1: Attitude, SubjectiveNorm, PBC, InfraProvision, Information, UnderstandingCE.

Annex 21: Binary Logistic Regression – Model 5 (Theoretical Variables + Control Variables)

Categorical Variables Codings

		Frequency	Parameter Codings (1)	(2)
Migration_New	Dutch	77	1,000	0,000
	Western	24	0,000	1,000
	Non-western	76	0,000	0,000
IncomeLessThan1000	No	151	0,000	
	Yes	26	1,000	
IncomeBetween1001and3500	No	108	0,000	
	Yes	69	1,000	
PrimaryEducation	No	162	0,000	
	Yes	15	1,000	
Gender	Female	85	1,000	
	Male	92	0,000	

Bloco 0: Beginning Block

Classification Table[a,b]

Observed			Predicted		
			Behavior		Correct Percentage
			DRPP	RPP	
Step 0	Behavior	DRPP	0	82	0,0
		RPP	0	95	100,0
	Overall Percentage				53,7

a. The constant is included in the model

b. The cutting value is ,500

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	0,147	0,151	0,953	1	0,329	1,159

Variables not in the equation

			Score	df	Sig.
Step 0	Variables	Attitude	6,716	1	0,010
		SubjectiveNorm	4,198	1	0,040
		PBC	6,304	1	0,012
		InfraProvision	9,649	1	0,002

		Information	9,816	1	0,002
		UnderstandingCE	5,505	1	0,019
		Age	1,587	1	0,208
		Gender(1)	1,745	1	0,186
		IncomeLess Than1000(1)	0,165	1	0,684
		IncomeBetween 1001and3500(1)	0,879	1	0,348
		PrimaryEducation(1)	4,807	1	0,028
		Migration_New	5,747	2	0,057
		Migration_New(1)	4,116	1	0,042
		Migration_New(2)	0,243	1	0,622
	Overall Statistics		35,702	13	0,001

Block 1: Method=Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	39,812	13	0,000
	Block	39,812	13	0,000
	Model	39,812	13	0,000

Model Summary

Step	-2 Log likelihood	Cox & Snell R square	Nagelkerke R square
1	204,607[a]	0,201	0,269

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Classification Table[a]

Observed			Predicted		
			Behavior		Correct Percentage
			DRPP	RPP	
Step 1	Behavior	DRPP	60	22	73,2
		RPP	20	75	78,9
	Porcentagem global				76,3

a. The cut value is ,500

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Attitude	0,368	0,322	1,307	1	0,253	1,445
	SubjectiveNorm	0,372	0,276	1,828	1	0,176	1,451
	PBC	0,317	0,262	1,458	1	0,227	1,373
	InfraProvision	0,363	0,368	0,970	1	0,325	1,437
	Information	0,544	0,293	3,446	1	0,063	1,723
	UnderstandingCE	-0,432	0,383	1,270	1	0,260	0,649
	Age	0,007	0,011	0,379	1	0,538	1,007
	Gender(1)	0,834	0,368	5,132	1	0,023	2,303
	IncomeLess Than1000(1)	-0,938	0,528	3,152	1	0,076	2,555
	IncomeBetween 1001and3500(1)	-0,586	0,391	2,243	1	0,134	1,797
	PrimaryEducation(1)	-1,843	0,720	6,549	1	0,010	6,318
	Migration_New			6,265	2	0,054	
	Migration_New(1)	0,891	0,376	5,605	1	0,018	2,437
	Migration_New(2)	0,882	0,553	2,549	1	0,110	2,416
	Constant	-9,064	1,931	22,035	1	0,000	0,000

a. Variable(s) inserted in Step 1: Attitude, SubjectiveNorm, PBC, InfraProvision, Information, UnderstandingCE, Age, Gender, IncomeLessThan1000, IncomeBetween1001and3500, PrimaryEducation, Migration_New.