

Circularity

transformation of household waste
management into a more circular one

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Course code: GEO4-3111

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Abstract:

Our current form of resource management is based on a linear economy, intensified by the constantly growing population and consumerism culture. These trends causing serious pressure on our finite resources, results in constantly growing amounts of trash, have wide environmental implications and affect the social and economic sustainability. One of the current trends trying to depart from this linear approach is the circular economy (CE) concept. CE is a complex and vague concept, embodying a variety of domains, circular waste management being only one of them. CE and circular waste management are only rarely and fragmentedly implemented in practice, and these examples only seldomly analyzed by the scientific literature. In addition, the involvement of individuals, private households and consumers in the transition process, although being one of the central enablers of the CE, is absent almost completely from scientific literature and policy measures. The aim of this thesis is to explore how can local governments, waste utility companies and other private or public-private service providers support private households' in more effectively contributing to CE through their waste management. Using Amsterdam as a case-study, this research analyzed the municipality's and its' partners activities along the 5Es framework adopted for this research. Results suggest that the municipality of Amsterdam and its partners acknowledge that effective behavioral change can only be achieved through a 'package' of measures, utilizing all the 5E groups of instruments. The greater use of the municipality is of the "engage" and "enable" instruments, followed by a much smaller scope of initiatives using the "exemplify" and "enforce" instruments. The "encourage" instrument is used only to a very limited extend. The municipality of Amsterdam started its transition towards CE only 4 years ago. It seems that the municipality has introduced pathways to CE in general and to the domain of circular waste management in particular, but the process is still too slow, focusing mainly on the already existing waste management system. To enhance the transition process, more often use of "enforce" and "encourage" instruments should be made, CE should be defined as priority in the municipal policy agenda, and most importantly, the transition process should be led and facilitated by higher levels of governmental authorities – the national and international ones.

Key words: circular economy, waste management, socio-technical infrastructures, circular waste management hierarchy, private households, behavioral change

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Introduction:

Our current form of resource management is based on a linear economy - extract-produce-use-dump (Korhonen et al, 2018; Pauliuk, 2018; Petit-Boix, & Leipold, 2018; Ritzén & Sandström, 2017; Salvia, 2015). Material consumption has grown eightfold over the past 100 years and is expected to triple by 2050, intensified by the constantly growing population and consumerism culture (Prendeville et al, 2018). This causes serious pressure on our finite resources and results in constantly growing amounts of trash. These trends have wide environmental implications, leaving remarkable footprint, stressing the ecosystem and the capacity of the planet to provide a safe habitat for us to live in. It also affects the social and economic sustainability and lead to global price volatility (Iacovidou et al, 2017; Korhonen et al, 2018; Prendeville et al, 2018; Ritzén & Sandström, 2017; Salvia et al, 2015). Current trends are trying to depart from this linear approach and to shift the production, consumption, disposal patterns and waste management facilities towards a more sustainable path by decreasing the amount of consumed resources and minimizing the impacts on the environment while still allowing economic growth (Iacovidou et al, 2017; Ritzén & Sandström, 2017; Salvia 2015). One such a trend, currently adopted by scholars, politician and businesses, is the concept of Circular Economy (CE) (EMF, 2015; Prendeville et al, 2018).

CE is wide and complex concept, encompassing various areas of life. Broadly, it is coping with 3 challenges - resource scarcity, environmental impact and increasing economic benefits. It suggest keeping materials available instead of disposing them; maximizing the value of a resource by closing the loop of materials in the product lifecycle in local, national or even global scale; creating a “spiral loop system” by keeping products in use as long as possible (Del Borghi et al., 2014; Kalmykova et al., 2018; Korhonen et al., 2018; Prendeville et al., 2018; Ritzén & Sandström, 2017). The newly created cycle will be high value material cycle, achieved through the multiple R-strategies - repair, reuse, refurbish, remanufacture and recondition, cascading and upgrading, as opposed to low grade raw materials created through the traditional recycling (Iacovidou et al., 2017; Kirchherr et al., 2017; Korhonen et al., 2018; Ritzén & Sandström, 2017). The ideal vision of the CE is a theoretical optimum of 100% mass, energy and resources efficient system (Pauliuk, 2018). CE’s ideal implementation is expected to reduce virgin resource usage, energy consumption, waste and emission outputs while at the same time saving material, resource and energy costs, dampening price volatility, improving the security of supply and retaining the highest possible value and quality of products for as long as possible, making the system more economic (EMF 2015; Kalmykova et al., 2018; Korhonen et al., 2018; Ritzén & Sandström, 2017).

The transformation to CE constitutes a big shift, requiring socio-technical change in a wide range of domains (Buclet & Godard, 2001). One such important domain is the waste management domain. In order to depart from the linear economy, keep materials available and fed back to the system, closing the loop of the production lifecycle and lowering the amounts of the virgin resources used, disposal and waste management patterns should be changed. Under the concept of CE, waste should be seen as resources and its management should be circular.

Circular waste management is gaining more and more attention and interest among researchers and practitioners alike and in 2017 CE has come to play a guiding role in contemporary EU waste

legislation...” (Zacho, Mosgaard & Riisgaard, 2018, p.3). Nevertheless, the idea of circular waste management is yet neither widely developed in theory nor fully implemented in practice (Kalmykova et al., 2018; Park & Chertow, 2014; Prendeville et al., 2018; Ritzén & Sandström, 2017).

Research gaps:

Although the scientific literature on CE is growing fast, it is still in its initial stages and has not caught up yet with the non-academic research and implementation of CE in practice (Kirchherr et al., 2017; Korhonen et al., 2018; Prendeville et al., 2018). Additionally, the scientific literature on circular waste management is relatively limited. Korhonen et al. (2018) analyzed 40 articles published between the years 2000-2017 and offering a definition for CE. Only 2 out of the 40 articles were published in Journals devoted to waste management as opposed to 13 published in Journals devoted to cleaner production. Also, the existing scientific literature on waste management “...mostly addresses the impacts of treatment options.” (p.1276). Analysis of an overall scope of the waste management systems and its transition to CE in a specific location is relatively rare.

Although it was adopted as aspirational concept by a plethora of cities, CE is infrequently implemented in practice. The implementation angle of CE has been discussed in the scientific literature even more scarcely, especially outside of China. And while the Chinese experience can be suitable and replicable in other countries, understanding the local context, policy, stakeholders and circumstances is of great importance for local recommendation formulation, decision-making processes and for choosing effective policy interventions (EMF, 2015; Kalmykova et al., 2018; Petit-Boix, & Leipold, 2018; Prendeville et al., 2018; Ritzén & Sandström, 2017). Thus, insights from a European perspective on CE implementation are still missing (Prendeville et al., 2018).

Also, most of the articles analyzing CE implementation examples, focus on policy makers, private companies and the industrial or service sectors. Very little attention is given to individuals - the consumers, private households or citizens - although many authors believe that they have a significant impact on the transition process (Kalmykova et al., 2018; Kirchherr et al., 2017; Petit-Boix and Leipold 2018; Prendeville et al., 2018). Prendeville et al. (2018) believe that public engagement is especially crucial in locally promoted transition to CE for setting priority elements and providing feedback on the already implemented incentives. MIE (2016) believes that individuals affect the demand for products and materials. Kirchherr et al. (2017) even see the consumer as the flipside of the business model coin. Concerning waste management, Ferrara & Missios (2005) state that much of the scope of use of the different treatment options is determined at a household level, where waste management takes place. For example, if high quality waste separation does not exist in households’ level, recycling treatment options will become somewhat limited.

Research objective and research question:

Following the research gaps, my research objectives are to:

1. Contribute to closing the gap between scientific and non-academic research on CE.

2. Conduct a research analyzing the implementation angle of CE in European local context, providing insights from European perspective on CE implementation.
3. Contribute to the limited knowledge base analyzing the overall system of waste management and its transition to CE on a local urban scale.
4. Explore the possibility of involving and engaging individuals in the transition process towards CE, focusing on the transition towards circular waste management.
5. Provide practical instruments and recommendation for local governments looking to transform the waste management system in their city into a more circular one.

Following these objectives, the main research question of this thesis is - How can the waste management of private households be supported by local governments, waste utility companies and other private or public-private service providers in contributing more effectively to a circular economy?

To answer the main question, three sub-questions were formulated:

1. What is the current private households waste management behavior?
2. What is CE and circular waste management?
3. Which strategies/instruments are used by the local governments and their partners to support private households' behavioral change?

To answer the research question, a case study of the city of Amsterdam, local government in the European context, was used. Empirical data was collected through in-depth semi-structured interviews with representatives of the national government, the local government, Amsterdam's waste utility company and other private or public-private stakeholders in the waste management and CE domains. To analyze the different instruments the municipality and its partners use to contribute to the private households' circular waste management behavior, a 5E instruments framework (Enable, Engage, Encourage, Exemplify and Enforce) was developed. The research analyzes Amsterdam municipality's and its partners' use of the 5 groups of instruments and evaluate the city's transition process from the existing socio-technical waste management system into a more circular one.

Scientific and societal relevance:

Kirchherr et al. (2017) believe that a description of a good example of CE implementation will provide a better understanding of the concept to scholars and practitioners alike.

The scientific community has a responsibility to provide clear guidelines to policy makers on how the CE concept should be implemented (Cox et al., 2010; Penderville et al., 2018; Petit-Boix & Leipold, 2018). Structured assessment of the existent CE implementation can help to shape these guidelines, assisting policy makers to prioritize or focus their attention on certain types of instruments or strategies (Penderville et al., 2018).

The focus on the instruments a local government should use in order to help the private households to contribute to CE transformation is of high interest at present - "...there is an increasing emphasis in central government to focus on the ways in which individuals and

households can deliver policy targets through the use of awareness raising and policy interventions to alter practices” (Barr et al. 2013, p.68).

Also, the effective stimulation and management of socio-technical systems’ transformation “...has become a central concern of academics and policy makers alike” (Gee & Uyarra, 2013, p.1176). And as “...CE has come to play a guiding role in contemporary EU waste legislation...” (Zacho, Mosgaard & Riisgaard, 2018, p.3), the instruments used by local governments and their partners in order to engage private households in the transition of the socio-technical waste system into a more circular one has high scientific and societal relevance.

Research structure and reading guide:

This research is structured along the following lines. The first chapter presents the development, stabilization, characteristics and limitations of the currently dominant waste management system in Europe, focusing on household waste. The second chapter introduces the concept of CE and circular waste management. It reviews the potential a transformation of the socio-technical waste management system into a more circular one has in solving the existing limitations of the system and demonstrates the current obstacles in implementing CE in practice. Chapter three presents the 5Es analytical framework, describing different available instruments municipality and its partners can use in order to facilitate the private households’ contribution to CE transition. Chapter four describes the research methods used. Chapter five elaborates on the chosen case-study. It covers the current waste management system in the Netherlands, the governmental recent call for transition to CE, Amsterdam’s inherited waste management system and the city’s efforts on its way of becoming fully circular by 2050. Chapter six offers the findings – the activities Amsterdam municipality’s and its partners promote, along the chosen 5Es analytical framework. Analysis of the findings and the overall analysis of the municipality’s progress in transforming its socio-technical waste management system into a more circular one, are presented in chapter seven. Chapter 8 concludes the thesis, answers the research question, explains the limitations of this research, provides practical recommendations to policy makers and offers directions for future research.

1. Development, stabilization and characteristics of the dominant waste management system:

As waste management system is one of the various infrastructure systems, this chapter will start from briefly presenting the general characteristics of infrastructures as socio-technical systems. Then, characteristics of the current waste management system will be presented, followed by a historical review of the development and stabilization of this dominant waste management system, the problems the system is facing and the difficulties to change it. At the end, the characteristics of the desired, future waste management system are provided.

Infrastructures as a socio-technical system:

Waste management system is one of the basic infrastructures of an industrial society that enables its function (Verhoef et al., 2006). The methods of organizing and managing infrastructures were developed in the 19th century in Europe, in order to tackle specific problems (such as the spread of the Cholera, that was a powerful driving force for the introduction of the public sewage system) in a specific context (19th century European urban industrial areas) (Jaglin, 2014). For historical reasons, the most efficient way of providing urban services to concentrations of populations and activities in the global north is conceived to be the uniform network. The network is a "...set of interconnected structures, centrally planned and managed by a single, monopoly-based, public utility offering a uniform service in a given area according to an egalitarian access standard..." (Jaglin, 2014, p.434). The infrastructural network and its institutional and technical framework evolved through the years, playing a fundamental role in the process of urbanization, "...setting new standards and expectations for everyday livelihoods." (Baptista, 2015, p.1007), and shaping the social, spatial and economic, developments (Baptista, 2015). Until recent decades, the provision of infrastructures was taken for granted and was seen mainly as engineering challenge and administrative issue (Hodson & Marvin, 2010). An autonomous entity, a technology that develops in its own direction through scientific discoveries (Russell & Williams, 2002). The role of the government was to find the ways to speed up the progress of technology "...by providing the required resources and removing obstacles and promoting the smooth adaptation of society to the changes it demands." (Russell & Williams, 2002, p.37). Users had to "...integrating new technologies in their practices, organizations and routines, something which involves learning, adjustments." (Geels, 2004, p.902). In the recent years, however, a recognition that infrastructural networks not only shape but are also being affected and shaped by various variables is growing. Economy, ecology, institutions, politico-legal characteristics (legislation and regulations for example), power struggles, available resources, knowledge and societal characteristics (such as norms, perceptions, cultural discourse, etc.) are all shaping and affecting infrastructural networks (Baptista, 2015; Geels, 2004; Hodson & Marvin, 2010; Jaglin, 2014; Russell & Williams, 2002). Technological feature, general characteristics, direction of developments and infrastructure's application can all be shaped by social processes (Russell & Williams, 2002). Technology and social arrangements are co-produced and co-evolve, making the infrastructure a socio-technical system (Geels, 2004; Jaglin, 2014; Russell & Williams, 2002). "Technological change, then, is always part of a larger sociotechnical transformation." (Russell & Williams, 2002, p.47). Thus, each socio-technical infrastructure system is a complex

system of interdependencies, a result of a combination of heterogeneous factors such the methods of delivering, the involved actors, the available tools, knowledge and values, institutions, equipment, resources, etc. (Baptista, 2015, Jaglin, 2014). "...the ways in which these services are produced and regulated differ, as does the role of networked infrastructures and the public utilities that operate them." (Jaglin, 2014, p.434). And although in the past many technologies "...were produced in generic forms to allow them to be applied widely.", and many indeed were "...transferred successfully and largely unchanged..." (Russell & Williams, 2002, p.48), the current socio-technical landscape is becoming more varied and complex, making it much less transferable (Geels, 2004; Russell & Williams, 2002). The privatization, liberalization and the opening of infrastructure provision for competition have greatly contributed to the system's complexity and to its wide range of operations, greatly varying between the different countries (Hodson & Marvin, 2010).

General characteristics of the current waste management system:

The service the waste management system nowadays provides is the removal and recovery of municipal solid waste (later referred to as MSW). The system is characterized by a wide variety of collection and processing techniques. The collection is ranging from individual households' bins, curbside collection, delivery of waste to distant collection points by private households, etc. The main processing techniques are recycling, incineration and landfilling (Verhoef et al., 2006). The processing techniques are dependent on the available technological solution but also on the local political situation, the needs of the citizens, the local financial availability and much more. In most countries waste is managed on a local level, traditionally by the municipality or an equivalent authority, although recently, due to privatization and liberalization of the services, the private market's share in the waste management responsibility is growing bigger. The service is usually financed by citizen through fees and taxes (Buclet & Godard, 2001; Zacho et al., 2018), and is seen as a key utility service effecting the public health and the external "image" of a city (Wilson et al., 2015).

Scheinberg et al. (2010) as cited in Wilson et al. (2015) defines MSW as household waste (later referred to as HW) and waste of similar composition from other sources in the city (companies, offices, etc.). HW compounds over 80% of the MSW. It is an aggregate of different products, materials and substances (Verhoef et al., 2006), "...those unwanted items that arise in a domestic dwelling: discarded products such as furniture, clothing or toys, used packaging, and food waste" (Waite, 1995 as cited in Chappells & Shove, 1999, p.269).

Through the years the composition and the quantity of HW and the problems it appears to impose on society changed, entailing the change of the whole waste management system, including the physical facilities, the expected service and the stakeholders involved in the process (Buclet & Godard, 2001; Chappells & Shove, 1999; Hultman & Corvellec, 2012; Verhoef et al., 2006). As many of the waste system arrangements were inherited from the past, the system was quite a rigid one. The complexity of the socio-technical landscape and the existing vested interests limited the range of possible strategies turning each change in the waste management system into a long struggle (Jaglin, 2014; Verhoef et al., 2006).

The following history review covers the development and changes in the waste management system in the European countries. Europe was chosen as methods of organizing and managing infrastructures were first developed there (Jaglin, 2014), thus – 1. Through the history of the waste management system, the European uniform network system was perceived as the conventional waste management system, been reproduced all over the world (Jaglin, 2014) 2. Being the first one to be developed, presumably, nowadays the European waste management system is the most developed, advanced and efficient system in the world.

Historical review of the development and stabilization of the dominant waste system:

In the late 1800's, public health legislation in the UK first defined waste as 'health problem' requiring a collective solution, casting the responsibility for its collection on the civic authorities. As burning was thought to be the safest way to dispose of the waste, households were expected to burn their waste before discarding it into the ashpit. "Throughout the last century and during the early 1900s ash made up almost all household waste, with unburned refuse representing only a small proportion of household debris and deposited in co-existing dustbins, which were often improvised receptacles provided by the household" (Chappells & Shove, 1999, p.273).

In the beginning of 1900's, with the change in energy source replacing the open coals fires in the houses and air pollution legislation decreeing smoke-free zones in the cities, burning waste was no longer expected. This led to the rise of volume and complexity of the waste and households started to struggle with the existing waste system's rule, defining that only dry waste can be thrown into the ashpits. Adjusting to the waste itself, the waste collection service went through changes, becoming more frequent and complex one, collecting various kinds of wastes. This change shifted the main responsibility for waste treatment from the individual households to the municipalities (Chappells & Shove, 1999). New developing trends as the use of more packaging and planned obsolescence and disposability of products contributed to additional growth in waste volumes, putting pressure on treatment capacities that were rapidly approaching site saturation in many areas. Waste volume became the defining factor in the organization of the waste system and developed into newly defined 'waste problem' (Chappells & Shove, 1999; Verhoef et. al, 2006).

In the 1970s the waste problem converted from local health problem to global environmental problem, making the waste management system one of the most critical infrastructures on a global scale (EEA, 2016; Verhoef et. al, 2006). The common controlled elimination schemes as dumping, landfilling or open incineration were heavily questioned due their unknown local and global risks. This gave rise to the first international regulation on waste, directive 75/442/EEC, that placed environmental protection up at front, enacted by the EU in 1975 (Bartl, 2014; Buclet & Godard, 2001; Chappells & Shove, 1999). It also caused the reorientation of the national policies from collection and disposal activities towards new actions as minimize, reuse, sorting and recycling, developing in the 1980s (Buclet & Godard, 2001; Chappells & Shove, 1999). With the reorientation, diversification and fragmentation of the waste streams appeared. The multiple options for separation, recycling, different curbside collections, communal recycling centers etc., the amount of which tremendously increased at the beginning of the 1990s, were mirrored in

the segmentation of waste collection services which became liberalized (Bartl, 2014; Chappells & Shove, 1999). National regulators involved new actors in the organization of the new regime, delegating them splintering responsibilities previously belonging solely to the local authorities. The new actors were private and public companies, charities, environmental organizations and community groups, each having its objectives and its physical and administrative structure (Buclet & Godard, 2001; Chappells & Shove, 1999). Buclet & Godard (2001) claim that “To some extent, this shift was an implicit acknowledgement of the failure of authoritarian approaches for dealing with matters having a huge economic and behavioral dimension” (p. 305). In the current multi-stream collection system, each waste stream is collected and transported by different actors. Some goes to treatment location, some to pre-treatment ones, trying to sort the waste after its collection. The treatment points are also various and managed by different organizations.

These changes restored the individual households’ status as stakeholders in the splintering responsibility over waste management. Moving from discard and forget, households were now expected to separate their waste for the different waste streams, while the plethora of waste treatment options did not make this task an easy or a clear one. In fact, “...households had the ability to make many more judgments than ever before” (Chappells & Shove, 1999, p.277) on how to treat their waste. Verhoef et. al (2006) state that “...because of the many stakeholders, the fuzzy, often conflicting objectives, perspectives and interests, and the size and ambiguity of the system at large” (p. 304), the waste management system was “...neither well-structured nor well understood” (p. 304) and became even more complex, politically loaded and emotionally charged.

As a reaction to this problem, a ‘science of rubbish’ was developed (Chappells & Shove, 1999). It is an increasingly sophisticated analysis used to optimize the frequency of collection, required teams and transportation capacities; collect data on the composition and quantities of the HW in order to find out the potentially recyclables; understand the waste disposal drives, economic costs of system operations, environmental impact of treatment technologies etc. All this information is thought to be important elements in devising waste management strategies (Chappells & Shove, 1999; Thyberg & Tonjes, 2015).

One of the actors in devising waste management strategies is the European Union (EU), which has a leading role in the domain since the policy reorientation in the late 1980s. From its very formation, the EU acted towards the harmonization of the different national waste policies of its member states (Buclet & Godard, 2001). As early as the 1994, the EU published the Packaging Waste Directive, which obliged the producers and distributors to take responsibilities over the waste they create. The directive included specific material-based targets for packaging recycling to be reached by 2008 (EEA, 2016; Nellesa et al., 2016). The conservation of natural resources, the improvement of resource efficiency and decoupling economic growth from environmental impact was set high on the EU political agendas, shifting the view from waste as a problem to waste as a resource (Corvellec, 2016; Hultman & Corvellec, 2012; Hunter et al., 2017; Read et al., 2009). In 2005, the EU issued a thematic strategy on prevention and recycling of waste under the 6th Environmental Action Plan (EEA, 2016; Hultman & Corvellec, 2012). The next significant step was made in 2008, when the Waste Framework Directive was set, determining a waste management hierarchy of prevention, preparation for reuse, recycling, energy recovery and at

the very bottom - disposal (Bartl, 2014; Cox et al., 2010; EEA, 2016; Hunter et al., 2017; Kalmykova et al., 2018; Zacho et al., 2018). The waste management hierarchy "...aims to change the status of waste in relation to the design, production and consumption of products." (Hultman & Corvellec, 2012). It also sets clear goals for the future - setting up separate collection for at least paper, metal, plastic and glass by 2015; increasing the reuse and recycle of at least these materials to a minimum of 50% by 2020; and encourage choosing the appropriate method, from these offered by the directive, to monitor the recycling process (EEA, 2016). In 2011 the Roadmap on a Resource Efficient Europe was formulated, containing a section on turning waste into resource, prioritizing reuse and recycle, promoting them as economically attractive options and emphasizing the needed development of markets for secondary raw materials. "EU waste policies include a number of specific provisions and targets for the collection, recycling and diversion from landfill of different waste streams, such as packaging, end-of-life vehicles, waste electrical and electronic equipment, batteries and biodegradable municipal waste" (EEA, 2016, p.8); In 2013 the 7th Environmental Action Program - "Living well, within the limits of our planet" was adopted stating that "...recycled waste should be used as a major, reliable source of raw material for the Union, through the development of non-toxic material cycles" (EEA, 2016, p.7). The program's "proposed indicators reflect on the elements of the waste hierarchy, in particular on waste prevention, waste recycling and waste diversion from landfill." (EEA, 2016, p.6), and aiming to a circular economy where nothing is wasted.

These trends in the waste management infrastructure are compatible with the latest trend in the development of also other infrastructure systems. Hodson & Marvin (2010) state that striving to deal with the new political, socioeconomic and environmental problems and endeavoring to ensure secure access to resources and economic and social development, governments are turning toward self-reliant urbanism. "The new sociotechnical configuration is similar to the concept of the autarkic or autonomous city" (p.479). Cities and countries are trying to avoid stretching long and complicated networks in search for distant resources, but "...seek to re-internalize resource endowments and create the re-circulation of wastes as they withdraw from reliance on international, national and regional infrastructures. (...) seeking greater independence through developing local resources" (p.479), combining environmental and resilience priorities.

Yet, Verhoef et al. (2006) claim that the transition process to the new and preferable sociotechnical configuration of the waste system, compatible with the waste management hierarchy, did not reach its desirable point. Although Verhoef et al. (2006) wrote their paper before the recent policy developments, their words resonate also in Hanter et al.'s paper, who wrote in 2017 that - "...the actual implementation of waste prevention activities has so far been hesitant, and the focus on end-of-pipe waste management prevails" (p. 838). Bartl (2014) and Zeller et al. (2019) claim that, except for food waste, no incentives for reuse and waste prevention were promoted in the European legislation. Zach et al. (2018) believe that the move up the hierarchy ladder came from the constraints imposed on the 2 lowest options - landfilling and incineration and not due to the promotion of the upper two levels of prevention and preparation for reuse. Diverting waste from landfills or incineration plants but with no prevention or reuse incentives leaves the policies mainly with recycling. Although more than two-thirds of HW can be recycled (Nellesa et al., 2016), there are limits to recycling - while the recycling rates in Europe

leaped from 13% in 1990 to 40% in 2008, the estimated recycling rate for 2020 is only 49%. Also, recycling is often an economic issue – if it is not economically competitive with energy recovery or disposal, it will be rarely promoted (Bartl, 2014). Verhoof et al. (2006) and Bartl (2014) also claim that the waste stream is still too heterogeneous, containing many chemical elements, limiting the amount of resources that could be recovered from waste. Resource recovering requires sophisticated and expensive treatment, causing a large economic loss of materials and interrupting the material cycle. Also, the ever-changing definitions of waste, the legislative framework around it and the treatment options cause challenges for public and private waste management companies determining which streams are waste and which are resources (Iacovidou et al., 2017).

To solve the current ‘waste problem’ the waste system should go through a transformation. The waste system should process the household waste effectively, provide flexibility to cope with the changing waste composition, improve its separate collection, maximize the recovered materials at grades required for production and require fewer investment in the waste infrastructure as the amount of what will be defined as residue should be minimized (Bartl, 2014; EEA, 2016; Gee & Uyerra, 2013; Verhoof et al., 2006). The system should develop from “waste management” to “resource management” (EEA, 2016; Hultman & Corvellec, 2012; Iacovidou et al., 2017; Wilson et al., 2015). The link between economic growth and environmental impact should be decoupled and the economy should be shifted to a circular one in practice and not only in policy papers (Corvellec, 2016; Hunter et al., 2017; Read et al., 2009).

2. A call for transition towards circular economy - theoretical discussion and political ambitions:

Circular economy is a very broad and complex concept, the waste management sector being only one of its many components. This chapter will present the incidents that led to the reappearance of the concept, its origins, the theoretical discussion of the concept and the practical approach to it. At the end, the waste management sector as part of the circular economy will be presented.

CE - theoretical discussion:

CE is a long-existing concept that recently regained attention due to the topical discussion on climate change and sustainable development (Kalmykova et al., 2018; Korhonen et al., 2018). The concept developed gradually, and its notion is based on fragmented collection of ideas derived from multiple schools of thought and a variety of scientific fields and semi-scientific concepts, some of which date back to the 18th and 19th centuries. It draws its ideas from the engineering field, industrial ecology, cleaner production, production service systems, eco-efficiency, cradle-to-cradle design, green growth, natural capitalism, biomimicry, resilience of social-ecological systems, zero-emission and many others (Kalmykova et al., 2018; Korhonen et al., 2018; Pauliuk, 2018; Prendeville et al., 2018). Due to the renewed interest in the concept, abundance of scientific literature emerged at the past 5 years, creating most of the existing definitions of the concept (Kirchherr et al., 2017).

CE is wide and complex concept, encompassing various areas of life. Broadly, it is coping with 3 challenges - resource scarcity, negative environmental impact and the challenge to continue increasing economic benefits. It suggest keeping materials available instead of disposing them; maximizing the value of a resource by closing the loop of materials in the product lifecycle in local, national or even global scale; creating a “spiral loop system” by keeping products in use as long as possible (Del Borghi et al., 2014; Kalmykova et al., 2018; Korhonen et al., 2018; Prendeville et al., 2018; Ritzén & Sandström, 2017). The newly created cycle will be high value material cycle, achieved through the multiple R-strategies - repair, reuse, refurbish, remanufacture and recondition, cascading and upgrading, as opposed to low grade raw materials created through the traditional recycling (Iacovidou et al., 2017; Kirchherr et al., 2017; Korhonen et al., 2018; Ritzén & Sandström, 2017). The concept also implies energy utilization and the shift towards renewable resources (Petit-Boix, & Leipold, 2018; Ritzén & Sandström, 2017), green construction materials, eco-design and durability of products (Petit-Boix, & Leipold, 2018). The ideal vision of the CE is a theoretical optimum of 100% mass, energy and resources efficiency (Pauliuk, 2018). CE’s ideal implementation is expected to reduce virgin resource usage, energy consumption, waste and emission outputs while at the same time improving the security of supply, retaining the highest possible value and quality of products for as long as possible, saving material, resource and energy costs, dampening price volatility (EMF 2015; Kalmykova et al., 2018; Korhonen et al., 2018; Ritzén & Sandström, 2017). Decoupling economic growth from environmental impacts (Pauliuk, 2018). CE is expected to create new sources of innovation and revenue, improve resilience of organizations-customers relationships and save costs (Del Borghi et al., 2014; EMF, 2015; Pauliuk, 2018). The multiple use of the value embedded in the materials will allow the existing business to minimize costs and will facilitate the emergence of new

businesses, markets and job opportunity, reusing these materials and significantly raising the GDP. It will also help the existing businesses to improve their image and boost their production and services (Del Borghi et al., 2014; EMF, 2015; Kalmykova et al., 2018; Korhonen et al., 2018; Ritzén & Sandström, 2017). Some even suggest that when fully and globally implemented, CE gains can exceed 1000 billion US dollars annually and bring net savings of up to 600 billion Euro for EU businesses (Kalmykova et al., 2018; Korhonen et al., 2018).

As described above, the concept of CE is a very broad and vague one, having internal complexities. There is no commonly accepted definition nor criteria for classifying cases as circular (Kalmykova et al., 2018; Prendeville et al., 2018). It can be seen as a “cluster concept” or an “umbrella concept”, having sub-concepts and involving many schools of thought and stakeholders, each having its own interests and concept interpretation (Kirchherr et al., 2017; Pauliuk, 2018). Different approaches see CE and its relation to other “environmental” concepts differently - some perceive it as a multidisciplinary approach while others narrow it to one main goal as municipal waste management (Prendeville et al., 2018) or even more specifically, waste prevention method (Kalmykova et al., 2018); some stress eco-efficiency as the purpose of CE, others see it as one of CE consequences; some believe CE is the operationalization of the concept of sustainability (Kirchherr et al., 2017), others see it as a convolution of several sustainability concepts (Kalmykova et al., 2018); some think it contributes to sustainable development initiatives encompassing all three pillar of sustainability (economic, social and environmental) (Korhonen et al., 2018); others claim it focuses mainly on the sustainable economy pillar, embodied in the resource efficiency ambition, rather than environmental preservation (Pauliuk, 2018; Prendeville et al., 2018); some accuse the present definitions of the concept in complete deficiency of the social perspective (Kirchherr et al., 2017; Pauliuk, 2018; Prendeville et al., 2018; Zacho et al., 2018). Prendeville et al. (2018) call for uniformity of the concept and claim that articulated relationships between CE and sustainability are crucial. Korhonen et al. (2018) believe that agreed upon definition will limit the development and the dynamism of the concept and lose important interest of some of the stakeholders.

Besides its vagueness, CE is also hard to implement. The concept is critiqued for being unrealistic, unclear, having contrasting views and goals (Prendeville et al., 2018). The desired change of the system requires a long period of time and investments while contemporary financial systems are focused on rapid returns of investments and cost savings (EMF, 2015; Ritzén & Sandström, 2017); no guarantee of the revenue following the change exists; it requires changes in the relationships between suppliers and producers and producers and consumers (Ritzén & Sandström, 2017). To generate real change, the concept should be agreed upon between academy, policy and industry and has to be integrated both into national policies and legislation and business practices (EMF, 2015; Korhonen et al., 2018; Paulik, 2018). Prendeville et al. (2018) claim that materials and energy cannot be infinitely cycled without efficiency loss. They also believe that the lack of common understanding limits the cities progress, as policy makers are struggling with translating the concept into practice (Prendeville et al., 2018). Also, the eventual impact of the different CE incentives is yet to be known (Paulik, 2018), while partial implementations of the CE may also result in some risks for the environment. For example, recycling characteristics often ignored are the degradation of the material quality and quantity and additional energy and virgin resource input requirements (Bartl, 2014; Petit-Boix, & Leipold, 2018).

In addition, CE's implementation angle has rarely been discussed in the scientific literature outside of China, although it was adopted as aspirational concept by a plethora of cities. The very few researchers that investigated the results of CE implementations found a positive yet limited effect on raw material demand, others estimated energy savings of 6%-11% to support economic activities. Different cities are struggling to understand the concept and to define which combination of CE incentives will be best at reaching their goals. And while the Chinese experience can be suitable and replicable in other countries, understanding the context, local policy, stakeholders and circumstances is of great importance for decision-making processes and effective policy interventions (EMF, 2015; Kalmykova et al., 2018; Petit-Boix, & Leipold, 2018; Prendeville et al., 2018). Thus, insights from a European perspective on CE implementation are still missing (Prendeville et al., 2018).

Although the scientific literature on the topic is growing fast, it is still in its initial stages, fragmented and unorganized (the largest number of articles on the subject occurred in 2014-2016), and has not caught up yet with the non-academic research and implementation of CE in practice (Kirchherr et al., 2017; Korhonen et al., 2018; Prendeville et al., 2018). Korhonen et al. (2018) even state that the concept "...has almost exclusively been developed and led by practitioners, i.e., policy-makers and business development agencies" (p.545). This is "...reflected in the fact that the majority of the relevant literature is published in the form of scope documents and initiatives from governments and NGOs" (Kalmykova et al., 2018, p.194). These help the concept formation, vision creation and strategy formulation. The various understanding of this concept, the lack of clear agreement on the concept goals, means or definition, the absence of units of analysis or methodology of inquiry, all pose conceptual challenges for researches (Korhonen et al., 2018).

CE - practical approach:

The practical approach to CE mainly focuses on economic prosperity the transformation to CE can facilitate. Mitigating the environmental impact and its effect on the economy, such as the annually rise of resource prices due to their scarcity, CE can generate profitable regenerative transformation, assisting the boost to economic growth and increase the competitiveness (Kirchherr et al., 2017; Korhonen et al., 2018; Prendeville et al. 2018). Prendeville et al. (2018) see CE in this context as mainly a business-focused narrative aimed at making profit and gaining competitive advantage, not really embedded in the broader urban agenda. Seen from this angle, it is a very attractive concept for practitioners - "The logic of turning from linear and wasteful to cyclical, restorative, reproductive and smart physical flow structures is appealing and positively provocative crossing sectoral, organizational, administrative and national boundaries and borders in its message." (Korhonen et al., 2018, p.551). As a wide concept, it needs a diversity of actors to realize its different levels (Kalmykova et al., 2018). One of the bigger attractors of attention to the concept is the Ellen MacArthur Foundation (EMF), recruiting diversity of sectors and organizations - businesses, policy makers, the market and even academia society (Korhonen et al., 2018). Although the clear economic focus, arguments are ongoing on other CE features that have to be given a higher priority in its application (Korhonen et al., 2018).

The Chinese government was the first one to implement CE in practice in 2002, with the goal of promoting sustainable urban development - maintaining economic growth and social progress while improving environmental quality (Kalmykova et al., 2018; Prendeville et al., 2018). The approach was promoted also through pioneering formal legislation - the Cleaner Production Promotion Law from 2003 was amended to 2005 Law on Pollution, Prevention and Control of Solid Waste (Kalmykova et al., 2018; Petit-Boix, & Leipold, 2018). In 2009, CE Promotion Law, aiming to promote economic growth without causing material or energy shortage, was implemented. Its targets were 3 function levels - individual businesses, eco-industrial parks and eco cities (Kalmykova et al., 2018). The European Union was the second big CE policy promoter. In 2011, the Roadmap on “Resource-Efficient Europe” was promoted as a flagship initiative. It contained a section on turning waste to resources, prioritizing reuse and recycle (EEA, 2015, Salvia et al., 2015). In 2013 the 7th Environmental Plan, “Living well, within the limits of our planet”, was adopted (EEA, 2015, p.9). The program was intended to help guide EU actions on environment and climate change. It stressed the need to use waste as a major, reliable source of raw materials, to develop a non-toxic material cycle and to move “...towards a circular economy where ultimately nothing is wasted” (EEA, 2015, p.7). And since 2015, CE is high on European political agenda - EU adopted a CE package aiming at boosting competitiveness for sustainable economic growth and jobs, putting resources back in the loop, shifting the perception from waste as a problem to waste as a resource (EEA, 2015; Hultman & Corvellec, 2012; Prendeville et al., 2018; Salvia, 2015; Zeller et al., 2019). “The package sets out a vision and concrete actions along the whole value chain to move towards a circular economy in Europe, including during design and production, throughout consumption and at the waste stage” (EEA, 2015, p.7-8). In 2017, the British Standard Institution has published the world’s first CE standard oriented at organization and businesses, helping them to implement more circular and sustainable practices through improved ways of working, production of more circular products and services, changing their business model and value propositions (Pauliuk, 2018). Currently, there are many initiatives implementing CE, acting in two main direction - 1. Systemic economy-wide implementation, at a local, regional, national or transnational scale, or 2. Implementation with a focus on a group sectors, products or materials, such as the European directive on packaging waste relying on the producer responsibility schemes (Kalmykova et al., 2018).

Nevertheless, CE has been applied rarely and only fragmentally (Prendeville et al., 2018; Ritzén & Sandström, 2017). 83 cities around the globe were recently identified as promoting CE, but due the scope of the concept and its unclarity, most cities including CE as a part of their sustainability plan, each having its own targets and interests. No major investments toward holistic transformation or impactful CE projects in line with the cities’ overarching future strategy were identified (Petit-Boix, & Leipold, 2018, Prendeville et al., 2018; Zeller, 2019). Ritzén & Sandström (2017) and Kirchherr et al. (2017) claim that the reason is the high complexity of the transformation to CE, requiring a fundamental systematic change of the organization as a whole, radically new solutions, new working ways and involvement of a large number of stakeholders. The change needs to be multi-dimensional and multi-domain, requiring changes in material and energy use, product design, business models, manufacturing, service and distribution processes, data management, etc. (Ritzén & Sandström, 2017). Prendeville et al. (2018) believe that the reason is the role municipalities adopt. Municipalities see themselves as facilitators and not

financers. They mainly promote incremental initiatives and business incentives, focusing on knowledge generation, baseline research and experimenting. The change is thought to be too expensive and too long to accomplish, limited by the political time constraints. “Therefore, real and ambitious plans to overhaul resource systems are delayed...” (Prendeville et al., 2018, p.24). Trying to address this problem, EMF’s (2015) activity started with campaigns on industrial system based on a closed loop, which cycles and cascades resources between the different industries in order to unlock multiple value streams. Lately they shifted into business-centered view, promoting innovative and competitive commercial value (Prendeville et al., 2018) and later, they developed a toolkit for policymakers, providing methodology for the transition towards circular economy (Kalmykova et al., 2018). EMF (2015) believes that a change on a local scale can be achieved through sector-by-sector analysis, addressing the specific sector opportunities and challenges in the process of transition.

As this thesis focuses on the waste management sector, a specific attention to this sector. It’s opportunities and challenges under the CE concept is presented in the following paragraphs.

Circular waste management:

CE is traditionally seen as waste-oriented model and a tool to create waste management policies by both, researchers and practitioners (Kalmykova et al., 2018; Petit-Boix, & Leipold, 2018). Many authors see the waste management sector as the main one in CE, as they see the recovering of resources and creating value from waste as CE primary mission. While cities tend to focus on different types of waste collection schemes, research mainly addresses the impact of their treatment options (Petit-Boix, & Leipold, 2018). According to the CE approach, products should be diverted from waste streams through extension of the products and its components life, capturing value at the end of their lifecycle through maintenance, repair, reuse, refurbishment and remanufacturing (Iacovidou et al., 2017; Zacho et al., 2018). CE ranks different resource strategies in the same order as they are ranked in the waste management hierarchy, following this order of priority: 1. Prevention, 2. (Preparation for) reuse, 3. Recycling, 4. Energy recovery, 5. Disposal (EEA, 2015; Korhonen, 2018; Zacho et al., 2018). This way, the product value chain and life cycle retain the highest possible value and quality as long as possible and is also as energy efficient as it can be (Korhonen, 2018).

The EU, as one of the leading promoters of CE is also very committed to circular waste management. The circular waste management hierarchy was adopted by the EU in the Waste Framework Directive from 2008 (Bartl, 2014; Cox et al., 2010; EEA, 2016; Hunter et al., 2017; Kalmykova et al., 2018; Zacho et al., 2018). “Prevention” is defined by the directive as: “measures taken before a substance, material or product has become waste, that reduce: (a) the quantity of waste, including through the reuse of products or the extension of the life span of products; (b) the adverse impacts of the generated waste on the environment and human health; (c) the content of harmful substances in materials and products.”. “Preparing for reuse” is defined as “checking, cleaning or repairing for recovery operations, by which products or components of products that have become waste are prepared so that they can be reused without any other pre-processing.”, while “Reuse” itself is defined as “any operation by which products or

components that are not waste are used again for the same purpose for which they were conceived” (WRAP, 2019). With the adoption of the Waste Framework Directive in 2008, all goals set by the EU in the waste management sector are compatible with the circular waste management hierarchy. The Waste Framework Directive also required from all EU member states to formulate national program for waste prevention by the end of 2013 (Cox et al., 2010). The goals set in this Directive include collection and preparation of 50% of the HW for reuse and recycling (Zacho et al., 2018); preventing the loss of valuable material (Salvia et al., 2015); developing a functional and economically attractive market for secondary raw materials; widening the variety of recycling flows and including critical raw materials and those having a significant impact on the environment, by 2020 (EEA, 2015). 2030 targets include even higher rates of recycling (65% of MSW, 70% of construction and demolish waste, 75% of packaging, etc.), promotion of industrial symbiosis and eco-design (Zeller, 2019).

Various researches see a lot of economic opportunities in the implementation of the circular waste management hierarchy. Hultman & Corvellec (2012) claim that the three bottom options demand a high energy input and generate relatively little output of value, while prevention and (preparation for) reuse “...are qualitatively different since the result is a decrease of output with economic value” (p.2414). Zacho et al. (2018) believe that reuse activities hold the largest potential for value capture on a local scale. They believe this is also the best level for upcycling and adding value by repairing and cleaning. Bartl (2014) believes that repairing can be promoted through lower taxes for labor and higher taxes for energy and raw materials introduced in a global scale. These actions, in Zacho et al.’s (2018) and Bartl (2014) opinions, will supply the recent growing demand for second-hand products and provide job opportunities, as the upcycling or preparation for reuse requires equipped workplaces and trained employees.

Nevertheless, the recent practitioner definitions or policies on CE rarely include the movement up the circular waste management hierarchy or a value-adding mind set (Bartl, 2014; Zacho et al., 2018). Currently, there are also no obligation or regulation pushing to prepare waste items for reused (Zacho et al., 2018). The highest priority on the waste management hierarchy, prevention, is not attractive for private businesses, which are risk averse and already have vested interests in the existing waste management system. Municipalities see prevention as reduction in economic growth, which is one of the main reasons for CE adoption by the municipalities in the first place (Kirchherr et al., 2017). Also, striving to involve as many stakeholders as possible to facilitate the complicated shift to CE, politicians cannot allow to lose partners, which results in more gentle policies, focusing on voluntary agreements and traditional technics as recycling and waste recovery (de Jong & Wolsink, 1997; Kirchherr et al., 2017; Prendeville et al., 2018). But even the increased recycling, currently holding the predominant role in the directives on waste, in Zacho et al.’s (2018) opinion, is a result of a push away from the incineration and disposal methods more than a pull toward recycling. Kirchherr et al. (2017) believe that this obstacle can be avoided on a local level by defining and promoting CE as a long-term investment instead of a quick gaining tactics. One that benefits the future generations but also profit the company in the long run, thus losing neither followers nor economic profit.

The role of the individuals and the private households:

While the goals in EU policies include high rates of household waste separation, recycling or preparation for reuse, the private households - the individuals who purchase the product, use it and then choose whether to maintain it, repair it or discard it, and in which way to discard it - are almost absent both in the scientific literature and the practical policies on CE.

Consumers are among the most central enablers of the CE. Individuals bear the responsibility for adequate use and maintenance of the product and materials and their high-grade return to the economy through the wide concept of waste management system. They affect the demand for products and materials (MIE, 2016). Prendeville et al. (2018) believe that public engagement is especially crucial in locally promoted transition to CE for setting priority elements and providing feedback on the already implemented incentives. Kirchherr et al. (2017) see the consumer as the flipside of the business model coin. Korhonen et al. (2018), claim that focus on sustainable consumption should be promoted alongside the sustainable production. They believe that the sharing economy approach (as shared cars for example) should substituting the current individual ownership-based consumption patterns, which will allow a bigger value extraction from each product. Corvellec (2016) found that in order to promote the higher levels of the circular waste management 3 main types of action should be taken, two of them concern consumers - increasing material efficiency, raising awareness about the need to prevent waste and developing sustainable consumption.

Nevertheless, most of the scientific research focus on policy makers, private companies, the industrial or service sectors and very little attention is given to the private households, individuals or consumers (Kalmykova et al., 2018; Kirchherr et al., 2017; Petit-Boix and Leipold 2018; Prendeville et al., 2018). Kirchherr et al. (2017) found reference to consumers in only 19% of the 114 CE definitions they analyzed and Petit-Boix and Leipold (2018) claim for even lower numbers of only 6% of the studies dealing with social consumption. Kirchherr et al. (2017) claim that most of the scientific literature on CE is adopting a supply-side view, excluding the consumer and their demands, which might result in advices on unviable business models. The importance of citizen and community voice and opinions, although widely recognized, is also not reflected in policy measures, focusing mainly on the biggest business stakeholders and data driven knowledge (Prendeville et al., 2018).

Kalmykova et al. (2018) believe that more institutional support should be given to actions as sharing, reusing and repairing of products, aimed at consumption and behavior change. The understanding of complexity of consumers behavior and the promotion of public awareness, engagement and responsibilities, through behavioral change has a vital role for the success of the transition towards CE (MIE, 2016; Kirchherr et al., 2017; Prendeville et al., 2018). "Effective influencing of these factors calls for sharp analyses, careful monitoring, and evaluation of interventions." (MIE, 2016, p.67).

To conclude, CE is a complex and vague concept, embodying in it a variety of domains, circular waste management being only one of them. CE and circular waste management are only rarely

and fragmentedly implemented in practice, and these examples only seldomly analyzed by the scientific literature. In addition, the involvement of individuals, private households and consumers in the transition process, although being a central enabler of CE in general and circular waste management in particular, is absent almost completely from scientific literature and policy measure. This thesis researches the private households' ability to better contribute to CE through circular waste management. Thus, the research question for this thesis is - How can the waste management of private households be supported by local governments, waste utility companies and other private or public-private service providers in contributing more effectively to circular economy? The research provides practical instruments and recommendation for local governments looking to transform the waste management system in their city into a more circular one.

3. Instruments used to promote individuals' behavioral change:

In order to analyze the initiatives taken by local governments, waste utility companies and other private or public-private service providers to support the change of individual households' waste management into a more circular one, an appropriate analytical framework had to be developed. Due to the gap between the scientific and the non-academic literature on CE, a framework relevant for both areas was designed. The following chapter first briefly reviews the existing waste management system evaluation models. Then 3 theoretical frameworks supporting individuals' behavioral change and one toolkit of implementation guidelines developed for policy makers by EMF, a foundation devoted to the promotion of CE, will be elaborated upon. The combination of the 4, creates a thorough theoretical framework compatible with the research question and is equally applicable to both, the scientific and the non-academic fields.

The existing evaluation models for waste management systems are mostly quantitative, including Life Cycle Assessment, Material Flow Analysis, waste weighing, etc. (Iacovidou et al., 2017; Petit-Boix & Leipold, 2018; Read et al., 2009). Other authors focus on measuring change in one of the 5 circular waste management hierarchy levels (prevention, reuse, recycle, recover for energy and discard) (Corvellec, 2016; Sharp et al., 2010; Zacho et al., 2018). Behavior studies offer a plethora of literature on waste behaviors (Andersson, 2018; Barr et al., 2001; Barr et al., 2013) but their main focus is on individuals themselves and the gap between their declared and actual behavior. Thus, a focus on scientific literature analyzing the effect of different measures, intervention or instrument on private households' environmental or waste management behavior was made.

Although no consensus exists on how behavioral change can be achieved, there is a wide agreement between scholars and policymakers that effective behavioral change can be attained only through a complex 'package' of measures. In order to be successful, the 'package' should simultaneously address the different and complex factors effecting individuals' behavior (EMF, 2015; Salvia et al., 2015; Cox et al., 2010; Darnton et al., 2006; HM Government, 2005; Sharp, Giorgi & Wilson, 2010). The leading question in choosing the different measures will then be "Is the package enough to break a habit and kick start (behavioral) change?" (HM Government, 2005, p.27).

The UK Department for the Environment, Food and Rural Affairs (Defra) offers one such a 'package' of measures. Defra commissioned a wide research project through its Waste and Resource Evidence Program, the goal of which was to develop 'policy-relevant' evidence - "...any information that Defra can use to turn its policy goals into something concrete, achievable and manageable." (Cox et al., 2010, p.3). Cox et al.'s article (2010) is one of the articles derived from Defra's wide research. It focuses on household waste prevention, dealing with purchase, consumption and discard – all the actions taken by individuals. Acknowledging that in order to change private households' waste management behavior, the government needs to be more active, adding means to the traditional regulation and enforcement measures (EMF, 2015; HM Government, 2005), Defra introduced the 4Es (Enable, Engage, Encourage and Exemplify) Behavior Change Framework.

The content of each component is defined to be:

Enable – People need help to make responsible choices. Enabling includes – information supply; provision of facilities, infrastructure and variable alternatives; provision of education, training, skills, capacity, financial and communication support; guidance and progress-monitoring.

Engage – There is a need to get to know one’s audience, understand their issues, ideas and questions. Realize how to target them effectively, in order to develop new ‘social norms’. Individuals need to be involved early on for them to understand and take personal responsibility. The involvement can be done through community actions; door-to-door stepping; co-productions; media campaigns/opinion formers; branding of the campaign; creating website and newsletters; using networks, personal contacts and enthusiasts to raise awareness, encourage participation, promote change, etc.; organizing events; engaging participants attention through repetition, etc.

Exemplify – Leading by example, achieving consistency in policies and in their message to the public, trying to reinforce the commitment from others by example.

Encourage – Giving the right signals to the wanted behavior through incentives (mainly financial). Can be achieved through reward scheme; subsidies; recognition/social pressure; tax system. The benefits are important as is regular feedback or group work which are proven encouraging incentives.

(Cox et al., 2010; HM Government, 2005; Sharp et al., 2010).

Cox et al. (2010) place economic instruments such as penalties and fines and enforcement action under “Encourage”, but as the 4Es framework is additional to the traditional regulation and enforcement measures (HM Government, 2005), these two indicators will be more appropriate under “Enforce”, adjusting the framework for this thesis to be 5Es. Enforce is interpreted in this thesis as:

Enforce – legislation, regulation, policies, enforcement, penalties and fines and encouragement of self-regulatory activities (such as voluntary agreements, minimum standards, etc.).

Defra offers this framework for a single level in the circular waste management hierarchy - the “prevention” level (Cox et al. 2010), but as this is the highest and thus the hardest level to achieve, this thesis will adapt this framework for analyzing the whole waste management system.

Similar frameworks are used by Darnton et al. (2006) and Salvia et al. (2015). The frameworks use different names for the instruments but both merge between what Defra divides to Enable and Engage into one. Salvia et al.’s (2015) framework will be reviewed first and Darnton et al.’s (2006) framework will follow.

Salvia et al. (2015) researched the ways in which South East Europe can make a better and faster progress towards European integration in fields of energy and waste. They covered policy making, best practices and technologies, changing behavior of selected target groups, main technical data and tools and the criteria for the assessment of resource efficiency strategies and plans. The behavioral change measures were divided into 4 basic groups:

Regulatory measures (resembles the 'Enforce' instrument) – quantitative or technical controls in form of prohibitions or requirements. Rules establishment that eliminate or restrict consumers' choice. Usually taken on a national level.

Financial measures (resembles the 'Encourage' instrument) – incentives and disincentives such as taxes and fees, forms of grants and subsidies that can encourage behavior change.

Information measures (a combination of the 'Enable' and 'Engage' instruments) – measures used to transfer knowledge, to persuade or convince people to the desired behavior. Achieved through informational and media campaigns, support for education and training programs, etc.

Technical measures (resembles the 'Enable' instrument) – regard changes in communal infrastructure and new technical solutions which can cause consumers to adjust their behavior.

(Salvia et al., 2015)

Darnton et al. (2006) analyzed 14 key policy interventions in order to help policy makers to choose the right instruments to deliver environmental behavioral change. For ease of the analysis, they grouped the 14 policies in to 4 categories based on the typology recommended by the OECD - economic, regulatory, social/voluntary and other. As this thesis focuses on private households' behavioral change, Darnton et al.'s (2006) policies directed at behavioral shift of the businesses sector were left out. Thus, the content of each category is defined to be:

Economic (resembles the 'Encourage' instrument) measures – policies that change prices/costs or budgets within which actors operate; they are used to introduce price signals to consumers to encourage environmental-friendly behavior or to discourage behavior that is environmentally harmful. Done through taxes, charges, levies put on some products, subsidies and tax credits, benefits and grants (Darnton et. al, 2006; Buclet & Godard, 2001).

Regulatory (resembles the 'Enforce' instrument) measures – policies that set restrictions on activities; regulatory limitations or constraints on both product ownership and use. Due to its intrusive nature and the costs of implementation and enforcement, such direct regulation is relatively rare for the individual consumer. Policymakers may rather choose to encourage self-regulatory activities, for example, by the use of codes of conduct, co-regulation, minimum standards or voluntary agreements not backed by regulation that individuals or organizations agree to abide.

Social/voluntary (a combination of the 'Enable' and 'Engage' instruments) measures – policies that provide information, education and/or advice, influence consumer knowledge and willingness to behave environmentally friendly. Done through information dissemination; public awareness and education campaigns; voluntary initiatives; labelling schemes; advisory service; open forum debate and discussion; participatory decision-making, etc.

Other – the policy instruments that fall under the 'other' OECD grouping include state of environment assessment and goal setting; development of measuring indicators; incentives for environmentally superior technological innovation and diffusion, which usually take the form of subsidies and grants (fits under 'Encourage' instrument), and infrastructure provision (part of the 'Enable' instrument).

(Darnton et. al, 2006)

While Salvia et al.'s (2015) regulatory, financial, information and technical measure and Darnton et al.'s (2006) economy, regulatory and social/voluntary measures all compatible with the 5Es framework, widening and elaborating it, Darnton et al.'s (2006) "other" category adds new components to the analysis – state of environment assessment and goal setting and use of measures and indicators. Although not explicitly stated, both are part of the leading general question - "Is the package (of incentives) enough to break a habit and kick start change?" (HM Government, 2005, p.27). In order to answer this question, one needs to set a goal that is compatible with the current environmental state and then measure whether he managed to achieve this goal through the use of specified indicators.

EMF's 'Toolkit for Policymakers' is a non-academic toolkit of guidelines for CE implementation on a city's level. The 3 scientific frameworks presented so far resonance in this toolkit. The 'Toolkit for Policymakers' outlines 6 policy intervention types that can be employed to overcome barriers in implementing CE in a specific sector, such as the waste management sector. As this thesis focuses on private households' behavioral change while the toolkit facilitates an overall change at a city level, the toolkit interventions directed at other than the private households target groups where left out. Four relevant interventions for this thesis were identified: education (falls under the 'Enable' instrument), knowledge development – information and awareness (falls under 'Enable' instrument), infrastructure development (falls under 'Enable' instrument), regulatory frameworks (falls under 'Enforce' instrument), fiscal frameworks (falls under 'Encourage' instrument) and collaboration platforms (Prendeville et al., 2018). Interdisciplinary and cross-governmental are crucial for the success of these intervention in EMF's (2015) opinion.

The combination of Salvia et al. (2015), Darnton et al. (2006), Defra's 4Es frameworks (Cox et al., 2010) with the interventions offered by a non-academic organization (EMF) to facilitate the implementation of CE creates a thorough theoretical framework for this thesis. The municipality's and its partners activities will be analyzed along 5E instruments framework. Additional attention will be given to goal setting according to the state of environmental assessment; to interdisciplinary and cross-governmental collaboration in the implementation of the 'package' of the chosen incentives; and to the use of indicators to measure the success of the incentives.

4. Methodology:

In this chapter, the methodological choices made for this thesis will be explained and elaborated upon.

This thesis is an explorative research, analyzing the different tools local governments, waste utility companies and other private or public-private service providers use in order to change the private households waste management behavior into a more circular one. Yin (2009) affirms that for conducting a research in social science, in which “...the investigator had little control over events and when the focus is on a contemporary phenomenon within some real-life context”, case study would be the preferred method (Yin, 2009, p.1). The case study method can be used for exploratory, descriptive or explanatory purposes, when the aim is to understand a complex social phenomenon. As this research is an explorative research; focusing on a complex social phenomenon as the change of private households’ behavior by a municipality and its partners; conducted in a real-life context of an existing waste management system and a transition process towards CE; and as the researcher had no control over the events taking place, a case study was the most appropriate method for this research.

The city of Amsterdam was chosen as the case-study for this research. Amsterdam was chosen as it is a city in the Netherlands located in Europe - both main promoters of circular economy, globally (Bartl, 2014; Cox et al., 2010; EEA, 2016; Hunter et al., 2017; Kalmykova et al., 2018; Zacho et al., 2018). The Netherlands even set an ambitious goal of becoming fully circular by the year of 2050 (MIE, 2016). Also, as methods of organizing and managing infrastructures were first developed in Europe (Jaglin, 2014), Europe has the longest history of managing waste and waste infrastructures. The city of Amsterdam is a pioneering city in the area of CE. It adopted the Dutch national goal and also marks 2050 as the year in which the city of Amsterdam will become fully circular (Municipality of Amsterdam, 2019a and 2018). In addition, under the domain of circularity, Amsterdam has a strong emphasis on urbane infrastructures in general (Petit-Boix & Leipold, 2018) and on waste management in particular, making the city an appropriate candidate for the case study of this thesis.

Ritzén & Sandström (2017) claim that as “The organizational perspective on circular economy is not well explored...” (p.9), qualitative research methods will be more suitable for a research on circularity. Thus, the case-study will be analyzed according to the 5Es theoretical framework, using qualitative methods. The common methods for conducting a case study research are analysis of primary documents, secondary documents, cultural and physical artifacts; direct observations; and systematic interviewing (Yin, 2009). Thus, the 3 qualitative methods used for this case study were: 1. The use of relevant secondary document as scientific literature, 2. Analysis of primary documents as policy papers, reports and official websites of relevant organizations, 3. Semi-structured interviewing. Elaboration on each method follows.

In order to understand the context in which Amsterdam operates, this thesis strived to present a wide understanding of the current Dutch waste management system, the national transition towards CE and circular waste management, including the main stakeholders, obstacles and opportunities in both areas. To do so, not only local but also national policy papers were analyzed and interviews with governmental employees, with municipal employees and with

representatives of other organizations in the broader context of the city of Amsterdam were conducted.

Policy documents:

The national policies used for this thesis were - the Government-Wide Program “A Circular Economy in the Netherlands by 2050” (2016); “LAP 3” – the National Waste Management Plan (2019, which is yet completely finished); VANG-HHA (2015) – national program focusing on household waste, the purpose of which is to facilitate municipalities to take the necessary steps towards CE. This program is part of the bigger national program “VANG – From Waste to Resources”.

The local-level policies analyzed for this thesis are: “Circular Amsterdam – A vision and action agenda for the city and metropolitan area” - report of Amsterdam’s in-dept study from 2015 on the potential inherent in CE for the city (Circle economy et al. 2015); Amsterdam’s policy on waste management – “Waste Plan – Resources from Amsterdam” (Uitvoeringsplan Afval, Grondstoffen uit Amsterdam) for the years 2016-2020 - the first and so far the only policy paper dealing with the city’s waste management (Municipality of Amsterdam, 2016); “A New Spring and a New Voice” - coalition agreements signed after the local elections in 2018 (Municipality of Amsterdam, 2018).

As Yin (2009) states that theoretical propositions should “...guide data collection and analysis” (Yin, 2009, p.13), all policy papers were coded and analyzed in accordance with the 5Es theoretical framework and with additional domains repetitively mentioned in the policies.

Semi-structured Interviews:

Semi-structured interviews with employees of the national government, of one knowledge institute and one private market company as well as with employees of the municipality of Amsterdam, its waste management company – AEB and additional organization were conducted.

As the thesis researches instrument local governments and their partners should use in order to change private households’ waste management behavior into a more circular one, the professional focus of the chosen interviewees was circularity, waste management, behavioral change or a combination of these. 11 interviews and short e-mail exchange with another employee from the Ministry of Infrastructure and Water Management (further referred to as IenW), were conducted.

The province was not interviewed as in the Netherlands it does not have direct responsibility over the management of the private households’ waste. Citizens were not interviewed as the purpose of the thesis is to research the instruments local governments and their partners can use in order to change the private households’ behavior, thus the private households’ opinions about the different instruments or interventions and their declared or actual behavior were not relevant for this specific thesis.

The list of interviewees included:

National level:

On the national, the interviewees were from IenW as waste management and the transition towards CE are this ministry's responsibilities.

1. Senior Policy Officer at IenW, directorate circular economy and sustainable environment. Among others, working on developing indicators for measuring the quality of the separated waste streams.
2. Senior Behavioral Expert in IenW's Behavioral Insights Team (further referred to as BIT). The BIT supports "...all the divisions in the ministry, by applying behavioral insights to all the different domains" (Interview, Senior Behavioral Expert, IenW, 2019). Senior behavioral expert interviewed for this thesis supports the circular economy domain.
3. Waste and Circularity Advisor in Rijkswaterstaat, the executive organization of the ministry. The organization's responsibility in the domain of waste include helping the ministry with formulating policies and caring them out on the local level. The Waste and Circularity Advisor is also a part of the ministry's BIT.

Knowledge Institute:

4. Program Developer of the program "Circularity in Urban Regions" in Amsterdam's Institute for Advanced Metropolitan Solutions (further referred to as AMS). The Institution develops and valorize integrated metropolitan solutions for the 6 urban challenges defined by AMS, circularity being one of them. The Program Developer is dealing with the scientific side of circular economy within cities, focusing mostly on data gathering and comparable evaluation systems.

Private market company:

5. Behavioral Psychologist in D&B. D&B is a consultancy company striving to bridge the gap between science and practice through behavioral change. The company won a few tenders of the municipality of Amsterdam on littering prevention, food waste separation, etc. The Behavioral Psychologist is currently working on a waste management project with the purpose of littering reduction in Almere.

Other organizations:

6. Strategic Advisor in Amsterdam's Economic Board (further referred to as "the Board"). The Board's goal is to streamline the working relationships between the private sector, knowledge institutes and governmental organizations in addressing complex urban issues in the Amsterdam Metropolitan Area (further referred to as AMA). One of the 6 urban challenges defined by the Board is circularity. The responsibilities of the Strategic Advisor include maintaining this network and disseminating knowledge.
7. Trainee, Policy Advisor in NVRD. NVRD unites the Dutch municipalities and their waste management and public space maintenance companies, supporting them in achieving their goals. Trainee, PA, at NVRD is dealing with, among others, circularity projects.

Municipality of Amsterdam:

8. Policy Advisor, Waste and Resources and Circular Economy (later referred to as Advisor CE), Waste & Resources Department and Environmental Policy Department.
9. Policy Realization Advisor, Waste & Resources Department.
10. Strategic Advisor and Project Manager for Innovation, Waste & Resources Department.

As Advisor CE works for 2 departments, one of them being the environmental policy department where she focuses on circular economy, no additional interviews with employees from the circularity department in the municipality were conducted.

Amsterdam's waste management company:

11. Business Developer, focusing on recycling and separation of streams at AEB – Amsterdam's waste management company.

Email-exchange:

1. Project Leader in Rijkswaterstaat. Contacted for information on the project of “circulaire ambachtscentra”, elaborated upon in the “Amsterdam's case-study” chapter.

All interviews were recorded and 10 out of them were transcribed, due to a clear request of Senior Policy Officer in IenW not to transcribe his interview. The recording of the interview with Strategic Advisor, the Board was cut short 10 minutes before the end of the interview. The conversation of the last 10 minutes was summarized at the end of the interview's transcript. When done interviewing, as more questions rose towards Advisor CE in the municipality, a phone call was scheduled to complete the missing information. The phone call was transcribed at the end of the interview's transcription. All transcriptions were coded in accordance with the 5Es theoretical framework and with additional domains repetitively mentioned by the interviewees. The list of all the interviewees can be found under appendix number 1.

Scientific literature:

Yin (2009) claims that a case study research “Benefits from the prior development of theoretical propositions...” (p.13). Thus, scientific literature on circularity was used for this thesis. The focus was made on the definition of circularity, historical development of the concept, comparison between the theoretical understanding of concept and its implementation in practice, the main trends of research on circularity and more. Identifying that the literature on circular waste management, especially the one focusing on private households' waste management, was relatively limited, scientific literature on waste management was also used. Here, the focus was made on infrastructure and its socio-technical characteristics; the historical development of the incumbent waste management in Europe; description of the existent waste management system on an urban scale, focusing on private households and their waste management habits. Additionally, literature on different instruments and initiatives local governments and their partners can apply in order to change private households' behavior was used.

For the case study, scientific literature analyzing the general Dutch waste management system, the transition process towards CE, Amsterdam's inherited waste management system and the local trends in the transition toward circular economy was used.

Additional sources of information:

1. Websites of all the interviewed organizations,
2. Website of the Department for Research and Statistics, municipality of Amsterdam
3. Amsterdam in Figures, 2018, Research, Information and Statistics - Report by the Department for Research and Statistics, municipality of Amsterdam (OIS, 2018).
4. Website of CBS – Statistics Netherlands

5. Amsterdam's case study:

In this part, first a brief explanation for the choice of Amsterdam as a case study for this thesis will be presented. Then, in order to understand the context in which Amsterdam operates, the most important actors in the Dutch waste management system will be briefly reviewed, followed by an overview of the recent changes and developments in the national waste management system. The shift towards CE will conclude the review of the national level. The focus on Amsterdam will start from some facts and figures on the city, then the city's waste management system will be presented, followed by a review of its shift towards CE. As waste management is a wide domain, most of the focus in this review will be given to household waste management. The existences of additional actors, legislations and developments in other sub-divisions of the general waste stream should be borne in mind.

Amsterdam – world leader in CE implementation:

Amsterdam was chosen as a case study for this thesis as it is one of the leading cities in CE implementation not only in the Netherlands but also in the world. The municipality is very committed to the subject, placing it high on the municipal agenda, and in 2015 it marked 2050 as the year in which Amsterdam will become fully circular (Municipality of Amsterdam, 2019a and 2018). Also, in 2015, the city commissioned an in-depth study on the potentials inherent in a circular economy, becoming the first city in the world to do so (Municipality of Amsterdam, 2019a and 2019b; Circle Economy et al., 2015). Petit-Box & Leipold (2018) found that Amsterdam drives the innovation in all the country as it was found to be engaged in 57% of all the identified CE strategies used around the Netherlands. The municipality activities are also backed up by the national level as the Dutch government strives to turn the Netherlands to a “circular hotspot”, promoting different policies, legislations and projects on the subject (Kalmykova et al., 2018). In the domain of circularity, Amsterdam has a strong emphasis on urbane infrastructures in general (Petit-Boix & Leipold, 2018) and on waste management in particular.

Waste management in the Netherlands:

Main actors in the Dutch waste management system:

The Dutch waste management is a very broad and evolved system, including hundreds of actors with splintering responsibilities (de Jong & Wolsink, 1997). At the beginning, the waste management system, as in most of Europe, was exclusively public authorities' responsibility. In 1979, the Waste Act was enforced, defining the Ministry of Housing, Physical Planning and Environment responsible for formulating waste policy goals at the national level in a National Policy Plan every four years. The Act also declared that every supplier of solid, nonchemical waste is responsible for its handling (collecting, removal and disposal), besides the households' waste, for which the local municipalities were defined responsible (de Jong & Wolsink, 1997; Dijkgraaf & Gradus, 2014 and 2008; Karré, 2011; Municipality of Amsterdam, 2016). Thus, since 1979, every organization, office, school, sports club, etc. is an active stakeholder in the Dutch wide

waste management system. Municipalities legal responsibility is “...to develop and maintain a system of waste handling that services all locations in a reliable, cheap and efficient manner, in accordance with environmental standards” (de Jong & Wolsink, 1997, p. 647). This responsibility is financed by specifically dedicated waste taxes, the purposes for which they can be used are specified in the designed legislation by IenW (Interviews, Waste and Circularity Advisor, Rijkswaterstaat, 2019; Advisor CE, Amsterdam, 2019; Senior Behavioral Expert, IenW, 2019). The definition of the responsibility is quite general, providing the municipalities with significant amount of freedom to choose whether to collect all waste as residual waste or to use different streams of collection, which waste streams to collect, which tax collection system to use, how to process the waste and more (Interviews, Waste and Circularity Advisor, Rijkswaterstaat, 2019; Senior Behavioral Expert, IenW, 2019; and Trainee, PA, NVRD, 2019). Municipalities can also choose whether to provide these services themselves or contract it to outside companies, public, private or public-private partnerships, thus involving many other actors in the system (Dijkgraaf & Gradus, 2014; Karré, 2011). In 1989, following a recommendation of the National Commission for Coordination of Waste Policy, another actor in the field, the “Waste Management Council” (AOO) was created under the Department of Environmental Management (DEM). The AOO consists of the DEM, the Association of Netherlands Municipalities, the Inter-Provincial Council and environmental and consumer organizations (Buclet and Godard, 2001). Its purpose was to improve cooperation between different governmental bodies dealing with waste policy, planning and handling of solid waste (Buclet and Godard, 2001; de Jong & Wolsink, 1997). Within a few years, AOO has developed into a central actor in the waste management sector and the DEM asked AOO to organize waste management on a national scale, publishing every 3 years a 10-year program, indicating the needed landfilling and incineration capacities and their future locations (de Jong & Wolsink, 1997). The Environmental Management Act passed the planning of disposal capacities and coordinating waste responsibilities to yet another actor by determining that waste handling has to be carried out on a regional level. Since 1993, provinces are legally obliged to issue Provincial Waste Plans every 5 years in which they specify the kind and scale arrangements needed to process and dispose of the different waste flows. Provinces were also granted the responsibility to provide permits to the processing and disposal facilities (de Jong & Wolsink, 1997).

All these waste managing organizations can be roughly divided into 2 groups - actors in the waste market (such as consumers, collectors, processor and disposals) and participants in the broader waste sector (policy making authorities, research groups and consultancies, interest groups and umbrella organizations). The first group controls the waste in a physical sense and is seen as the economic arena while the second one is concerned with supporting and influencing waste management policy (de Jong & Wolsink, 1997). The structure of a simple Dutch waste market is mainly public collection - most municipalities carry out collection service themselves, private procession and disposal by private companies (de Jong & Wolsink, 1997; Dijkgraaf & Gradus, 2007; Karré, 2011). Disposal mostly stands for landfilling and incineration. Although the operation of the disposal sites is done by private companies, the choice of the system and its planning are done by public authorities. They are also the owners of the facilities, overseeing that the disposal is done in accordance with environmentally sound standards. Today, more and more private and public organizations are expanding their activity in the waste market, mainly in order

to remain attractive. Some companies collect, process and even dispose of the waste themselves (de Jong & Wolsink, 1997).

Recent changes and developments:

As part of Europe and the EU, the Netherlands were going roughly through the same changes in their waste management system, described in the chapter “Development, stabilization and characteristics of the dominant waste system”. From WWII and until the 1970s, the common waste treatment options were landfilling and incineration (Verhoef et al., 2006). Very few private organizations recognized the attractiveness of waste processing, focusing on the valuable materials, such as paper, textile, scrap and non-ferrous metals. Attention to hazardous materials was hardly given (de Jong & Wolsink, 1997; Verhoef et al., 2006). In the 1980s, the Dutch government struggled with similar challenges as all Europe - due to growing waste quantities, its complexity, the tightening environmental constraints, growing public opposition to new landfilling and incineration facilities and also due to severe land shortage that the Netherlands suffered from, the Dutch government promoted reduction of the household waste sent to landfilling and incineration facilities (de Jong & Wolsink, 1997; Dijkgraaf and Gradus, 2014 and 2008; Verhoef et al., 2006). Waste management went high up on the political agenda and various actions trying to change its generation, composition and treatment began. As early as 1979, De Ladder van Lansink, the waste management hierarchy of prevention, material reuse, recycling, energy recovery through incineration, disposal other than landfilling and landfilling was adopted by the Government. Lower-level solutions of the hierarchy could be used only if higher ones were not available (Buclet and Godard, 2001; Kalmykova et al., 2018; Municipality of Amsterdam, 2016). In 1988, Ministry of Housing, Physical Planning and Environment issued a memorandum with waste reduction and recycling goals for each waste stream (de Jong & Wolsink, 1997). While most countries, in order to achieve these goals, introduced financial mechanisms as complementary to the regulatory ones, the Netherlands promoted them through voluntary agreements - covenants. A covenant is a typical instrument used in the Netherlands - it is a deal between authorities and a specific sector in the society on a specific issue. For example, the promotion of producer responsibility with the packaging industry (Buclet and Godard, 2001; de Jong & Wolsink, 1997). The regulatory control was used to “...punish actors that do not take their responsibility and sign a covenant.” (de Jong & Wolsink, 1997, p. 648). In 1993, the Waste Act was integrated in the Environmental Management Act, which determined what is legally classified as waste and what is not and set a priority order of handling materials and products, according to the waste management hierarchy (Circular Economy et al., 2015; de Jong & Wolsink, 1997). Aiming at 10% reduction in waste generation and 66% recycling by 2000 (de Jong & Wolsink, 1997), the government banned the landfill of combustible waste in 1996, later promoted taxes on landfilling, followed by high incineration taxes (Buclet and Godard, 2001; de Jong & Wolsink, 1997; Dijkgraaf & Gradus, 2014 and 2008). The AOO even established a moratorium on incineration capacity, hoping for the development of new recovery initiatives, but as these have not developed and the municipal waste separation targets were not met, the moratorium was reconsidered (Verhoef et al., 2006). In the 1990s, driven by the new regulations and developments in recycling technologies making recycling and reuse more economical, public

collecting and waste disposal organizations started expanding their activities to waste processing (de Jong & Wolsink, 1997). The Dutch municipalities started providing infrastructure for separate collection of glass, paper and textile, and in 2000 plastic packaging was also added (Dijkgraaf and Gradus, 2014). The means of collection varied between curbside collection, nearby collection points as shopping centers or schools, waste drop-off points or separated bins (Dijkgraaf & Gradus, 2014 and 2008; de Jong & Wolsink, 1997). For bulky waste, municipalities created refuse centers where waste can be brought by the inhabitants themselves or, in some municipalities, collected on request or on regular basis by the municipality, with or without extra charge. To stimulate the separate collection of recyclables and to reduce the total amount of waste, by 2012, 36% of Dutch municipalities introduced a unit-based user fee for unsorted waste, also referred to as DIFTAR (differentiated tariffs) or pay-as-you-throw system. The unit may be volume, frequency, bag, weight or classification (de Jong & Wolsink, 1997; Dijkgraaf & Gradus, 2014 and 2008; Verhoef et al., 2006). The percentage of municipalities owning refuse centers today reaches 97%. With time, the number of separately collected waste streams at refuse centers increased to include drinks cartons, flat glass, construction and demolition waste, gravel and chemical waste (as batteries, medicine, paint, etc.) and today as much as 18 streams are collected around the country (Interview, Project Leader, Rijkswaterstaat, 2019).

Due the great amount of freedom, the municipalities were granted, a need for sharing experience, information and knowledge was constantly growing. Thus, in 1995, the NVRD association was established. NVRD unites the Dutch municipalities, their waste management public companies and the private service provider and supplier parties. The association has around 450 members and its focus is on waste and cleaning. It provides a platform for knowledge and information sharing and promotes topics and projects that are in the interest of the municipalities, representing them also in the national government (Interview, Trainee, PA, NVRD, 2019; NVRD & Hendriks, 2017).

The ministry responsible for waste management in the government nowadays is the Ministry of Infrastructure and Water Management (IenW). As the actual waste management is exclusively the responsibility of the municipalities in the Netherlands, the ministry has more of a guiding and facilitating role. It creates national guiding policies, sets guiding goals and help municipalities to overcome the obstacles and problems preventing them from reaching these goals. The ministry holds a monthly meeting on waste management in which representative of the municipalities and the relevant stakeholder for the specific topic are present (Interview, Senior Behavioral Expert and Senior Policy Officer, IenW, 2019). In the recent years, the ministry, through Rijkswaterstaat, the ministry's executive organization, notably invested in encouraging the municipalities to collect the same waste streams throughout the whole country, to use uniform bins for this collection (using the same colors, openings and symbols) and to implement the pay-as-you-throw system, which has proven to be very efficient in many municipalities in decreasing the amounts of residual waste (Interviews, Senior Behavioral Expert, IenW, 2019; Waste and Circularity Advisor, Rijkswaterstaat, 2019). The ministry and Rijkswaterstaat are also working on the third National Waste Management Plan (LAP3) – a plan the government is obliged to submit periodically, according to the European Waste Directive. This plan will focus on guidelines for waste prevention and separation for recycling, expanding the responsibilities of the municipalities (Rijkswaterstaat, 2019; Municipality of Amsterdam, 2016). Senior behavioral

expert in lenW claims that there is an on-going debate on whether the municipalities have enough financial means and workforce to comply with the extension of the responsibilities (Interview, *ibid*, 2019).

CE in the Netherlands by 2050:

The Ministry of Infrastructure and Water Management is responsible also for the promotion of circular economy in the Netherlands. In 2013, the Dutch government launched the national Green Deal initiative, followed by the Realization of Acceleration of a Circular Economy (RACE) project. RACE was launched in cooperation with other stakeholders in 2014, aiming at turning the Netherlands into a “circular hotspot”. It includes business design, knowledge-sharing, demonstration projects and community involvement measures (Kalmykova et al., 2018). In 2016, the Dutch Ministry of Infrastructure and Environment (the former name of the Ministry of Infrastructure and Water Management) in cooperation with other ministries issued a program under the name “A Circular Economy in the Netherlands by 2050”, outlining a vision of a future-proof, sustainable economy. The ambition of the program is 50% (interim) reduction in the use of primary resources by 2030. By 2050, resources should be used and reused without any harm to the environment. In this document, 5 domains were defined as priorities - biomass and food, plastics, manufacturing industry, construction sector and consumer goods. The consumer goods domain is tightly connected with the waste management system in the document (Interview, Senior Behavioral Expert, lenW, 2019; MIE, 2016). The importance of cooperation of all the parties involved, including citizens, is greatly emphasized in the document (MIE, 2016). In the beginning of 2019, the ministry published the “Circular Economy Implementation Program 2019-2023” - an execution program of the vision outlined in “A Circular Economy in the Netherlands by 2050”. The execution program specifies the concrete actions to be taken in order to promote the transition in the 5 chosen domains. It also defines which organization has the responsibility over each action to be taken (Interviews, Senior Behavioral Expert and Senior Policy Advisor, lenW, 2019).

Circular waste management:

Since 2018 the ministry is also promoting the VANG program - “From Waste to Resource” (personal translation), that strives for better separation of waste in order to reduce the use of the virgin resources and reduce the amount of waste been incinerated. The program aims at 75% of household waste separation by 2020 and the reduction of residual waste to 100 kg per person per year (further referred to as p.p.p.y) (Interviews, Waste and Circularity Advisor, Rijkswaterstaat, 2019; Trainee, PA, NVRD, 2019; Municipality of Amsterdam, 2016). Waste and Circularity Advisor in Rijkswaterstaat stated municipalities are really commitment to these goals – the goals were included in the local policies and real progress towards them is being made (Interview, *ibid*, 2019). Striving to achieve these goals, Rijkswaterstaat provides the municipalities with information, knowledge, knowledge exchange platforms, benchmarks, advice, tools and techniques for different waste strategy implementation and training courses on behavioral influence among citizens. Sessions are conducted with all municipalities, with a special focus on municipalities which are slow in their progress. The benchmark is composed of 4 sessions a year

– kick off meeting defining the theme; second session – presenting the analysis and comparing the figures; third session discussing possible solutions; and the fourth one – creating and signing commitment agreement to work towards the agreed upon goals. In each benchmark between 60 and 100 municipalities take part (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019). In order to change the municipalities perspective on waste management, Rijkswaterstaat uses the “Behavioral Change Wheel” (later referred to as BCW). In the waste and circularity advisor in Rijkswaterstaat’s opinion, BCW is quite comparable with the framework used for this thesis. BCW is composed of three main groups of interventions – Ability, Motivation and Opportunity and it has been in use for around 10 years. Rijkswaterstaat uses the BCW to change the behavior of the municipalities themselves, but the BCW it is also taught in the training courses for municipal representatives, guiding them on how to change and shape the behavior of their residents. Municipal representatives are taught to produce better campaigns and to commit citizens to the municipal goals through consistency and rewards (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019). Around 200 municipalities have already attended these courses and the waste and circularity advisor in Rijkswaterstaat claims that improvement in their performance is clearly visible (Interview, *ibid*, 2019).

Another way that the ministry is trying to affect the Dutch citizens behavior is through direct activity of the Behavioral Insights Team. Starting quite recently, each ministry in the Netherlands has its own BIT, focusing on the needed behavioral change for the relevant domains in the ministries’ activities (Interview, Senior Behavioral Expert, *lenW*, 2019). “...we support all the divisions in the ministry, by applying behavioral insights to all the different domains.” (Senior Behavioral Expert, *lenW*, 2019) and promoting the wanted behavior.

Some of the recent activities of the BIT include: the formation of 10 potential interventions encouraging people to buy secondhand and to donate the products they are done using to secondhand shops. Implementation steps for these interventions are being considered nowadays; Formation of 10 interventions private companies can make to reduce the plastic packaging littering of their products; Formation of a list of interventions that can be taken in to promote smart online purchase of the desired goods and more (Interview, Senior Behavioral Expert, *lenW*, 2019).

A few of the recent incentives of the ministry include research on waste separation in high-rise buildings, a tender for “circulaire ambachtscentra” and a research on extended producer responsibilities. The idea of extended producer responsibilities is making manufacturers responsible for the product through its full life-cycle - after it was purchased and even when it is discarded. The ministry invests a lot of financial and human resources in this topic as it is seen by the ministry as one of the main catalysators for CE (Interview, Senior Behavioral Expert, *lenW*, 2019). Waste separation in high-rise buildings arose as a major challenge from many municipalities striving to reach the 75% separation goal. The ministry designed an experiment conducted in 5 municipalities, Amsterdam being one of them, to see what behavioral influence technique is the most effective one in encouraging waste separation in high rise buildings. The experiment is over and when all results will be available, Rijkswaterstaat will invite all municipalities for an update meeting informing them on the results, the difficulties and successful

factor and providing tools for the implement of the solution on a bigger scale (Interviews, Senior Behavioral Expert, IenW, 2019; Waste and Circularity Advisor in Rijkswaterstaat, 2019).

The most recent incentive of the ministry is the “circulaire ambachtscentra”, on a European level called Urban Resource Centers. The ministry published a tender calling for municipalities to apply by the end of June 2019 for a subsidy of 75,000 Euro for implementing such a center. The purpose of such centers is “Reusing a product in the shape and form that it has when people discard them...” (Personal contact, Project Leader, Rijkswaterstaat, 2019). Meaning, preventing products incineration but also avoiding recycling, climbing higher in the circular waste management hierarchy and enhancing reuse. The centers are expected to connect between the waste collection points (refuse centers) in the cities with secondhand stores and to add repair cafes to the locations. The social purpose of the project is also to create jobs for people with a large distance to the labor market and to enhance education on the subject. “It will be a multifunctional place where the circular economy will be practiced and promoted.” (Personal contact, Project Leader, Rijkswaterstaat, 2019). 43 municipalities applied for the tender, 10 were chosen to be granted the subsidy. All the applying communities will be invited to join the “Community of Practice” on “circulaire ambachtscentra”, the purpose of which will be exchanging existing knowledge. For example, there are already waste collection points that cooperate with secondhand stores; some municipalities cooperate with knowledge institutes to develop a new production line from the materials collected in the waste collection points, etc. (Personal contact, Project Leader, Rijkswaterstaat, 2019).

Some of IenW’s future incentives include cooperation with Milieu Centraal on spreading a questionnaire on a national level about the various actions a private household can do to prevent waste. The questionnaire is designed to provide Rijkswaterstaat with information on what people already know, but also to raise the number of searches people will conduct on these subjects after they answer the questionnaire. The ministry is also planning to tax the amount of residual waste, as additional taxation to the existing taxation on incineration (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019).

Nowadays, there are 85,000 circular activities in the Netherlands, 1500 innovative circular companies and the sector employs 420,000 people (Amsterdam Economic Board, 2019). The future economic profit of circular economy in the Netherlands was estimated to amount to 7.3 billion Euro and to create 54,000 jobs (Circle Economy et al., 2015; Kalmykova et al., 2018; Municipality of Amsterdam, 2019a). It is also estimated to reduce CO² emission by 17 megaton and predicts a significant decrease in water consumption.

Amsterdam:

Amsterdam is the capital and the biggest city in the Netherlands. It is a home to 862,987 inhabitants of 175 nationalities (OIS, 2019). In 2030 the number is expected to rise to 981,319 and to 1,062,501 in 2040 (OIS, 2019). As of January 2018, the city consists of 8 districts and 99 neighborhoods (OIS, 2018). In 2015, 25% of Amsterdam citizens in the ages of 15-72 had low education rate, 32% had secondary education rate and 43% had high education rate (OIS, 2018).

The annual income of a person in private household in Amsterdam is 33,500 Euro. In 2017 the unemployment rate was 5.7% of the labor force (OIS, 2018).

The characteristics of the inherited waste disposal system:

The responsibility for waste management in Amsterdam until 2015 was divided into the 7 districts of the city. Each district was independently responsible for its waste management, drawing up a policy, deciding on its collection methods, its containers (that differed in volume, dimensions, methods of recording and emptying them, etc.) and the amount of the taxes charged for the waste management (Interview, Strategic Advisor, Amsterdam, 2019; Municipality of Amsterdam, 2016). Each had its own department, administration, collection fleets, etc. The waste collection varied between underground containers, garbage bags collection, mini containers in front of private houses or in their gardens, curbside recycling containers for different waste streams and even a chemo cart driving in the city (Municipality of Amsterdam, 2016).

Since the end of 2015, realizing that this fragmentation reduces efficiency and constitutes a barrier to the achievement of the different goals, the city decided to promote a centralized organization of waste management. The new organization has one control, one administration, one information provision, a uniform financial and operation system, responsible for all the public spaces used for waste management, centrally buying the containers and vehicles and financing the collection and processing of waste through city-equal waste-tax rates (Municipality of Amsterdam, 2016). The chosen harmonized collection system is underground containers for paper, glass, plastics, textile and residual waste. The optimization of the existing system took place at the past 3 years and has not being finished yet. It is applied neighborhood by neighborhood and includes installation of containers in new locations and replacement of the old ones that deviate from the new decided upon standard (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019; Municipality of Amsterdam, 2016). Yet, area-oriented customization in the waste collection and processing system are applied in many neighborhoods, where the municipal workers identify a need or an opportunity (more on that under the “Engage” instrument in “Results” chapter) (Interview, Policy Realization Advisor, Amsterdam, 2019; Municipality of Amsterdam, 2016). “...and that is also the tension of the work we are doing. On the one hand we need to do it efficiently, unify it in one way for the whole Amsterdam. On the other hand, we have to make it work very locally. And it is difficult sometimes to get it done” (Interview, Policy Realization Advisor, Amsterdam, 2019).

As the transition from waste management on a district level to waste management on the municipal level is still in progress, there are still differences in the frequency and method of collection, mostly evident in bulky waste collection. The frequency of collection varies between once a week, every two week or every month. In some neighborhoods it is collected only by appointment. Some districts pay extra for this service, in some it is collected for free. The other two existing options for bulky waste treatment is its handing to one of the 6 city’s waste collection points (free of charge) or its passing to one of the ten secondhand stores working with the municipality (Municipality of Amsterdam, 2016 and 2019).

In parallel with the consolidation of the waste management system, Amsterdam works on the consolidation of the information provided to the citizens. Municipal employees inform the

citizens in the neighborhoods where waste separation was not previously existent on the new installation and explaining them which waste goes to which bin (more on the information provided to the citizens under the “Enable” and “Exemplify” instruments in “Results” chapter) (Interview, Policy Realization Advisor, Amsterdam, 2019; Municipality of Amsterdam, 2016).

The city of Amsterdam collects the household waste and Amsterdam’s waste and energy company, AEB (Afval Energie Bedrijf) Amsterdam, is responsible for waste processing and for the operation and the collection of waste in the 6 waste collection points around the city (Municipality of Amsterdam, 2012 and 2016). The waste collection points are “...intended for waste that it is illegal to place in a bin/bag or is oversized, including construction and demolition waste, broken furniture and chemical waste such as batteries and paint.” (Municipality of Amsterdam, 2012, p.16). AEB was owned by the city of Amsterdam until 2014. Since then, it is an independent company, but the municipality is its 100% shareholder (Interview, Business Developer, AEB, 2019). AEB operates 2 incineration plants for the processing of residual waste, supplying the city with electricity and heat and extracting raw materials as iron and aluminum from the combustion residues. It is also responsible for contracting out the other ways of processing the separately collected waste streams (Interview, Business Developer, AEB, 2019; Municipality of Amsterdam, 2016). Two years ago, AEB installed a post-collection separation plant, that by separating plastics, papers and cardboard, beverage cartons and metals from the residual waste, increases the overall percentage of waste separated in the city (Interview, Business Developer, AEB, 2019). Thus, at present the city has a combined system of source separation and post-collection separation (Interviews, Advisor CE and Strategic Advisor, Amsterdam, 2019; Business Developer, AEB, 2019). The percentage of the post-collection separation from the residual waste is highly debated, and while AEB’s business developer claims it to be 20% of all residual waste (Interview, *ibid*, 2019), the waste and circularity advisor in Rijkswaterstaat claims it to be only a one-digit number (Interview, *ibid*, 2019).

All Amsterdam’s waste management activities are funded by the waste-tax. *IenW* defined by law which activities could be funded by this tax and according to that the municipality operates its waste today (Interview, Advisor CE, Amsterdam, 2019). Before 2015, the tax variation between the different districts was 328€-367€ a year for a multi-person household. Since the consolidation of the waste management system, the waste tax for a multi-person household have gone down from 320€ in 2015 to 313€ in 2016, and for a single-person household from 240€ to 235€. Low income households are completely exempted from this fee (Municipality of Amsterdam, 2016).

In 2016, Amsterdam published its first Waste Implementation Plan (“Waste Implementation Plan, Resources from Amsterdam”, Municipality of Amsterdam, 2016) for 2016-2020 setting three central ambitions - improving sustainability (through the raise of waste separation to 65% in 2020), improving services (by making waste separation faster and easier) and establishment of efficient organization for financing the waste management process (Municipality of Amsterdam, 2016).

The amounts of household residual waste in Amsterdam reach around 230,000 tons a year (Interview, Business Developer, AEB, 2019). In 2013, the total waste amount p.p.p.y was 422kg. In 2017, this number decreased to 380.7kg p.p.p.y (OIS, 2018 and 2019). In 2014, only around a quarter of it was separated (27%) (Municipality of Amsterdam, 2016), through all the available

separation options (different shops (collecting electrical equipment, batteries, light bulbs, etc.), paper, glass and plastic containers, biodegradable containers in some districts and the 6 waste collection points) (Municipality of Amsterdam, 2016). This percentage was far below the Dutch average, with organic waste particularly rarely separated at source (Circle Economy et al., 2015).

The city's department responsible for waste management is called "waste and resources department". It is relatively big and includes a big team working on community building and area-oriented customization of the waste system; an innovation team, researching and promoting technological and digital innovation in the waste domain; and even one employee whose particular focus in the waste and resource department is waste prevention (Interviews, Advisor CE, Strategic Advisor and Policy Realization Advisor, Amsterdam, 2019).

A present concern in the city is the separation between the responsibilities over the household waste and the commercial waste established by the Waste Act. Advisor CE of the city of Amsterdam states that this separation causes a lot of problems – the commercial waste is usually not separated and all the waste is discarded as residual waste, which restricts the city's ability to reach its goals on waste and circularity (Interview, *ibid*, 2019). Also, it creates pressure on the city's facilities, as each store, sport center or school contracts a waste collector of their choice, creating situations in which in some streets 17 waste collection truck pass daily. The municipality is actively lobbying the national government to change this law and recently they were granted a permission to conduct a pilot in the area of the nine-streets in Amsterdam where the municipality will also be responsible for the commercial waste collection (Interview, Advisor CE, Amsterdam, 2019).

The 2015's revolution:

2015 was a very significant year for the promotion of CE in the city - the city alderman established the Dutch 'Nederland Circular' - a platform connecting between entrepreneurs, employees and other interested parties, enabling collaboration, knowledge sharing and providing opportunities to invest in CE activities (Prendeville et al., 2018). The city's current sustainability agenda was also adopted in 2015, setting CE as one out of the city's 5 long-term goals, including also sustainable city, renewable energy, climate-change and resilience and air-quality (Circle Economy et al., 2015; Municipality of Amsterdam 2018 and 2019b; Prendeville et al., 2018). 2015 was also the year in which the city adopted the national goal of becoming fully circular by 2050 (Interview, Advisor CE, Amsterdam, 2019; Municipality of Amsterdam, 2019a and 2018). In the same year, using the services of "Circle Economy" - a Dutch CE consultancy, Amsterdam commissioned an in-depth study on the potentials inherent in CE, becoming the first city in the world to do so (Interview, Advisor CE, Amsterdam, 2019; Municipality of Amsterdam, 2019a and 2019b). The results of the study showed that the ambition to become a circular hotspot is widely supported in Amsterdam not only by the municipality but also by businesses and citizens. It also showed that striving to become a front-runner in circularity, Amsterdam region is already in a good starting position as it already has "...many entrepreneurial and innovative businesses, citizens, start-ups, organizations and knowledge institutions that are already working within the framework of a circular economy" (Circle Economy et al., 2015, p.5). Additionally, it was found

that by transforming to CE, Amsterdam can significantly reduce its greenhouse emissions and material consumption while rising the employment opportunities and continuing its economic growth (Circle Economy et al., 2015). The value chains that were recognized as having the biggest potential for influence were construction and biomass (Circle Economy et al., 2015; Interview, Advisor CE, Amsterdam, 2019). The conclusions were validated with the market and based on them; 3 pilots designed for a period of 2 years took place. The evaluation of the three pilots brought to light another value chain in which transition to CE the local government can have a significant – consumption goods. Nowadays, the municipality is working on developing specific policies for the 3 value chains – construction sector, biomass and consumption goods. They should be ready by the end of 2019 (Interview, Advisor CE, Amsterdam, 2019).

To promote CE, the city uses collaboration platforms, business support schemes, knowledge development activities, etc. (Prendeville et al., 2018). The city even established and partly funds an independent Institute for Advanced Metropolitan Solution (AMS Institute) that focuses on developing sustainable solutions for 6 urban challenges, circularity being one of them (AMS, 2019; Interview, Program Developer, AMS, 2019; Prendeville et al., 2018).

As CE is a relatively new concept in practice, the municipality helps to facilitate CE initiatives in practice and initiate pilots. 'Living labs', used for experiments and innovations, are widely applied around the city in the "free-zones" (Buiksloterham) - decaying postindustrial areas, that were defined by the city as "free of regulations". Thus, municipality's partners can experiment in these areas with innovative ideas (Interview, Program Developer, AMS, 2019; Municipality of Amsterdam, 2019a and 2019b; Prendeville et al., 2018). One of the purposes of these "free-zones" is to identify where regulation block the innovation towards circularity and to develop an alternative (Interview, Program Developer, AMS, 2019). A few examples of such "living-labs" are the participatory, self-efficient, fully circular community called "De Ceuvel" (Municipality of Amsterdam, 2019a and 2019b; Prendeville et al., 2018); Schoonschip - a floating residential area of energy-self-sufficient boats, using rainwater to the amount of 95% or their water consumption (Metabolic, 2019); Circular Buiksloterham – a fully circular neighborhood, promoting waste minimization, high levels of waste separation and improved recycling techniques (Metabolic, 2019a).

Amsterdam is also one of the main partners in a voluntary organization called Amsterdam Economic Board. The Board is a joint organization of municipalities and other parties like businesses and knowledge institutes located in Amsterdam Metropolitan Area. It is fully funded by its members – "...you have to pay 5000 Euros to be part of that council and you have to really be committed to improving the whole region in terms of making it smarter, more sustainable and more healthy." (Interview, Strategic Advisor, The Board, 2019). The Board defines Circularity as one of the main five urban challenges AMA is facing, seeing the Circular Transition as one of the 3 fundamental transitions the area needs to undergo. The Board sets 2025 as the year in which AMA will become the world's leader in the field of CE (The Board, 2019a). As a part of its activity in the Board, the municipality of Amsterdam has signed a commitment to invest 150 million in circular procurement contracts by the year of 2025. Amsterdam is also a member in "Amsterdam Smart City", a sub-program of the Board, which serves as communication, advice and knowledge share platform. The city of Amsterdam leads the Board, drives the innovation in 32 projects

promoted through the Board (researches, reports, pilots, etc.) and is seen by the Board as a front runner with a strong voice on CE (Interview, Strategic Advisor, The Board, 2019).

Identifying all the CE strategies used around the Netherlands, Petit-Box & Leipold (2018) found that Amsterdam drives the innovation in all the country. The city was found to be engaged in 57% of them, with strong emphasis on urban infrastructure and industrial systems. They also found that the city is working on district redesign through citizen participation as a CE strategy, to approach climate-friendly models (Petit-Boix & Leipold, 2018).

Prendeville et al. (2018) researched 6 cities in transition to CE, Amsterdam being one of them. They found that Amsterdam is in a preliminary stage of implementing CE strategies, including it in policies and agendas, and promoting CE projects and multiple community-owned and public engaging initiatives. They believe that Amsterdam's policy makers have a nuanced vision of the concept, understanding its complexity and adopting a cross-sectoral interpretation (Prendeville et al., 2018).

Circular waste management:

Since 2015 the municipality started its oriented activity toward circular waste management. In 2016 the municipality published its first waste management plan "Waste Implementation Plan, Resources from Amsterdam", where it defines 65% waste separation as a goal to achieve until 2020. The policy also defines 100kg p.p.p.y as an objective to strive to. Endeavoring to achieve the 2, the municipality aims to gradually reduce the number of residual containers from around 60 households per container of residual waste to 100 households per container (Municipality of Amsterdam, 2016). After the local elections in 2018, the new Mayor and coalition intentions to continue and act in this direction were declared in the collision agreements - "The waste chain must become a raw material factory" (Municipality of Amsterdam, 2018, p.41). AEB, Amsterdam's waste management company, is accomplice to the city's goals and has set a goal of becoming "the most sustainable waste management company in the world" (Interview, Business Developer, AEB, 2019).

Nowadays, the municipality is working on a new waste management plan for the years 2020-2024 that will focus more on waste prevention and waste upcycling (Interviews, Advisor CE and Strategic Advisor, Amsterdam, 2019). AEB is also developing its policy, in consultation with the municipality, for 2020-2025. One of the things discussed for this future policy is the possibility of not extending the activity of the older incineration plant operating from 1993 (Interviews, Advisor CE, Amsterdam, 2019; Business Developer, AEB, 2019). Also, from September 2019, the municipality of Amsterdam will start a collaboration with the University of Amsterdam and Amsterdam University of Applied Sciences on research and experimenting projects in the different neighborhoods in Amsterdam in order to find the best ways to promote the circular waste management and wanted behavior on a local scale (Interview, Policy Realization Advisor, Amsterdam, 2019).

Some examples of the ongoing or recently finished pilots and experiments on circular waste management in Amsterdam are: diapers recycling project; better waste separation in high-rise buildings; household and commercial waste collection by the municipality in the area of the nine-

streets; small bulky waste collection in a moving container on a neighborhood level; separate stream for bio-waste collection; and many more (Interviews, Strategic Advisor, The Board, 2019; Senior Behavioral Expert, IenW, 2019; Waste and Circularity Advisor, Rijkswaterstaat, 2019; Policy Realization Advisor and Advisor CE, Amsterdam, 2019; Municipality of Amsterdam, 2016).

Amsterdam's activities specifically targeting private households, aiming to change their waste management behavior into a more circular one, will be presented in the following chapter of "Results" and analyzed in the chapter "Analysis and Conclusions".

6. Results:

This section presents the use the municipality of Amsterdam and its partners made of each instrument of the 5Es framework – Enable, Engage, Encourage, Exemplify and Enforce. Some incentives were designed to use more than one instrument thus, the analysis might partially overlap. Following, the findings on the process of goal setting, use of measures and indicators and interdisciplinary and cross-governmental collaboration will be presented. Additional findings will be presented at the very end of this chapter. All the results were formalized based on interviews, policy papers analysis and additional sources of information.

Enable: (provision of infrastructure, provision of knowledge and information, education, present and future initiative to be taken under the “Enable” instrument”)

Enable instrument was noted by all the interviewees as the main tool in use, with focus on knowledge and information provision. Behavioral psychologist in D&B believes that this is the most important tool in facilitating behavioral change (Interview, *ibid*, 2019).

Provision of facilities and infrastructure:

1. Until 2015 each of the 7 districts in Amsterdam had their own waste management system, with independent policies, ways of collection, different waste streams collected, different standards for bins, etc. Since 2016, one of the main focuses in the municipality of Amsterdam is on harmonizing the system. The importance of a uniform system throughout the city but also throughout the whole country was emphasized by most of the interviewees, including all governmental levels and the private market company. The municipality invests a lot of resources in the provision of uniform facilities – the same underground bins, with the same structure, size, colors and specific openings, the same waste streams and the same recording, collecting and emptying methods. The number of bins is on significant increase, bins are installed in neighborhoods that did not have them before, existing bins are made more visible, closer to houses and easier to reach. It is a work in progress, and it will take a few years before this project will be finished. The purpose is to provide basic and uniform infrastructure to facilitate waste separation all over the city (Interviews, Policy Realization Advisor and Advisor CE, Amsterdam, 2019; Municipality of Amsterdam, 2016).

2. Providing special facilities to specific neighborhoods – realizing that there are big differences between the different communities living in Amsterdam, the municipality strives to balance between the harmonization of the whole system and between area-oriented customization. The municipality in cooperation with the 7 districts, which have closer relationships with their local residents, work in 22 areas, striving to offer infrastructure particularly adjusted to the needs of the specific community in a specific neighborhood. Connecting them through their unique way of living, in the most effective approach, to sustainability and circularity concepts. A relatively big group of people work on this goal in the municipality, policy realization advisor being one of them (Interview, Policy Realization Advisor, Amsterdam, 2019; Municipality of Amsterdam, 2016). An example of an area-oriented project is the bread collection infrastructure installed in 29 locations in 3 different districts – Nieuw-West, West and Oost. The problem was littering of bread – a problem very common in Islamic neighborhoods, as throwing bread to the garbage is not well

accepted in the Islamic religion. The citizens would spread it on the streets, assuming that dogs, birds or ducks will eat it, but the amount of bread was too big. Identifying the problem, the municipality co-created with a group of locals from these neighborhoods a system that was accepted by the residents – a garbage bin designated for bread that will be used to produce biogas and compost. The collection of the bread waste is done by people with a distance to the labor market, making the project also a one of social inclusion. Policy realization advisor of the city of Amsterdam emphasizes this project as successful since it engages a group of people that is usually hard to reach and enables “...this group to contribute to CE within their living world.” (Interview, *ibid*, 2019). More on this way of working is elaborated under the “Engage” instrument.

3. Food collection facilities – understanding that food fraction in the residual waste has a significant effect on the quality of the resources extracted through post-collection separation (Interviews, Business Developer, AEB, 2019; Waste and Circularity Advisor, Rijkswaterstaat, 2019), the municipality is working on providing specific facilities for food waste (Interview, Policy Realization Advisor, The Municipality; Municipality of Amsterdam, 2016). Java island was chosen as the pilot project and D&B, a behavioral change company, won the tender for the project implementation (Interview, Behavioral Psychologist, D&B, 2019). As a part of the project, facilities in form of small bins were provided to each household willing to participate. Designated bins that can only be opened with a chip-card distributed to the participating households were installed on the streets. Before the pilot was over, due to its relative success and due to pressure from 1000 residents of IJburg island who signed a petition calling the municipality to provide food separation facilities also to their island, the pilot was expanded. Currently, more and more people and neighborhoods are starting petitions to get food waste separation facilities in their neighborhood. The food waste collected is used to produce compost and biogas (Interviews, Policy Realization Advisor and Strategic Advisor, Amsterdam, 2019).

4. Circulaire Ambachtscentra – Amsterdam applied for the national tender for funding Urban Resource Centers but did not win. Advisor CE of the city of Amsterdam claims that the municipality will still implement its ideas, financed by the municipal budget. The idea is to transform the waste collection points into “circular working stations” – “...creating atmosphere of resources, where you can fix things, where you can use resources yourself...” (Interview, *ibid*, 2019) providing the citizens with facilities for maintenance, repairmen, reuse and creation.

Provision of knowledge and information:

Next to the facilities and infrastructure, the municipality of Amsterdam sees great importance in providing people with the right and uniform information and knowledge on circular waste management (Interview, Policy Realization Advisor, Amsterdam, 2019; Municipality of Amsterdam, 2016). As policy realization advisor of the city of Amsterdam puts it: “So, the people know what they have to do with waste. What is plastic. What is hard plastic, what is soft plastic, where is the container for plastic.” (Interview, *ibid*, 2019). This need is emphasized as especially critical due to the previous division of the waste management system into 7 different districts. Advisor CE of the city of Amsterdam states that in the first years the ways of informing the citizens were not good enough, so nowadays the municipality puts more effort in informing people in a structured way, neighborhood by neighborhood (Interview, *ibid*, 2019). The knowledge and

information are provided in various ways by the municipality and its many partners – the municipality website has a “Waste Guide” per each district, available in Dutch and English (Municipality of Amsterdam, 2019d); Milieu Centraal’s (2019) website provides a platform in which one can choose an item of the list and the website will specify which bin this item should be thrown to and how this waste stream is processed; door-to-door stepping in neighborhoods where new installations of infrastructures were made (Interview, Advisor CE, Amsterdam, 2019); AMS and the Board have websites with a plethora of information (Interviews, Strategic Advisor, The Board, 2019; Program Developer, AMS, 2019); and much more. Furthermore, realizing that many of Amsterdam residents are illiterate, the municipality created illustrated guidelines and signs on bins and on flyers distributed to the citizens, helping illiterate people understand how to better sort their waste (Interview, Policy Realization Advisor, Amsterdam, 2019). Behavioral psychologist in D&B believes that this kind of information provision is actually best not only for illiterate, but for all citizens – “...make your communication brief and powerful. So, the use of icons, colors and images about what should be inside the garbage cans.” (Interview, *ibid*, 2019).

Education:

Education is seen by the municipality and its partners as a very important tool in the transition towards CE. As the strategic advisor of the city of Amsterdam states – “...if you can plant the seed now with the children or with the training of the adults, you will see a huge behavioral change in 10 years from now.” (Interview, *ibid*, 2019). Realizing that the faster you start, the better, The Board is working at a regional level to promote an agreement on including the theme of circularity into the curriculum of all the levels of education, from primary school to Universities. After the agreement will be achieved between all the relevant parties, a letter of commitment will be signed by all partakers and a website supporting the program will be launched, shedding light on the already existing examples of education on circularity. The Board is only a facilitating organization meaning that after the agreement is signed, each municipality or organization will have to find its own ways to implement this agreement (Interview, Strategic Advisor, The Board, 2019).

Although the agreement is yet to be signed, the municipality of Amsterdam is already working in that direction. A fixed program dealing with CE for children at the ages of 12 and older is already in place, and now the municipality, in cooperation with entrepreneurs and private companies, is developing a uniform program for children in the ages of 5-12. Trying to find the best way to manage it, the project is run today in different piloting forms, varying between a complete independence of the school and a fixed program dictated fully by the municipality. Policy realization advisor of the city of Amsterdam believes that the experiment will end up somewhere in the middle with a modular program in which the school will be able to choose 1 or 2 modules funded by the municipality and finance by itself the additional modules. The purpose of this program is to develop children’s independent and critical thinking on the topic, “So, they create their own thoughts about importance of circular society and of sustainability within their house but also within their neighborhood and their city.” (Interview, *ibid*, 2019).

Examples of present initiatives:

Examples of the different projects of higher levels than recycling in the circular waste management hierarchy initiated by the municipality and its partners:

Provision of infrastructure and facilities - library for cloths; a small “exchange” corner in the container for bulky waste in the Pijp where residents can place items they no longer use and other residents can utilize them (elaborated upon under “Encourage” instrument) (Interview, Advisor CE, Amsterdam, 2019); cooperation with secondhand shops in collecting unwanted goods from inside the individuals’ houses, diverting the goods from going to waste and preventing their exposure to weather erosion (Interviews, Advisor CE and Policy Realization Advisor, Amsterdam, 2019; Municipality of Amsterdam, 2016); collection of bulky waste by phone-call appointment. This way, on the one hand, the citizens have no need to wait for the once-a-week collection day and on the other hand, the municipality knows what is to be collected and can prepare for its better treatment instead of disposal (Municipality of Amsterdam, 2016); food collection in Java and IJburg Islands; bins for bread in Nieuw-West, West and Oost districts (Interview, Policy Realization Advisor, Amsterdam, 2019); bread digester in Wildermanbuurt (elaborated upon under “Engage” instrument) (Interview, Program Developer, AMS, 2019).

Provision of information – a guide book on how to organize a give-and-take party for your neighbors is available on the municipality’s website (Interview, Advisor CE, Amsterdam, 2019); Milieu Centraal’s (2019a) website provides information on how private households can produce less waste, shop consciously, save energy, etc.

Information and infrastructure - Future developments:

To make it easier to separate the waste and make sure the separated waste is of high-quality, the municipality is looking into alternative ways of collection through increasing the number of mini-containers; finding local forms of food and garden waste collecting; and through smart collection alternatives for collection of new flows (such as chemical waste, electrical appliances, cat litter, etc.).

One specific infrastructure being developed in the innovation team of the waste and resource department in the municipality is a kitchen grinder that is planned to be installed in the sink in new built areas. The waste grinded in the kitchen is planned to be collected and treated not through the sewage system as it is sometimes done, but separately and as local as possible (Interview, Strategic Advisor, Amsterdam, 2019).

The future vision of strategic advisor of the city of Amsterdam for the municipality in the area of information and knowledge distribution was described as a huge open circular data platform, a “library map of Amsterdam”. “There is hardly a citizen in Amsterdam that knows how much its street, or its neighborhood is producing in waste or how much is sorting waste and how much is being done with waste. And I believe if you want to convince people, and if you want to inform people first of all about the important of waste and what your numbers are, you have to be really open in this data.” (Interview, *ibid*, 2019). This data, in his opinion, should include all the resources in a neighborhood scale. The platform will show how much waste is produced, how much of it is sorted or recycled. strategic advisor of the city of Amsterdam believes that this will

lead to conscious behavior of the private households but also will allow the evolvement of new business – “...because if you are showing the resources that you can mine in your area, then it is easier for entrepreneur to say – “I can mine resources there”, which is a really important step to become more circular”. Strategic advisor of the city of Amsterdam is now working on collecting all the relevant information for such a platform for the textile stream, providing information on the amount of cloths bought in Amsterdam, the amount of the thrown away and incinerated cloths, the amount of unused cloths, etc. The platform will also include the existing alternatives or initiatives to buying new cloths, like secondhand shops or sewing workshops (Interview, *ibid*, 2019). Strategic advisor of the city of Amsterdam sees the part of the alternatives as the most important one “...because it might be, in the city as Amsterdam, that you live next to one these initiatives and you do not know about it” (Interview, *ibid*, 2019).

Engage: (Knowing your audience and involving them from the beginning, participation and discussion, use of existing networks and local enthusiasts, media campaigns and door-to-door interventions and future developments)

A lot of the interviewees believe that engaging citizens from the very beginning of a project, informing them on the planned changes and asking their opinion not only significantly facilitates the success of a project (Interviews, Trainee, PA, NVRD, 2019; Advisor CE, Amsterdam, 2019), but also promotes engagement to the whole idea of circularity (Interviews Strategic Advisor, Amsterdam, 2019; Program Developer, AMS, 2019). “You will see that neighbors will talk to each other that has never seen each other before. You will see that they will also think about “Hey, maybe I should not fly to my holiday, but I should take the train”. All these kinds of things. And that is being done by these door-to-door stepping. Not by encouraging, but by this face-to-face talk.” (Interview, Strategic Advisor, Amsterdam, 2019).

Involving all the citizens in the transition towards circular economy is of high importance to the municipality of Amsterdam, therefore the municipality uses a wide variety of tools for citizens engagement (Interview, Strategic Advisor, Amsterdam, 2019; Municipality of Amsterdam, 2016).

Knowing your audience and involving them from the beginning:

As was already mentioned under the “Enable” instrument, the municipality works towards area-oriented customization. The responsibility of the people working in this team is to involve the residents who do not participate through the conventional channels available; to try and understand their issues, ideas and questions; identify the already existing networks and the local enthusiastic residents who want to contribute to the neighborhood; and evolve bottom-up solutions to target the problems in an acceptable and effective way, in order to bring these groups closer to CE and the wanted behavior (Interviews, Advisor CE and Policy Realization Advisor, Amsterdam, 2019). The communication takes place on streets, sports courts, mosques, etc., through un-formal meetings. Identifying a clear need, an obstacle or a willingness to cooperate with a project the municipality is looking to implement, the municipal employees report back to the municipality which then decides whether to address this problem by providing skills, knowledge or facilities (Interview, Policy Realization Advisor, Amsterdam, 2019;

Municipality of Amsterdam, 2016). Policy realization advisor of the city of Amsterdam claims that such bottom-up projects are specifically successful if they are done using the locally existing network and cooperating with the leaders of the community. People that are well known, respected and influential. In the project of the bread bins (mentioned earlier under “Enable” instrument) for example, the citizens that took part in the creation of the solution were the ones to spread the word in their neighborhood, explaining the importance of such an act and engage their neighbors. “...we didn’t do anything about communication or whatever. All the people from that community did it themselves. And we collected a lot of bread. So, it is much more effective that way.” (Interview, *ibid*, 2019).

Another significant point of engagement is the different experimental “living-labs” and “free-zones” around the city, operated by municipality’s different partners such as AMS and Metabolic, with or without the participation of the municipality. Usually, the communities in the “living-labs” are very active, owning the knowledge and the willingness to act towards circularity. In such projects, knowing one’s audience, involving the citizens from the very beginning and through the project development throughout the years, is crucial to the success of the project. An example for such “living lab” is the community around the bread digester at Wildermanbuurt, Amsterdam-West. The problem was similar to the one in the Islamic neighborhoods described earlier – the citizens did not want to throw the bread to the garbage. The problem, again, arose from the citizens. AMS, Wageningen University and other partners, conducted a research on the possible solutions and came up with a bio-waste digester. In September 2016 the digester, with a kitchen attached to it, was installed in place, allowing the residents to cook using the gas produced from the bread and other bio-waste they themselves supplied. As the problem came from the community, they were involved in the solution and implementation processes. AMS and Wageningen University used the help of known, respected and trusted local residents to create social pressure and facilitate the change. The community took responsibility on the collection of the bread and operation of the digester. They also organized cooking events and workshops around the digester’s kitchen, making the idea that waste can be a resource visible and practical. The installation of the digester created a positive attitude towards the idea of circularity and contributed to the rise of the very low percentage of waste separation in the neighborhood (Interview, Program Developer, AMS, 2019; Rietveld & Lie, 2018). Program developer at AMS claims that the people in the neighborhood “...really got thinking about being more sustainable and changing their behavior as well and also being more of a community on this subject.” (Interview, *ibid*, 2019), or as Rietveld & Lie (2018, p.4) state: “These local residents were proud on their “Osdorp gas”!”.

Participation and discussion (through formal channels):

Strategic advisor of the city of Amsterdam believes that the municipality already carries out many meetings with citizens, allowing wide participation and discussion about the problems and the desires of the citizens, trying to provide them with their needs. “And of course, you cannot always adjust fully to that, but it is really important to keep your ears open for this and to see and to fit that thing to your process” (Interview, *ibid*, 2019). The policy paper “Waste Plan, Resources from Amsterdam” (Municipality of Amsterdam, 2016) frequently mentions the existing discussions with citizen - informing them about changes in the waste collection system in their neighborhood,

regularly measuring their satisfaction with municipal services and with the quality of the waste system, asking for ideas for improvement, etc. “These meetings yielded a few hundred ideas for improving waste collection, the infrastructure and keeping the city clean” (Municipality of Amsterdam, 2016, p.68, personal translation). Two other formal communication channels are Amsterdam’s information line and the “Public Space Notification” app. Both can be used to inform the municipality about dirty streets, full or non-functioning containers, other problems in the public space or share any ideas on the waste system or the public space in general. Through these channels, the municipality can also inform the citizen whether the problem was solved and react to their ideas (Municipality of Amsterdam, 2016 and 2019c). Advisor CE of the city of Amsterdam stated that the municipality is now developing a strategy and a structural way of involving citizens on a regular basis on environmental and social issues, including circular economy. The municipality uses the doughnuts model from the “Doughnut Economy”, a book by Kate Raworth, thus the meetings will be called “doughnut workshops”. In these workshops, the neighborhood needs, future goals, the upcoming changes, the feedback the residents have on the municipal activity and service and much more will be discussed. On the 13th of June the first workshop took place. It was a pilot meeting, in which the municipality wanted to see “...how is it going to work. And then we go and make it better and better and then we are going to have them in every neighborhood.” (Interview, *ibid*, 2019).

Use of existing networks, enthusiasts and well-known, trusted and respected people in the neighborhood:

In Amsterdam-West, the municipality was struggling with additional placement (placing garbage bags next to the container instead of inside it) leading to streets littering and with general resistance against the municipality and its initiatives. The municipality, using the services of D&B, came up with a solution of passing the message through a semi-campaign, using Virgil on the posters on the garbage trucks. Virgil is very-well known, respected and trusted by the citizens of the neighborhood. He is an employee in the waste collection department in the municipality, collecting waste also in Amsterdam-West. The respect Virgil showed for his job and his friendliness motivated the citizens in the area to handle their waste in a better way to help Virgil with his duty (Interview, Behavior Psychologist, D&B, 2019). Other examples of enthusiasts and respected people involvement were mentioned previously in this chapter (bread-digester project) and under the “Enable” instrument (bread bins project).

Media campaigns and door-to-door interventions:

Campaigns are used nationally as well as locally, and if done correctly, can be effective (Interviews, Waste and Circularity Advisor, Rijkswaterstaat, 2019; Trainee, PA, NVRD, 2019).

An example of a successful campaign the municipality of Amsterdam conducted was the campaign for food separation in Java island. Its slogan was “Java neighborhood is being first to do it” (free translation by the Behavior Psychologist, D&B, 2019), making it “...a collective “let’s do this”. We versus I.” (Interview, *ibid*, 2019). Besides the campaign, the project was initiated by door-to-door explanations on the practical issues of the project, its goals and the contribution each household can make. A “welcome package” with a small bin for waste separation and a welcome letter were also provided (Interview, Strategic Advisor, Amsterdam, 2019).

Nevertheless, policy realization advisor of the city of Amsterdam claims that top-down initiated projects are less successful. Such projects require constant interventions to maintain the engagement of people. "...in the beginning it is very enthusiastic then it goes down a bit. Then we do an intervention to stimulate them again and it goes up... and it goes down... and it goes up... but then it goes down. So, it is a very long path to get it into the normal habit." (Interview, *ibid*, 2019).

Door-to-door intervention is also used in every neighborhood where the new uniform waste separation system is introduced, "...involving people to use it and to use it correctly." (Interview, Advisor CE, Amsterdam, 2019).

Future developments:

Future planned campaigns are: a uniform wide national campaign alongside various small locally modified campaigns promoting circular behavior (Interview, Trainee, PA, NVRD, 2019); national campaign on secondhand purchasing (Interview, Senior Behavioral Expert, IenW, 2019); more national campaigns on food waste and smart food purchasing in which the city of Amsterdam is planning to take part (Municipality of Amsterdam, 2016).

Strategic advisor of the city of Amsterdam believes that when more data will be available (as mentioned under future developments of the "Enable" tool), engaging could be done more easily through different kinds of gaming and competitions between neighborhoods. The competition will include showing a neighborhood how well are they doing on waste separation or reduction compared to other neighborhoods, encouraging participation and discussion (Interview, *ibid*, 2019).

Encourage: (Reward schemes, feedback, financial and other means to encourage wanted behavior)

The encouragement instrument is not used much by the city of Amsterdam or its partners, or as strategic advisor of the city of Amsterdam puts it: "... for many people there is no incentive to sort waste. So, either financially or morally there is not really an incentive." (Interview, *ibid*, 2019).

Reward schemes:

The prominent example municipality representatives gave for a reward scheme was the municipality's cooperation with WASTED. WASTED launched a project in Amsterdam-Noord encouraging the wanted behavior of waste separation. For every garbage bag of separated waste (plastics, glass, etc.), residents would get a digital coin which s/he can then use to get discounts or free products in local businesses (Interview, Policy Realization Advisor, Amsterdam, 2019; WASTED, 2019). At the end of March 2019, a pilot project with similar idea, also with cooperation with WASTED was launched in the Pijp. This time the digital coins are granted for waste that do not have a separate collection stream - small bulky waste as irons, pots, cooking oil, toys from hard plastic and much more. The waste can be delivered to a container that is placed in 2 different locations in the neighborhood, once a week in each of them, from 15 to 19. The container is

operated by 2 representatives of the municipality that involve and inform the local citizens. The container is not permanent and could be moved to other locations. If the pilot proves successful, after optimization, the concept will be expanded to additional locations around the city (Interview, Advisor CE, Amsterdam, 2019; WASTED, 2019).

Feedback:

Not much examples for group work, feedback or social pressure where found either. The municipality sees the importance of these and tries to give direct feedback to all the area-oriented customization projects (Municipality of Amsterdam, 2016). For example, in the project of the bins for bread collection, the community is always informed on what is done with the bread and the amount of bread collected, providing them with feedback on their performance and information on whether the trend is growing stronger or weaker (Interview, Policy Realization Advisor, Amsterdam, 2019). A feedback is also presented on a board in the container for small bulky waste in the Pijp, stating which kinds of waste and how much was collected in the week before (Interview, Advisor CE, Amsterdam, 2019).

The municipality also strives to monitor and give feedback on waste separation per neighborhood, but for now this is not yet happening (Municipality of Amsterdam, 2016). Strategic advisor of the city of Amsterdam also has some future ideas in the area of group work, feedback and social pressure in shape of competition between neighborhoods, already elaborated upon under “Future Developments” under “Enable” and “Engage” instruments, but none of them are planned to be implemented in the near future (Interview, *ibid*, 2019).

Financial means to encourage wanted behavior:

A proven successful system of financial encouragement in the Netherlands is the DIFTAR or “pay-as-you-throw” system, in which, residents pay for their residual waste, charged by weight/volume/waste bag. Waste separation and reduction of the amount of the residual waste lowers the private household’s expenses – rewards wanted behavior. Among the proven benefits of the system are the reduction of municipal costs for waste processing, and encouragement of waste separation and waste prevention (Interviews, Trainee, PA, NVRD, 2019; Waste and Circularity Advisor, Rijkswaterstaat, 2019; Senior Behavioral Expert, IenW, 2019; Municipality of Amsterdam, 2016). Currently, the system is used by 165 municipalities. In order to encourage more municipalities to embrace the system, Rijkswaterstaat offers tools to promote the city’s council agreement and tools for the implementation of the system (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019). A discussion on the possibility of adopting the system in the city of Amsterdam is a long-going one – the obstacles, opportunities, benefits and costs of the system implementation were already discussed in the policy paper “Waste Plan, Resources from Amsterdam” (Municipality of Amsterdam, 2016). It is a hot political issue, but the present municipality does not think that the system is suitable for a big, diverse and frequently visited by a large number of tourists’ city, as Amsterdam (Interview, Advisor CE, Amsterdam, 2019).

Other means to encourage wanted behavior:

Another two successful system to decrease the amount of residual waste on a municipal level are the use of waste collection centers at a neighborhood level and lowering the frequency of

collection of residual waste from single family homes. The later forces the private households to find storage solution for the amounts of their residual waste if those exceed the size of a standard bin and causes the private households to realize the amount of waste produced by them. This results in a significant decrease in the amount of residual waste per household. In the waste collection centers at a neighborhood level system, no bins for residual waste are available on the streets at all. In order to discard one's waste, one must visit the waste collection center, usually located underground. These centers are spread at a neighborhood level, being not too far but also not conveniently close to the residents' houses, causing them to separate their waste better, use the curbside collection recycling bins and reduce the amount of the residual which they must transport to the waste collection centers. Amsterdam does not use any of the two systems (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019).

Exemplify: (Leading by example and consistency in policies)

Leading by example:

All interviewees understood the importance of exemplifying - senior behavioral expert in IenW emphasizes that "...if you are starting to all the municipalities – “You have to try hard and to do the waste management! You have to try really hard! Come on, try!” - you have to have here in the ministry itself... it should look spotless. You want to show them “Look, we also separate our waste and we also try to minimize the general waste.”.” (Interview, *ibid*, 2019). Nevertheless, the organizations' examples were very limited and most of the time included only waste separation and only to some extent (Interviews, Program Developer, AMS, 2019; Strategic Advisor, The Board, 2019; Waste and Circularity Advisor, Rijkswaterstaat, 2019; Policy Realization Advisor, Amsterdam, 2019).

Most of the organizations used successful project or successful participants to set the leading example (Interviews, Program Developer, AMS, 2019; Strategic Advisor, The Board, 2019). Strategic advisor of the Board: “We always talk about (how) we have to show examples of the front runners in this area in order to inspire the rest of the pack to join”. The Board is even considering making the “exemplifying” “...almost like a condition – if you want to be a part of the Amsterdam Economic Board you have to show what steps you did as organization” (Interview, *ibid*, 2019). Some of the interviewees did not always understand the importance of leading by example themselves, as an organization – “...well it is a different level of authority and we cannot be an example for the municipalities. But the municipalities themselves can be for the citizens.” (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019).

The main obstacle for leading by example were named to be either economic constraints or the lack of ownership over the building in which the organization operates, limiting its possibilities of action (Interviews, Strategic Advisor, The Board, 2019; Program Developer, AMS, 2019; Senior Behavioral Expert, IenW, 2019). Program developer in AMS: “...we live on money from citizens also, so we have to explain what we do. So of course, you cannot spend a lot of money on things that are not necessary. But examples are necessary I think so... we spent money on it sometimes” (Interview, *ibid*, 2019).

Trainee, PA, in NVRD believes that municipalities indeed see example setting as one of their roles as the local government. They are willing to do some changes and investments even if these are expensive (Interview, *ibid*, 2019). The municipality of Amsterdam, for example, has a waste collection vehicle running on renewable energy (Interviews, Trainee, PA, NVRD, 2019; Advisor CE, Amsterdam, 2019). Nevertheless, the municipality is not going to meet its own goal set in the “Waste Plan, Resources from Amsterdam” - 75% waste separation by 2020 within the organization (which is 10% higher than the separation percentage goal set for the citizens) (Municipality of Amsterdam, 2016). Municipal employees feel more can be done – “I think is really important but it is so difficult because we are big organization and our garbage man who collects it, they have a big story of re-organization... we asked them to be ambassadors and they say “Well, no”.” (Interview, Policy Realization Advisor, Amsterdam, 2019); “...you are telling the people that you have to sort waste and be careful with it, and you can see here there is no waste sorting facility. So that is a bit ambiguous. Not very good.” (Interview, Strategic Advisor, Amsterdam, 2019); “...we are not very good in giving the right example. I find it not good, but it is politically hard, and it is complex...” (Interview, Advisor CE, Amsterdam, 2019). But advisor CE of the city of Amsterdam believes the municipality is improving – “We want all cars to be climate neutral, we want (in) every department waste separation. All kinds of things. And that is coming now... we were behind, but we are now coming to be quicker.” (Interview, *ibid*, 2019).

Consistency in policies:

As waste management is done on a municipal level, the national waste management system is not consistent in its messages to the public – different municipalities collect different waste stream, use different strategies, different bins and different colors for the bins (Interviews, Waste and Circularity Advisor, Rijkswaterstaat, 2019; Behavioral Psychologist, D&B, 2019). And although “To unify all the ideas in all of the country would be better. So be consistent in use of colors and icons” (Interview, Behavioral Psychologist, D&B, 2019), it does not seem that national standardization is on its way.

As mentioned previously, Amsterdam made a significant step in unifying its waste management system under one policy for all the 7 districts. Nevertheless, due to the Waste Act distinguishing between the responsibilities over household and commercial waste, the uniform system exists only for household waste, and waste separation is still missing in offices, sport center and even on the streets. “...it is very strange of course for children not to separate the waste in school (while) they should do it at home.” (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019). The municipality see this situation as very problematic and lobbies the national government for changing the law and include the commercial waste under the municipality’s responsibilities. The municipality indeed achieved an approval to conduct an experiment of joint waste collection and management in the area of the nine-streets (Interview, Advisor CE, Amsterdam, 2019).

Also, although the “Waste Plan, Resources from Amsterdam” clearly states that “All municipal expressions must carry out one coherent message.” (Municipality of Amsterdam, 2016, p.38, personal translation), policy realization advisor of the city of Amsterdam explains that different messages are sent to the citizens. Sometimes the message is that waste separation into 5 bins is the wanted behavior; some messages include the importance of food separation; others

encourage to consume less new products, etc. (Interview, *ibid*, 2019). Policy realization advisor of the city of Amsterdam believes this happens due to the municipality's attempt to balance between the harmonization of the whole system and between area-oriented customization. Each group of Amsterdam residents is differently engaged and active in the area of circularity and hence, at this point, striving to engage all the citizens in Amsterdam, there cannot be just one message. The message should be customized to the group it is targeting (Interview, *ibid*, 2019).

Enforce: (Voluntary agreements, legislation, penalties and fines)

Enforcement on the national level:

The working culture in the Netherlands is based on discussion, communication, negotiation and finding mutual solution. And although "...legislation and regulation... (are) seen as a really important thing in CE" (Interview, Senior Behavioral Expert, *lenW*, 2019), the preferred way of working in the Netherlands is through voluntary agreements, based of mutual trust and willingness, whereas legislation and regulation are used to a significantly smaller extent (Interviews, Waste and Circularity Advisor, Rijkswaterstaat, 2019; Senior Behavioral Expert, *lenW*, 2019). This is also the reason no national standardization for waste management exists - "...there are not really hard rules from the government that the municipalities are obliged to reach. It is kind of a soft policy goals. And every municipality in the Netherlands has quite a lot of autonomy, so they decide what they are going to do and how they are going to do that" (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019).

Most of the time these agreements are successful as "...it is always with the same mission with the same goals. So, it is more intrinsic agreements." (Interview, Program Developer, AMS, 2019); "...what works for us, with the circular procurement it worked - we bring together those governments, we basically put them on a podium, they sign this commitment to be more circular..." (Interview, Strategic Advisor, The Board, 2019); "...if it is clear that the law is not going to change, but we do want a solution and that is where we are heading, it is getting better the solutions. Because everybody wants... at the end, everybody wants to solve the problem in such a way that is best for them. And if you are not prohibiting anything so they work together." (Interview, Senior Behavioral Expert, *lenW*, 2019).

Thus, all the waste policy goals such as 100kg p.p.p.y and 75% waste separation, are soft policies, based on voluntary agreements between the municipalities, the ministry and other stakeholders involved, like the NVRD for example (Interview, Senior Behavioral Expert, *lenW*, 2019). And that, in the eyes of senior behavioral expert in *lenW*, what enables the sense of partnership and mutual work towards mutual goal, flexibility and constant dialog: "...as a ministry you have the role or the possibility to dive in these problems and to see if you can find a solution for all them... We have 300 municipalities, if 60 have the same problem and they all trying to figure out a solution, that is would be not logical. So, there you do not want them simply to just stick to it and just do what you agreed on. You want them to come back and say "yeah, but we thought, but it doesn't work. We have to change it". That possibility has to be there." (Interview, *ibid*, 2019).

Voluntary agreements are treated very seriously by all parties – local governments but also private companies and even the national government itself. A designated team in the circularity department in IenW is working on the changes and preparations required for the implementation of the upcoming EU directive banning the use of single-use-plastics. Although a directive, in the voluntary agreements working culture, the national government sees itself as a part of this mutual agreement and strives to implement the Directive as fast as possible “The Dutch point of view is that it (EU directive) has the weight of a law.” (Senior Policy Officer, IenW, 2019).

Yet, if an agreement is not followed, usually no consequences, penalties or fines are in place – “But we do not really know yet how we will do it with the once that signed the commitment and they are not doing anything.” (Interview, Strategic Advisor, The Board, 2019); “...there are not really tough measures if they (the municipalities) do not reach the goals.” (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019).

Although the general agreement is that voluntary agreements are the preferred way of working, some interviewees expressed their difficulties with this working culture – AEB’s business developer believes that the Netherlands becoming fully circular by 2050 – “...can only be done with measures from the government. CO₂ taxes, more grants for projects. Otherwise it will not work.” (Interview, *ibid*, 2019). These perceptions also exist in the highest levels, among employees of IenW - senior behavioral expert in IenW, although much more inclined towards the existing working culture, admits that “Maybe we have a bit too many voluntary agreements on some things.”. And that maybe in the future, in certain situations, if a real change is really wanted, the national level just has to enforce rules (Interview, *ibid*, 2019). Waste and circularity advisor in Rijkswaterstaat more boldly emphasized his ideas - he thinks that municipalities get too much freedom sometimes; that he would prefer to have standardization and more powerful tools to put some hard pressure on the municipalities, to make them responsible for achieving the goals (Interview, *ibid*, 2019). Policy realization advisor of the city of Amsterdam thinks that enforcement on the national level is what delaying the faster transition towards circular economy – “...And I think that the government has a big big big role to get there, to the point. And to make a fist and say “No more! It is finished. No more!”. I hope they will take it.” (Interview, *ibid*, 2019). Senior behavioral expert in IenW believes that even if the government indeed chooses to use more enforcement – legislation is not a quick nor an easy solution - to pass a new law takes around 2 years, some hard decisions on its content and implementation options will have to be made. After passing it, enforcement will have to be in place, otherwise it will not work (Interview, *ibid*, 2019).

Enforcement on the local level:

As the representatives of the municipality of Amsterdam do not think the national legislation is strong enough or goes fast enough, and because they have less authorities than the national government, the municipality is constantly lobbying the national level. They are striving to promote tighter cooperation with the private market on issues like textile and clothing production; to change the law specifying which actions can be financed by waste-tax money, in order to promote also prevention and reuse initiatives with this money; to unify the responsibilities over household and commercial waste and much more (Interview, Advisor CE, Amsterdam, 2019).

Nevertheless, some interviewees believe that enforcement should be applied more often also on the local level. Waste and circularity advisor in Rijkswaterstaat believe that enforcement is one of the tools that municipalities themselves out to use if they want to make bigger and faster progress (Interview, *ibid*, 2019). Policy realization advisor of the city of Amsterdam also expressed her wishes for more enforcement, which in her opinion, will serve two goals – enforcing the people who are not willing to contribute to the city’s goals and gaining more trust among the citizens that already express the wanted behavior (Interview, *ibid*, 2019). Strategic advisor of the city of Amsterdam has similar ideas to the ones held by the senior behavioral expert in IenW - he believes that the first step should be voluntary agreements, and if these do not work, regulations should be enforced – “And then I am also pretty sure that if these kinds of companies are aware of the damage that they are making to the world they are also... open to change... And if they are not the ones that are open to change, then we need to go to the European or the national law to create there a legislation to decrease the amount of cloths for example” (Interview, *ibid*, 2019). Advisor CE of the city of Amsterdam believes that enforcement is a much more influential instrument than “Enable” or “Engage” but the local authority is relatively limited in this area. She also thinks that the municipality should be very careful in applying enforcement. That is why, before transforming the law on the mailbox sticker (elaboration upon follows under the “Legislation” section), she tried first to address the problem through an agreement with the private market “...but they did not want to work with us. So, we did it ourselves.” (Interview, *ibid*, 2019). However, her concerns were verified when the municipality got sued by the private market for using the waste-tax money to fund this project. According to the private market claim, the use of the money was done in contrary to the legitimate spending of the waste-taxes, as it is defined by the law. “So, the major of the politician are very careful and I understand (them).” (Interview, *ibid*, 2019).

Although the waste management system was unified, the enforcement of it in Amsterdam is still done on a district level. Each year, the municipality of Amsterdam chooses the areas in which it wants to promote more enforcement, and these are introduced in the Urban Enforcement Program. In 2016 for example, 19 issues were chosen out of 250, waste being one of them. Later, each district writes its own Enforcement Implementation Program on the chosen issues, in which it decides on the frequency and the ways of enforcement (Municipality of Amsterdam, 2016). So, although the operation in 7 districts was seen inefficient and although the waste management system and the provision of information were unified, the enforcement stayed divided between the 7 districts.

Voluntary agreement:

The municipality works a lot with voluntary agreements, but this tool is less relevant working with private households. Only one related example was found – the municipality is working on a local climate voluntary agreement dealing with climate neutrality, partly including circularity. When finished, all interested parties will be able to sign the agreement – governmental representatives, private companies and also citizens (Interview, Advisor CE, Amsterdam, 2019).

Legislation:

Amsterdam promoted a local legislation that reverses the usual custom of the mailbox stickers in the Netherlands. Around the Netherlands, advertising and information leaflets are distributed to all mailboxes, unless a mailbox has a sticker saying “Nee, Nee” – no to advertising and no to information leaflets. The city of Amsterdam turned the local law around stating that advertising and information leaflets can be only distributed to mailboxes having a “Ja Ja” sticker - actively saying “yes” to advertising and information leaflets. If there is no sticker on the door, the delivery workers are not allowed to put advertising and information leaflets inside the box (Interviews, Strategic Advisor and Advisor CE, Amsterdam, 2019). The purpose of this project was to prevent waste by significantly decreasing the amount of discarded paper. Additional to the legislation, a website was launched, where - “...you can make a complaint (about violating companies). And based on the complaints you do enforce and penalties.” (Interview, Advisor CE, Amsterdam, 2019).

According to the strategic advisor of the city of Amsterdam, as the national level has been debating for almost 20 years on the subject of the “return services” – getting a small amount of money for bringing bottles back to the super markets (Interviews, Trainee, PA, NVRD, 2019; Waste and Circularity Advisor, Rijkswaterstaat 2019), the municipality of Amsterdam is now examining the option of enforcing the law on the local level, preceding the national government (Interview, Strategic Advisor, Amsterdam, 2019).

Penalties and fines:

The municipality fines for additional placement – putting garbage next to the bins instead of inside them, and littering (Interviews, Advisor CE and Policy Realization Advisor, Amsterdam, 2019; Municipality of Amsterdam, 2016). Policy realization advisor in the city of Amsterdam states that it is not easy to do but it achieves the wanted results (Interview, *ibid*, 2019).

There is an enforcement instrument, proved to work well at a municipal level the Netherlands, used to enforce the quality of waste separation. Through the system, yellow and red cards are sent as warnings to households with low quality waste separation, and if the behavior continues, the violators are fined. Rijkswaterstaat is providing guiding and technological tools (scanning containers for example) for implementation of such a system (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019). But the municipality of Amsterdam does not use this system.

5Es framework:

Generally, there is wide agreement and understanding that in order to achieve real behavioral change, all 5 instruments must be used – “...you need them all. Because you have a lot of different types of people, so you need them all. (...) if one of those factors is zero, there will be no behavior (change).” (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019). Senior behavioral expert in IenW also agrees that the 5E’s framework covers all the possible options to change individuals’ behavior and states that the ministry uses them all (Interview, *ibid*, 2019). Strategic advisor of the city of Amsterdam states that the whole waste management team in the

municipality promotes all these 5 tools together, while different colleagues of his focus on different tools – “If you are only focusing on 4 out of the 5 components then you are sure out of luck. You are not doing to do it. You need to have 5 components of it.” (Interview, *ibid*, 2019). This perception was already existent in the city’s first waste management policy - “Waste Plan, Resources from Amsterdam” – “Behavioral change is sometimes mistakenly seen as a stand-alone project or as a measure that exists among other measures. Behavior change is, however, the sum of the effect of all affected measures.” (Municipality of Amsterdam, 2016, p. 39, personal translation).

Additional results:

As was stated in the chapter on instruments used to promote individuals’ behavioral change, besides the 5E instruments, attention was also given to goals setting according to the state of environmental assessment, the interdisciplinary and cross-governmental collaboration in the implementation phase of the initiatives and the use of indicators to measure the success of initiatives and taken by the municipality and its partners in order to change the private households’ waste management into a more circular one. The results are presented below. Additional results found will be stated shortly at the end.

Goals setting:

In most cases, there is separation between the goals on circularity and the goals on waste management. The goals in both areas are very ambitious, set while knowing that they will not be met by most of the participants. Some goals are set based on research: the optimal value creation for 14 material flows of the Board, where the flows were chosen based on a research meant to find the most high-impact material flows (Interview, Strategic Advisor, The Board, 2019; Amsterdam Economic Board, 2019c); the domains that the municipality of Amsterdam chose to focus on in their circularity transition after conducting an in-depth research on the potential inherent in a CE (Circle Economy et al., 2015; Interview, Advisor CE, Municipality, 2019; Municipality of Amsterdam, 2019a and 2019b). Others set based on already existing examples, proving the goals to be feasible. One such example is the 100kg residual waste p.p.p.y and 75% of waste separation (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019). No assessment of the environmental state, neither at a national nor at a local level, were conducted.

The goals on circularity are usually more general, with no hard indicators, and are promoted by a series of individual projects. “...our ambition is to become the most sustainable company in the world. (...) we do not have specific numbers and goals at this moment for the coming years, but we do have as I said, a pipeline of projects. Around 20 initiatives on which we work on to get this company more circular (...)” (Interview, Business Developer, AEB, 2019); “By 2025, the Amsterdam Area aims to be a frontrunner in the field of smart solutions for resource conservation, so valuable resources will be used more efficiently and for longer.” (Amsterdam Economic Board, 2019b). IenW did set specific goals in its “Circular Economy Implementation Plan 2019-2023” for the different domains it promotes in its transition to CE (IenW, 2019; Interview, Senior Behavioral Expert, IenW).

The goals on waste management are usually more uniform, widely coordinated and agreed upon, but they mainly include the improvement of the already existing waste management system. The present goals are 75% of waste separation and 100kg residual waste p.p.p.y in 2020 (Interviews, Trainee, PA, NVRD, 2019; Waste and Circularity Advisor, Rijkswaterstaat, 2019; Senior Behavioral Expert, IenW, 2019; Advisor CE, Amsterdam, 2019). Assuming that 100kg residual waste p.p.p.y can be achieved only through better waste separation and waste prevention, the goals are thought to also promote circularity (Interview, Advisor CE, Amsterdam, 2019). It becomes truly inevitable when aiming at the goal for the year of 2030 - 30kg residual waste p.p.p.y (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019). Nevertheless, no goals directly aiming at the promotion of the higher levels of the circular waste management hierarchy are visible yet.

Although being very independent in the domain of waste management, the municipality of Amsterdam adopted all the national goals. In the domain of circularity it adopted the final general goal of becoming fully circular by 2050, but on the way of getting there the municipality sets its own goals in accordance with the in-depth research on the potential inherent in CE it conducted (Circle Economy et al., 2015; Interview, Advisor CE, Municipality, 2019; Municipality of Amsterdam, 2019a and 2019b).

Interdisciplinary and cross-governmental collaboration in the implementation phase:

As mentioned before, the Dutch working system is based very much on discussion, debate, mutual agreement and finding widely agreed upon solutions. This way of operation is often seen more effective than top-down enforcement. Thus, the interdisciplinary and cross-governmental collaboration are seen as essential and are present through all stages, from knowledge sharing, to goals setting, through the implementation to the evaluation and conclusion drawing phase. The stakeholders vary for each project, but all organizations strive to get all the relevant stakeholders involved, including political parties, knowledge institutes, private market, NGOs and even various representatives of the citizens (Interview, Senior Behavioral Expert, IenW, 2019). In fact, the main purpose of some of the organization interviewed for this thesis, such as NVRD, the Board and partly Rijkswaterstaat, is to create a platform for knowledge and implementation techniques sharing and promotion of interdisciplinary mutual agreements (Interviews, Strategic Advisor, The Board, 2019; Trainee, PA, NVRD, 2019; Waste and Circularity Advisor, Rijkswaterstaat, 2019).

The municipality of Amsterdam involves a lot of stakeholders in its goals setting and projects implementation. It cooperates with the different departments in the municipality, with knowledge institutes, with the national level, participates in different cooperation platforms and strives to involve even the citizens (Interview, Advisor CE, Amsterdam, 2019). When implementing a project, the municipality often publishes a tender searching for a private company to help it with the implementation process and sets specific team for each specific project. The team includes representatives from all the relevant departments in the municipality, making sure that all departments will have equal interest in promoting the project. The private company to win the municipality's tender is also part of the municipal team, and the analysis, choices and advices are shaped together (Interview, Behavioral Psychologist, B&D, 2019). In general, behavioral psychologist in B&D states that the municipality of Amsterdam is very

cooperative so that even if the final advices require more means than was initially estimated, the municipality will still try to comply with the company advices (Interview, *ibid*, 2019).

Due to the size and internal complexity, the municipality of Amsterdam uses a few methods within its structural organization to avoid internal conflicts and promote municipality's internal cooperation. One of the methods is the innovation team. Each member of the innovation team is a member of a different department. In this way, the innovation team is crosscutting the different municipal departments (Interview, Program Developer, AMS, 2019). There are also specific employees working for 2 departments simultaneously. Advisor CE of the city of Amsterdam is one of them - she works in the department of waste and resources management and in the department of environmental policy, strengthening the cooperation between the two departments (Interview, *ibid*, 2019). Another method of the municipality is the chief science officer, who has a budget of hours that can be devoted for research. These hours can be divided between the different departments, depending on the needs of a specific project or research (Interview, Program Developer, AMS, 2019). These two methods promote internal municipal cooperation, which is crucial in the opinion of the strategic advisor of the city of Amsterdam. He states that each department have different ambitions, and without a conversation and coordination, some of them might be left out (Interview, *ibid*, 2019). But it also facilitates the communication of other organization with the municipality. Through the crosscutting team and employees, the relevant people can be found more easily, and the budget of hours allows to promote projects that were not thought of at the beginning of a year (Interview, Program Developer, AMS, 2019).

Nevertheless, the complexity of the municipal structure and the need for cooperation between the various departments are usually the reason for the slow implementation processes (Interviews, Behavioral Psychologist, B&D, 2019; Policy Realization Advisor, Amsterdam, 2019) - "It's difficult to get stuff done." (Interview, Policy Realization Advisor, Amsterdam, 2019).

Evaluation and use of indicators:

There are no uniform, widely agreed upon indicators for circularity and the indicators used today for waste management are somewhat questioned.

AMS sees creating uniform evaluation models as one of its roles – "...at some stage every research project within CE sort of creates its own evaluation model. And even business side creates its evaluating model. But we also strive to bring those together." (Program Developer, AMS, 2019). Policy realization advisor of the city of Amsterdam believes it is hard to choose indicators because the idea of circularity is quite new in practice so most of the projects are at their very beginning, in the stage of a pilot. "... the weight of the garbage - is that an indicator? Is it the group of people who is enthusiastic? Is that a good indicator? We do not know it." (Interview, *ibid*, 2019). Thus, most of the organizations, including AMS itself, use per-project designed evaluation models which do not have strong circularity indicators (Interviews, Trainee, PA, NVRD, 2019; Policy Realization Advisor, Amsterdam, 2019; Program Developer, AMS, 2019). Other organization, like AEB do not measure their project from a circular point of view at all, even if those projects are meant to promote circularity (Interview, Business Developer, AEB, 2019).

Understanding this complexity, IenW dedicated a big part of their circular transition program to the development of a monitoring and evaluation system. The ministry hired 3 independent companies to set a clear monitoring protocol for its CE transition program, specifying indicators for each goal. These indicators were later approved by knowledge institutes. The 3 independent companies also monitor each goal every half a year to see whether progress was achieved in each field (Interview, Senior Behavioral Expert, IenW, 2019). Senior behavioral expert in IenW states that the decision on what indicators to use is a very hard one, especially at the beginning of a project or a program, because it is sometimes really hard to predict what will be all of its outcomes – “...you have to be a little bit inventive then, to see how to measure it and be most precise”. She also states that the ministry tries to have qualitative and quantitative indicators, but that the politicians and individuals are mainly interested in numbers - “It is all tax money. Everybody what is to know whether the tax money is well spent, if it is cost effective.” (Interview, *ibid*, 2019).

The indicators for waste management are thought to be more solid, clear and widely agreed upon (Interview, Senior Behavioral Expert, IenW, 2019). Nevertheless, trainee, PA in NVRD questions the existing evaluation system for waste management. Even if 80% of the waste was separated, it does not mean that all the 80% could be recycled. Also, he wonders “...what does it (the goal) say in term of circularity?”. It is hard to determine whether 75% of waste separation and 100kg of residual waste p.p.p.y is better than 60% waste separation but with 50kg residual waste p.p.p.y. The lack of uniform indicators and standards is preventing from determining which solution is more circular and whether circularity was accomplished (Interview, *ibid*, 2019). NVRD and IenW are now working also on developing qualitative measures for waste. Strategic advisor and advisor CE of the city of Amsterdam claim that the new municipal waste policy that will be published at the end of this year, will present better indicators for circular waste management evaluation. Indicators that no longer include just waste separation but focus also on waste upcycling, reuse, repair and more - numbers that reflect the ways in which things are managed after they have seemingly finished their lifecycle (Interview, *ibid*, 2019).

Additionally, the municipality of Amsterdam carries employee training on project-base working – how to set goals in advance and how to measure them. “...but this is in theory.” - states advisor CE of the city of Amsterdam - “We are not very good at it” (Interview, *ibid*, 2019). The municipality of Amsterdam has a measuring “triangle”, based on the sustainability concept – before a project is approved, the project manager is expected to estimate how will the project contribute to environmental improvement, economical aspect such as employment opportunities, and social aspect such as increase in the quality of citizen services (Interview, Advisor CE, Amsterdam, 2019; Municipality of Amsterdam, 2016). If estimated successful, the project is approved, and those aspects are measured after implementation. “But you know, like a real world, sometimes politician want something very quick and then you have to run, and you do not always have the time to do it very well thought through.” (Interview, Advisor CE, Amsterdam, 2019). In addition to the triangle, the municipality also measures the success of its projects through unique indicators for each project. Policy realization advisor of the city of Amsterdam sees a general obstacle in the existing evaluation system for municipal interventions – “...you have to connect something outside of the house to behavior inside the house. And that is difficult to do.”. The municipality cooperates with local groups in the city and with the other 3 big cities – The Hague,

Rotterdam and Utrecht, trying to understand what works better in order to choose the best indicators for circular projects evaluation, including circular waste management, in the future (Interview, *ibid*, 2019).

Additional results:

- Some organizations realize that the choice of very rigid goals or ways of operation towards CE holds the hazard of switching from one lock-in system to another. Thus, they are using more flexible goals, soft policies and limited enforcement. "... but we do not have a clear-cut strategy. It would not make sense. (...) I cannot make a road map that outlines exactly how will you do it. Because there are technical innovators coming in, there are a lot of context factors that influence it." (Interview, Strategic Advisor, The Board, 2019). "Waste Plan, Resources from Amsterdam" also states that "Flexibility and adaptability are important, so that collection and processing can respond to new flows..." (Municipality of Amsterdam, 2016, p.9, personal translation). CE implementation requires continuous learning, improvement and adaptation (Municipality of Amsterdam, 2016), thus, the municipality sets its pilots for short periods of time – 2-3 years. "We said let's do it short because it is a new topic and it is very much moving and developing." (Interview, Advisor CE, Amsterdam, 2019).
- The transition towards CE is lead mainly by economic considerations (Interview, Program Developer, AMS, 2019). Today the value of a project is estimated in terms of financial profit (Interviews, Trainee, PA, NVRD, 2019; Strategic Advisor, Amsterdam, 2019; Business Developer, AEB, 2019), but most interviewees agreed that environmental measure should be also taken into account – "...we should think that circular indicators are as important as GDP" (Interview, Strategic Advisor, Amsterdam, 2019), "Because if that would be the case, then the system would work pretty differently" (Interview, Trainee, PA, NVRD, 2019).
- One of the main reasons for the slow progress towards CE are political constrains at both levels, the national and the local one. Politicians are responsible for decision-making, laws and financial policies promotion and agenda priorities. But they are chosen for a short period of time and facing problems, most of the time, the different parties cannot agree on one solution. Thus, politicians prefer to avoid radical changes, causing frictions with the citizens or the private market, and long-term solutions, the benefits of which will be seen only after their terms-of-office will be over. Thus, CE is mainly promoted through slow incremental change (Interviews, Trainee, PA, NVRD, 2019; Waste and Circularity Advisor, Rijkswaterstaat, 2019; Advisor CE, Amsterdam, 2019; Senior Behavioral Expert, IenW, 2019).

7. Analysis and Conclusions:

This chapter will start with a brief introduction of Amsterdam's achievement in the areas of CE and circular waste management, followed by analysis of the municipality's and its partners' activities along the 5Es instruments theoretical framework. Later, evaluation of the city's transition process from the existing socio-technical waste management system into a more circular one will be presented, including elaboration on the city's delaying factors. Lastly, Amsterdam significant progress in the last four year will be presented followed by overall conclusions of the research.

The municipality of Amsterdam is indeed a front runner in the domain of circular economy on a national and even international level. It sets ambitious goals for itself and its partners and adopts the ones offered by the national government. The municipality's activity in the domain is backed up by the national government and supported by the other 3 big cities in the Netherlands – the Hague, Utrecht and Rotterdam. Amsterdam has a budget and a working team specifically designated to the promotion of the transition. It conducts various experiments and pilot projects trying to find the best ways to implement circularity in practice. It develops specific policies for the value chains that were identified as having the biggest potential of being influenced by the local government in the transition towards CE. Understanding the interdisciplinarity of the CE concept, the municipality strives to involve all relevant stakeholders. It takes part in national campaigns promoting circularity; funds the AMS institute; cooperates with knowledge institutes; facilitates social and bottom-up initiatives promoting CE; takes part in various knowledge exchange and collaboration platforms at regional and national levels; etc.

In the domain of waste, Amsterdam is one of the leaders in circular waste management. Striving to achieve the national goals, the municipality works in close cooperation with AEB, its waste management company. Being AEB's 100% shareholder, the municipality has considerable influence on the city's waste management, striving to convert the company's operation to as circular as possible. Under the waste and resources department in the municipality, a large team is working on community building and citizens involvement, promoting circularity through the different life-styles of the various groups of Amsterdam citizens; a team working on promoting advanced innovative technological developments to enhance circularity in the waste management system; and even a single-person team focusing on waste prevention. The municipality is lobbying the national government to promote circular subjects and change restrictive laws. When discussing circular waste management, some organizations interviewed for this thesis focused on waste separation and recycling. Different consumption patterns, maintenance or repair of products were seen as part of CE but not as a part of the waste management domain. The municipality of Amsterdam, however, has a developed vision of the circular waste management, which includes the highest levels of the circular waste management hierarchy – prevention and reuse. Pendeuille et al. (2018) also found that Amsterdam's policy makers have a nuanced vision of the concept, understanding its complexity and adopting a cross-sectoral interpretation. The cross-sectoral approach is evident also in the organizational structure of the municipality – the innovation team of the municipality is compound from representatives of different departments and some employees in the municipality work for two departments at the same time, facilitating better communication and cooperation between the departments (for

example, advisor CE of the city of Amsterdam working for the waste and resources department and for the environmental policy department simultaneously).

The understanding that in order to change the waste management system into a more circular one, among others, the waste management behavior of private households have to be changed, is common at the governmental level in the Netherlands, but also at the local level in Amsterdam. As the instruments the local government and its partners use to change the private households' waste management behavior was the subject of this thesis, elaborated analysis of the findings in this area is presented below.

Analysis of the use of the 5Es instruments:

Behavioral change became an important component in the Dutch policy setting and transition agendas' implementation. Each ministry in the Netherlands has its own "Behavioral Insights Team", focusing on the needed behavioral change for the relevant domains in the ministries' activities (Interviews, Behavior Psychologist, D&B, 2019; Senior Behavioral Expert, IenW, 2019). Besides the BIT, IenW's executive organization, Rijkswaterstaat, is also promoting behavioral change specifically in the domain of waste, encouraging the municipalities to change their own behavior but also to promote behavioral change among their citizens (Interviews, Waste and Circularity Advisor, Rijkswaterstaat, 2019; Senior Behavioral Expert, IenW, 2019). The change is promoted through the use of "Behavioral Change Wheel", which is compounded of three main groups of interventions - Ability, Motivation and Opportunity, quite closely comparable with the 5Es framework used in this thesis.

The employees of the municipality of Amsterdam, who work in close cooperation with Rijkswaterstaat's team (Interview, Strategic Advisor, Amsterdam, 2019), are generally aware of the BCW, striving to use its different tools as often as possible and find it generally helpful (Interviews, Strategic Advisor and Policy Realization Advisor, Amsterdam, 2019). Therefore, in its overall activities, the municipality of Amsterdam uses all the 5E instruments – Enable, Engage, Encourage, Exemplify and Enforce. Prendeville et al. (2018) got to similar conclusion, stating that in its activities, the municipality covers the different principals offered by EMF in its "Toolkit for Policy Makers", which was also used to form the 5Es framework for this thesis. Nevertheless, although the strategic advisor of the city of Amsterdam thinks that "...in all these things the city-hall should work on with the same energy" (Interview ibid, 2019), major differences can be seen in the municipality's use of the different instruments. "Enabling" and "engaging" instruments get most of the focus in the municipal activities. "Enforce" and "exemplify" activities are quite limited and the "encourage" instrument is used only scarcely.

As the use of some instruments is intertwined and hard to distinguish, especially between the "engage" and "enable" instruments, the analysis might partially overlap.

Engage: The municipality has defined a goal to involve all citizens in the city's transition towards CE - it invests a lot of time, effort and budget to reach all its citizens. It created illustrated guidelines on waste separation for illiterate people; it performs neighborhood-by-neighborhood interventions; it is developing a structural way of involving citizens using the "doughnut workshops"; and it creates un-formal communication channel, with citizens that do not

participate through the formal channels, in order to help them to connect to the concept of CE from their unique lifestyle.

Enable: The municipality puts a lot of effort into infrastructure and facilities provision. It is done through two main channels – providing the municipal uniform system on the one hand and providing area-oriented customizations of the system on the other. The area-oriented customizations supply unique suitable infrastructure for the different communities in Amsterdam, needing help to connect to the concept of CE from their own way of living. This combination is quite complex, and it seems that alongside the mutual enhancement, the two approaches also inhibit each other. On the one hand, endeavoring to provide a uniform system the municipality limits the variety of the area-oriented customizations – one of the conclusion drawn by Rietveld & Lie (2018) from the evaluation of the implementation of the bio-digester in Wildermanbuurt neighborhood was - “The choice for bio-fermentation at the neighborhood level does not seem to fit well in the current approach of central waste separation at city level.” (p.5, personal translation). Yet, on the other hand, systems such as pay-as-you-throw or systems enforcing the quality of waste separation are not implemented as the municipality believes that the variety of the different groups of citizens in the city is too big for such a uniform system to be successful (Interviews, Advisor CE and Policy Realization Advisor, Amsterdam, 2019). The municipality also invest a lot of means in education and information supply on circularity, waste management and circular waste management through various information platforms. Nevertheless, behavior psychologist of D&B claims that when dealing with information and communication, there are three main assumptions that almost always are not met: 1. “...people already know what they should do. And if they don’t know...”, it is assumed that 2. “...they will look for it”, and if they will look for it, it is assumed that 3. “...they will actually find it.” (Interview, *ibid*, 2019). The municipality of Amsterdam already recognizes that a lot of the citizens do not know what to do and strives to inform them through various platforms, but the information is still not accessible enough. For example, one of the initiatives aiming the higher levels of the circular waste management hierarchy mentioned by advisor CE of the city of Amsterdam was a guidebook on how to organize a give-and-take party for your neighbors (Interview, *ibid*, 2019). Although specifically looked for by the author of this thesis in the website of the municipality, the guidebook was not found. The same is true for the feedback board in the container for the small bulky waste in the Pijp informing the residents on the amount of waste collected, also mentioned by advisor CE of the city of Amsterdam (Interview, *ibid*, 2019). No initiatives promoting training or skills development were found.

Exemplify: All interviewees believe that “exemplify” instruments has a significant impact on individuals’ behavior, and while some organization did not see the importance in their own example setting, the municipality of Amsterdam is well aware of its responsibility to serve as a role model to its citizens. The city of Amsterdam owns a waste collection vehicle operating fully on renewable energy and waste separation is available in some of the municipality’s buildings, but these initiatives are quite limited. Municipality’s employees believe that more can be done even within the existing financial and bureaucratic constrains. Amsterdam also strives to be consistent in its policies, but the lack of consistency in waste management at the national level combined with the divided responsibilities over the household and commercial waste, pose obstacles on the overall consistency of the waste management system. The main municipal

message in the domain of household waste is waste separation. Yet, due to the municipality's attempt to reach all the different groups and citizens of the city, the message is been customized in accordance with the targeted group, to contain more progressive or more basic goals.

Encourage: The municipality uses the “encourage” instrument in a very limited number of projects the success of which was hard to evaluate, thus decisions on scaling up these projects were never made (Interview, Policy Realization Advisor, Amsterdam, 2019). Darton et al. (2006) and Salvia et al. (2015) state that rules eliminating or restricting individuals' choices through taxes, fees or levies on specific products are usually taken on a national level and are relatively rare due to their intrusive nature and implementation and enforcement cost. Thus, the scope of the initiatives the municipality can promote, using the “encourage” instrument at a local level is indeed limited. However, even the at-local-level-encouragement-systems (such as pay-as-you-throw or waste collection centers at a neighborhood level), although proven to be effective in reducing the amount of residual waste, are not implemented by the municipality. Moreover, the municipality lowered the municipal waste-taxes in 2015 and then again in 2016, “rewarding” citizen, although no change in the waste management behaviour was identified.

Enforce: The enforcement instrument is the most debated one. The current working culture in the Netherlands is based on mutual agreements and solutions. Most of the activity is focusing on soft policies and voluntary agreements, based on mutual goals setting, commitment and trust. In most cases, this approach proves successful. Thus, legislation, fines and penalties, although proven equally successful, are rarely used. Failing to coop with an agreement has no clear implications. Thus, some interviewees believe that a tougher approach should be taken, an approach that will oblige the partakers to reach the decided upon goals. The municipality of Amsterdam also works mainly through voluntary agreements, but this tool is very rarely relevant for private households. The municipality makes use of its local authorities promoting local legislation, policies and fines to reduce the amount of waste and littering. Yet, the initiatives using this instrument are relatively limited. For example, the municipality does not utilize its enforcement authorities to improve the quality of waste separation through a well-proven system of yellow and red cards serving as warnings, followed by fining if the violating behavior continues.

Using these 5E instruments, the municipality promotes a wide range of initiatives facilitating the private households to manage their waste in a more circular way. Some examples of such initiatives are - bulky waste collection by secondhand stores; reversed legislation on the mailbox stickers, preventing significant amounts of paper waste; “exchange” corner in the container for small bulky waste in the Pijp neighborhood; clothing library; separate food waste collection, and others. The municipality's future projects include the conversion of the waste collection points into Urban Resource Centers, a place where one can repair one's items, use them to build new products or exchange them with other individuals; creation of an information platform in the domain of textile, providing the citizens with different statistics on the domain and specifying all the possible alternatives the city offers to buying new textiles; and others.

However, most of the municipality's efforts are invested in making the existing waste management system more efficient and widely applied than in promoting real transition towards circular waste management.

Stability and resistance to change of existing waste management system

CE is not yet a priority in the municipality's waste policy agenda. The municipality of Amsterdam's efforts are mainly focused on making the separation of waste at source, waste collection, post-collection separation, incineration and recycling options more efficient and more widely applied. No structural changes were made to the waste system; the activity continues along the existing paths and technical trajectories, promoting solutions in which the municipality and its partners have already vested interests and in which they are already locked-in. Thus, the change towards circular waste management is more incremental rather than a radical one.

Incineration - AEB, the waste management company of Amsterdam, defines its main goal as becoming the most sustainable waste management company in the world, and yet, when asked about their focus in the near future, AEB's business developer state that they "...need to improve the process of the energy from waste. That's our main focus at this moment." (Interview, *ibid*, 2019). AEB is proud to have one of the most energy efficient waste incinerators in the world, the only emission from which is CO₂. Nowadays, the company investigate the technical and economic feasibility to capture the CO₂ and providing it to greenhouse horticulture companies (AEB, 2019; Interview, Business Developer, AEB, 2019). AEB's business developer believes that in this way, incineration will actually contribute to circular economy by fully closing the loop – using the waste for heat, electricity and greenhouse horticulture (Interview, *ibid*, 2019). But the developed vision of CE refers to closing the loop as to keeping material available and using the products, or the resources they are consist of, for as long as possible, maximizing the value of the resources (Del Borghi et al., 2014; Kalmykova et al., 2018; Korhonen et al., 2018; Prendeville et al., 2018; Ritzén & Sandström, 2017), not to using them as a source of energy. And although the incineration process provides the city of Amsterdam with energy and heat, which otherwise would be produced thought the use of fossil fuels, the incineration process cannot be seen as producing neither green nor circular energy. AEB's business developer states that the city "...wants the incineration to run efficiently; it is dependent on the energy that comes from AEB; and it wants less waste going into incineration. So, we have to find a balance in these three." (Interview, *ibid*, 2019). And although AEB and the city of Amsterdam are discussing the possibility not to extended the operation of the old incinerator from 1993, it seems that, due to the significant financial investments already made, incineration will not be so quickly given up on in this search for balance - "Closing down a facility is really... well really, quite not an option." (Interview, Business Developer, AEB, 2019). The results of this discussion will be visible in the new strategy for 2020-2025 that AEB is working on these days, but both, AEB's business developer and advisor CE in the city of Amsterdam believe that incineration will be in use for at least 10 to 20 more years from now (Interviews, *ibid*, 2019).

Waste Separation and Recycling - Policy realization advisor in the city of Amsterdam states that in promoting circular waste management, the municipality's main focus for the future is "...don't get garbage burned." (Interview, *ibid*, 2019). However, the main alternatives promoted by the municipality to incineration are waste separation at source and post-collection separation, seen as the main means to achieving higher rates of waste recycling. Recycling is yet another part of

the already existent system and only the third out of the 5 levels in the circular waste management hierarchy. Amsterdam's "Waste Plan, Resources from Amsterdam" (Municipality of Amsterdam, 2016), extensively reviews the 65% separation goal for 2020, while only half a page in the policy is dedicated to products' reuse and waste prevention. In the use of the 5E instruments, a significant effort of the municipal activities is focused on supplying infrastructure and facilities for waste separation, providing citizens with information and knowledge of the correct way to separate waste, engage them with their local separation system and encourage them to use it. It is also visible in the responsibilities' distribution in the waste and resources department – while there is a big team working on community building and engaging people with waste separation, only one person in the department is responsible for waste prevention. Also, when asked for examples for the use of the "exemplify" instrument, all interviewees talked about the bad waste separation infrastructure in the buildings. Nobody mentioned the furniture acquisition process, efforts to decrease the amount of acquired office supplies or initiatives to maintenance or repair electronic devices in the office. Although focusing on waste separation, the widely successful, more radical methods for reducing the amount of residual waste and increasing waste separation (such as the pay-as-you-throw system or the waste collection points at a neighborhood level) were never implemented in the city. Although being a hot political issue, the present assumption is that these systems cannot be successful in a big and diverse city as Amsterdam (Interview, Advisor, CE, Amsterdam, 2019). The city does not even use Rijkswaterstaat recommended method for ensuring the quality of waste separation, using yellow and red warning cards, followed by fines (Interview, Waste and Circularity Advisor, Rijkswaterstaat, 2019). Thus, although the tremendous emphasis on promoting waste separation, in 2014 Amsterdam achieved only 27% of waste separation (Municipality of Amsterdam, 2016. More up-to-date numbers could not be found). The actual recycling rates of these 27% of separately collected waste are unknown but assumed to be low as no system enforcing high quality waste separation is in place.

Nevertheless, the city of Amsterdam is not the only organization responsible for its slow progress towards circular waste management. Many delaying factors affect the city's activity.

CE transition - delaying factors:

The list of challenges delaying Amsterdam's process of transition towards CE is a long and diverse one. It includes the complexity of the internal structure of the IenW and the municipality, resulting in a slow progress (Interviews, Policy Realization Advisor and Strategic Advisor, Amsterdam, 2019; Program Developer, AMS, 2019); the unwillingness of the private market to cooperate with the various initiatives, not even in knowledge exchange platforms (Interviews, Program Developer, AMS, 2019; Strategic Advisor, The Board, 2019); the transition being led mainly by economic considerations (Interviews, Trainee, PA, NVRD, 2019; Strategic Advisor, Amsterdam, 2019; Business Developer, AEB, 2019; Program Developer, AMS, 2019); and many more. The four main delaying factors, in the transition of the waste management system into a more circular one, are the lack of circular indicators and evaluation system for circularity, Municipalities policy priorities, the limited support from the national and international

governments and the plethora and the level of independence of the different stakeholders in the waste management domain.

The existing evaluation systems – CE in practice is in its initial stage of development. There are no universal indicators, widely agreed upon, for circularity. Each organization develops its own set of per-project indicators and most of the projects are evaluated by their financial profit, while any attention to circularity indicators are hardly paid. IenW dedicated a big part of their circular transition program for the development of monitoring and evaluation system, but the chosen indicators are very specific to each goal chosen by IenW and the evaluation is done separately on each domain. No evaluation of the overall progress towards CE is done. Also, until today, the IenW's evaluation system is yet only another unique, single-organization's evaluation system, and is not yet adopted nationally. The ability of the quantitative indicators used today in the domain of circular waste management to reliably reflect the current domain's trends are widely questioned. The option of setting also qualitative indicators for evaluating the transition of the waste management sector into a more circular one is under discussion. With no indicators able to evaluate whether the applied initiatives or the chosen action plans lead to the advancement of CE, choosing initiatives or action plans becomes a very complex and sometimes doubtful task for the municipality of Amsterdam.

Municipal policy priorities – CE is gaining interest, but it is still quite low on the municipality's agenda compared to other domains. It is seen as only one out of 5 sub-subjects under the municipal sustainability agenda. Policy realization advisor in the city of Amsterdam sees the team working on circularity as a "...small boat next to the big mammoth tanker of energy transition." (Interview, *ibid*, 2019). She states that the budget of the department can cover an experiment or a pilot, but to scale-up and to develop an initiative into a successful project, she will have to get special budget and approval from the Aldermen (Interview, *ibid*, 2019). Another priority of the municipality is housing. In the near future, all the waste collection points, that are already located quite on the edges of the city, will be pushed even more to the outskirts, clearing the land for housing. Their movement will be utilized for their make-over into Urban Resource Centers (Interview, Advisor CE, Amsterdam, 2019), but the effectiveness of this make-over might be in question due to their even less accessible and distant location.

Limited support from the national and international governments - In the global context of the contemporary economy, the scope of influence of a single municipality is quite limited. The Dutch national government and the international EU policies, while supporting the transition towards CE are seen also as a major delaying factor for the municipality's progress towards CE. The European Union has a major role in promoting CE among its member states. An example, can serve the future directive on single-use-plastics that although not adopted yet, has driven the Dutch government into a process of new policies, regulations and enforcement development (Interview, Senior Advisor, IenW). This, in turn, drove many national-wide festivals restrict their policies on single-use-plastic, promoting hard plastic reusable glasses with or without a deposit system, paper or bamboo plates and utensils and other solutions. The change in practice has started even before the actual directive was in place. And while there is more and more engagement with the subject at the European level, the actual progress is very slow. The policies are presented in form of directives, usually setting general goals for the far future rather than

banning, subsidizing or imposing levies. The achievement of the goals is not overseen and there are no enforcement measures or implications for not following the directive. Thus, the directive banning the use of single-use-plastics is probably the exception to the rule than foretelling a real change in perception. The same is true for the Dutch national level. While the Dutch government has developed a Government-wide Program for a Circular Economy (MIE, 2016), this program is mainly promoted through the Dutch traditional regulation methods - voluntary agreement. The government does not apply financial incentives in form of taxes, fees or levies on problematic products or reward schemes or subsidies for buying circularly produced products. It also does not apply enforcement measures such as legislation, penalties or fine. And although mostly successful, voluntary agreements take very long time to achieve, are very limited in their scope, slowly progressing, mainly focusing on the already existent waste management system and have no consequence for not complying with the agreement. On the other hand, in the current political situation, the Dutch government is also reluctant to change the already existing legislation, delaying the transition towards CE. The removal of barriers and the promotion of CE is not happening fast enough neither on the international nor the national levels. Both levels are unable to supply the city of Amsterdam with a stable base for action or to leverage the municipalities CE initiatives.

The plethora of stakeholders and the level of their independence – The Waste Act, a legislation from 1979, declares that besides the households' waste, for which the local municipalities are responsible, every supplier of solid, nonchemical waste is responsible for its handling (collecting, removal and disposal). Thus, the law defines every supermarket, school, office, sport center and every other supplier of solid non-chemical waste as a stakeholder in the Dutch waste management system. The authorities in charge of the suppliers of commercial waste were defined to be the national government and the regional environmental authorities. Although the separated responsibilities over the waste handling, the national goals for waste management are the same for household waste and for solid, nonchemical waste produced in places other than the private households' dwellings (widely referred to as commercial waste). As these goals are only soft policies, most of the commercial waste suppliers do not have separation facilities in their buildings, not to mention any activities promoting waste prevention or reuse (Interview, Advisor CE, Amsterdam, 2019).

The city of Amsterdam finds this law as one of its biggest current problems. A big city like Amsterdam has thousands of independent commercial waste suppliers, each contracting a different collecting company with different disposal options. This interferes with the conduct of the city, affecting road traffic, creating loads on the transport infrastructures, congestions, noise and CO₂ emission, but also delaying the city's transformation to CE. In the waste domain, as the municipality is not responsible for the commercial waste, the city can reach its 65% separation goal even if all the suppliers of commercial waste will not separate waste at all. But for becoming fully circular, managing all the household waste in a circular way is not enough – the whole city should go through this transition.

Realizing that, Amsterdam is lobbying the national government to change the law and recently it got a special permission to conduct an experiment in the 9-streets area of the city, where the municipality will be responsible for the management of all the waste. Nevertheless, Amsterdam's

pilot is just one of the national government's various attempts to overcome the problem. Among them is an experiment of a single collecting company operating inside the city and later distributes the waste to all the contracted waste collection companies outside the city; an ongoing negotiation with the companies collecting waste from elementary schools, aiming at promoting an agreement on separated waste streams collection and more (Interview, Senior Policy Officer, IenW, 2019).

Amsterdam's progress in the last 4 years:

Despite all limitations, it is important to notice Amsterdam's progress over the past 4 years. Until 2015, Amsterdam saw its role in the waste management system limited merely to waste collection (Interview, Strategic Advisor, Amsterdam, 2019). The city's first and current waste management policy "Waste Plan, Resources from Amsterdam" (Municipality of Amsterdam, 2016) was published only in 2016 and was designed for a period of 4 years' time. Accordingly, its main focus, was unifying the waste management system in all seven districts, starting from the very basics as collecting the same waste streams, having the same standard for underground bins collection and promoting waste separation. "So that was the first moment that we actually thought on higher levels on how to get closer to those 2050 goals." (Interview, Strategic Advisor, Amsterdam, 2019). But Amsterdam was not the only one to start the process in 2015. The Dutch government initiated a few CE projects in 2013 and 2014, but the government's first significant step towards the transition to CE was made in 2016, when the government published its first policy paper on circularity - "A Circular Economy in the Netherlands by 2050" (MIE, 2016). And even at the international level, although promoting what is today seen as circular waste management from the Waste Directive in 2008, EU officially adopted the CE package only in 2015 (EEA, 2015; Hultman & Corvellec, 2012; Prendeville et al., 2018; Salvia, 2015; Zeller et al., 2019). Thus, Amsterdam's capability to promote the various changes in its waste management system and implement the previously mentioned initiatives promoting the higher levels of the circular waste management hierarchy, in a newly developing domain and in a period of 4 years' time, can be seen as quite an achievement. Employees in the municipality of Amsterdam claim that not much significant changes can be seen yet, as the domain is indeed quite new - "We are still at the beginning of CE, so a lot is not known" (Interview, Advisor CE, Amsterdam, 2019); "A lot is a pilot because we really develop the new way of thinking and doing" (Interview, Policy Realization Advisor, Amsterdam, 2019). That is also, in the opinion of the policy realization advisor for the city of Amsterdam, the reason why Amsterdam does not have a well-developed evaluation system (Interview, *ibid*, 2019). Strategic advisor in the city of Amsterdam believes that it is too early to witness the effect of the incentives already taken by the municipality, as the change of the waste management depends on the citizens' behavioral change, and this might take 10 years to happen. Also, he believes the goals for 2020 were too ambitious in the first place "...but I am convinced that what (the goals) we've set in 2016 we will achieve in 2030" (Interview, *ibid*, 2019). The second waste policy, for the years 2020-2024, is being formalized and should be published by the end of this year. The interviewees from the municipality are looking forward to this policy - "And it's really a different one from our policy plan from 4 year ago. And we need it. We need a new frame to do it better." (Interview, Policy Realization Advisor, Amsterdam, 2019). Advisor

CE and strategic advisor in the city of Amsterdam assure that the new policy will focus on prevention and upcycling – “...of course then you talk about refuse, repair, reuse, that kind of things, and (...) closing the loop. So, this high value recycling.” (Interview, Advisor CE, Amsterdam, 2019). The municipality’s employees strive to include in the new policy also new indicators and ways of measuring the different initiatives to be taken (Interviews, Advisor CE and Strategic Advisor, Amsterdam, 2019). Strategic advisor of the city of Amsterdam believes that a bigger progress will be possible to reach in the new policy as the city’s current Mayor and coalition are green (Interview, *ibid*, 2019).

AEB, Amsterdam’s waste management company, is also working on a new policy for 2020-2025, for which the decision on the extension of the incineration plant from 1993 is yet to be made. The policy will include more circular initiatives as biomass power plant, diapers recycling facility, CO₂ capture and utilization, etc. (AEB, 2019). AEB’s business developer states that although it will take a significant period of time “...in theory it can be possible that there’s no waste anymore, so we don’t have material to incinerate. So, we have to prepare for that.” - the company is already working on its future transformation to material recycling company (Interview, *ibid*, 2019).

And the change is not only local. The current national waste management goals were set in 2016. This year will be the first year that the quantitative goals will be discussed at a national level in Rijkswaterstaat’s benchmark on waste. An attempt will be done to get an insight in the numbers and to define more qualitative ways of measuring the quality of the separated waste (Interviews, Trainee, PA, NVRD, 2019; Senior Policy Officer, IenW, 2019). This year was also the year IenW published their first Circular Economy Implementation Program. It also allocated resources for the creation of “circulaire ambachtscentra”, promoting initiatives of maintenance, department and reuse around the country. In addition, nowadays, IenW conducts significant preparational work for the quick adoption and implementation of the upcoming EU directive banning the use of single-use-plastics and works on the new National Waste Management Plan, in which new guidelines for waste management, including waste prevention, will be presented (Rijkswaterstaat, 2019).

Conclusions:

To conclude, although the waste management hierarchy, constituting the base for the circular waste management hierarchy, was adopted by the Dutch government as early as 1979, and the goal for 66% waste separation was set for the year of 2000, it seems that only recently a real effort to align with the waste hierarchy has been made. The current national waste management goals were set only in 2016. The commitment the national level expressed to the current goals promoted the local authorities’ engagement to the subject, who picked up on the goals quite quickly (Interviews, Senior Policy Officer, IenW; 2019, Waste and Circularity Advisor, Rijkswaterstaat, 2019).

2016 as well as 2015 were also a very important years for the city of Amsterdam. In 2015, the municipality change the interpretation of its role in the waste management system from waste collector to system designer, it published its first waste management plan, included CE under the

city's sustainability agenda and conducted a research in to the potential inherent in CE for the city. The initiatives the municipality promotes in the CE domain are set for a short period of time, after which they are evaluated, and future decisions are made. By this, the city is trying to avoid the threat of being locked-in again in a new rigid system. In the past four years, Amsterdam developed a nuanced cross-sectoral perception of CE visible in its organizational structure and also in the waste management sector.

The city realizes the great role private households have in the shift of the waste management sector into a more circular one and uses all 5E available instruments to changes its citizens behavior. It promotes a lot of initiatives in the higher levels of the circular waste management hierarchy and has even assigned one employee in the waste and resources department exclusively for waste prevention. The municipality works hard on developing unique approaches and facilities to involve all of its different groups of citizens in the transition process; it strives to exemplify the wanted behavior and provide a consistent message to its citizens; it considers to expand its encouraging initiatives and examining options to use the enforcement instrument more often.

Amsterdam has made a huge leap in the circular domain in general and specifically in the circular waste managements, but serious improvement and changes to the existing system are out to be considered in the very near future if the city indeed strives to become fully circular by 2050. EMF (2015) states that – “Even in a country with a starting position as advanced as Denmark, there are significant opportunities to scale up the transition towards the circular economy...” (p.4). The same is true for the Netherlands.

8. Summary:

The aim of this thesis was to provide practical instruments and recommendation for local governments looking to promote CE and to transform the waste management system in their city into a more circular one. Realizing that private households have a significant impact on the transition process (Kalmykova et al., 2018; Kirchherr et al., 2017; Petit-Boix and Leipold 2018; Prendeville et al., 2018), the thesis provided a structured analysis of the instruments local governments, waste utility companies and other private or public-private service providers should use in order to support the change of the private households' waste management behavior in to a more circular one. The municipality of Amsterdam was used as a case-study for this research.

Main findings:

The research showed that in the past 4 years, the municipality of Amsterdam has introduced pathways to CE in general and to the domain of circular waste management in particular. It developed a nuanced cross-sectoral perception of CE visible also in the waste management sector. Yet, the transition process is still too slow and until today most of the municipal activities in the waste domain focused on improving the already existent waste management system, making it more efficient and more widely applied. However, the municipality is very committed to the CE transition, striving for better performances and investing great efforts and significant financial means in its future ambitious aspirations. It also copes with a lot of delaying factors at local as well as national levels. Realizing the great role private households play in the transition of the waste management sector into a more circular one, the municipality puts a lot of emphasis on changing the private households' behavior, focusing on the transition of their waste management behavior into a more circular one. Recognizing that changing behavior is a challenging goal, the municipality of Amsterdam uses a package of instruments to promote it. The municipality utilizes all the 5 groups of interventions offered by this thesis's framework – “enable”, “engage”, “encourage”, “exemplify” and “enforce”. The greater focus of the municipality is on the “engage” and “enable” instruments, followed by a much smaller scope of initiatives using the “exemplify” and “enforce” instruments. The “encourage” instrument is used by the municipality only to a very limited extend.

More generally, the research indeed demonstrated the vagueness and the width of the CE concept visible through the diversity of domains the different organizations focused on, varying from construction materials, biomass, nutrient recovery from wastewater, energy, mobility and many more. It also indicated the gap between its understanding by the academic community and its implementation in practice. The challenges of translating the concept into practice were also clearly visible. The different interviewees expressed their struggle in choosing the right incentives to promote the chosen domains of the concept; involving all the relevant stakeholders; evaluating the outcomes of their projects; and more. The lack of agreement on the concept goals, means of achieving them and the absence of measuring indicators were also visible.

As the goals and activities of the public sector were mainly analyzed for this thesis, leaving the private market out of the picture, economic prosperity was not identified as the concept's main catalyzer. The urgency in promoting CE came rather from environmental and resilience concerns

arising from the size of the Dutch ecological footprint and the Dutch aspiration for greater independence. The country is striving to disconnect from the international and global supply networks and utilizing resources at a local level. The possible economic benefits were seen as an additional gain but not the leading purpose. As opposed to the findings by Prendeville et al. (2018), the municipality of Amsterdam did see itself not only as a facilitator but also as the financier of the transition. Nevertheless, no major investments towards holistic CE transformation were found. The initiatives identified were still mainly incremental, focusing on knowledge generation, research and experimentation. Geels (2004) states that incremental change is one of the possible routes to transformation, a gradual one. This transformation "...starts with increasing problems in the existing regime. This leads to a search for alternative technologies. The search does not immediately yield a winner, resulting in a prolonged period of uncertainty, experimentation, and co-existence of multiple technical options." (p.916). Only after a long time one option becomes dominant and the system is developing stabilization again (Geels, 2004).

Research limitations:

The limitations of this research are important to keep in mind. First, this research was limited in both depth and scope. It focused on a single city, analyzing the waste system and the transition to CE in a local and specific for the city context. As the present economy as well as resource and material flows are organized on a global scale, the capacity of local policies to affect the economy and actually transform into a circular one is quite limited. For the transformation to be successful, any locally applied initiatives have to be promoted or at least backed up by the national and international levels. In the context of the research itself, the analysis was based mainly on the two relevant, publicly available, policy papers, "Circular Amsterdam: a vision and action agenda for the city and metropolitan area" (Circle Economy et al., 2015) and "Waste Plan, Resources from Amsterdam" (municipality of Amsterdam, 2016), and on the views of a limited number of interviewees from various organizations. Thus, although striving to present a wide picture, the study and its findings should be treated in accordance with the study's depth and scope. Second, each city functions in its own unique context – its own political, economic and social constraints and opportunities, its own socio-technical infrastructure systems, etc., "which demands specific studies adapted to each situation." (Petit-Boix & Leipold 2018, p.1278). Thus, the offered results and recommendations should be addressed cautiously and carefully, considering the specific context of the city in question. Third, as "It is very difficult to demonstrate a consistent, direct link between specific policy instruments and measurable (...) achievements." (Cox et al., 2010, p.208), the efficacy of the different tools has not been evaluated in this study. Thus, it is not possible to determine which tool is less or more effective and the different tools rather serve as indicators to the various options of action available. Fourth, CE "Monitoring and evaluation practice is not yet standardized so results are not necessarily comparable." (Cox, et al. 2010, p.203). Fifth, the language functioned as a barrier in policy analysis as well as in the conduction of interviews. The policies in Dutch were translated to English using google translate, translation which is subjected to inaccuracy and loss of subtleties. Not all interviewees felt perfectly comfortable with being interviewed in English, succeeding to deliver the general message but lacking the professional terminology and the ability to express their ideas in a precise manner. Thus, when reading this thesis, the focus should be on the general idea or message rather than on the specific choice of wording.

Recommendations:

“Nevertheless, available insights might inspire and help cities...” to shape the instruments in their use and prioritize their implementation initiatives (Petit-Boix & Leipold 2018, p.1278). Thus, recommendation for the city of Amsterdam and other cities willing to transform their waste management system into a more circular one, are presented below.

Engage – this instrument is the most exhaustively used by the municipality. The municipality should continue investing significant amount of time, effort and budget to engage all its citizens through formal and unformal channels of communication. Both kinds of communication should be done through structural and at the same time flexible way of citizen involvement.

Enable – although widely and at most successful used by the municipality, this instrument can be utilized even more. Two specific areas of focus should be: 1. The accessibility of information on circular waste management and CE. The flow of information on circular waste management is a very comprehensive one. The municipality strive to spread this information through its engaging initiatives, but it is still quite seldomly used by the citizens, and when looked for, it is not always easily accessible. More efforts should be invested in making the information widely available and accessible. 2. The balance between the uniform waste management system and the area-oriented customizations of the system. Area-oriented customizations of the waste facilities at a neighborhood level should not be seen as fragmentation of the system but as its variety. This variety should be promoted under one control and one administrative system. On the contrary, other central waste management systems such as the pay-as-you-throw and waste collection centers at a neighborhood level should not be avoided from implementation due to the concern that not all the different groups of citizens in Amsterdam will easily coop with the system’s change. These systems and the possibility of their implementation should be examined and tried out as a pilot alongside the other experiments and pilots the city conducts. A good combination of both approaches can serve the Urban Resource Centers. These can be implemented as a centralized system, locating them in each district or neighborhood in Amsterdam, close and accessible to all citizens. All of them should provide exchange, repairment and maintenance facilities but their content and the way of operating them, the different waste streams dealt with etc., should vary according the specific characteristics of each neighborhood or district. These Centers can also be used as training and skills acquirement centers, functioning somewhat as repair coffees, as these initiatives are quite completely absent under the current municipal use of the “enable” instrument. Skilled individuals repairing broken products or making something new of what was defined as waste will pull the waste management sector higher up on the circular waste management hierarchy and contribute to the idea of CE by closing the loop of resources and material use.

Exemplify - the municipality should invest more in making its operation more circular. It can promote circular public procurement; contract maintenance and repair services for the municipal equipment and property; take actions to avoid unnecessary waste generation like limited printing services and the use of single-use-cups; order office supply in a smarter way and from circular companies; install bins for waste separation; find solution for food waste and many other initiatives. Examined in a long-term, a lot of these initiatives are financially sound, which should

make them easier to promote even in the existing economic conditions. Regarding consistency in policies and their message to the public, the municipality of Amsterdam already operates in a successful manner. Like the waste management system, the message to the public should be centralized and uniform on the one hand and area-oriented on the other. In Amsterdam, the overarching message is the same for everyone – Amsterdam strives to become fully circular by 2050, but the messages carried at a neighborhood level should be adequate to the local citizens and their current abilities to contribute to CE and circular waste management. For some, this will be waste separation, for others also food waste separation and for others it will include also smart consumption.

Encourage – as most of the initiatives under the “encouragement” instrument are most effective if promoted at the national level, the municipality’s options are quite limited with this instrument. Nevertheless, as mentioned under “enable” instrument, the municipality of Amsterdam should examine the possibility of implementing encouragement system proven successful in lowering the amounts of residual waste at a local level, such as the pay-as-you-throw system and waste collection centers at a neighborhood level, or at least lowering the frequency of residual waste collection from single family houses. The municipality should also provide better feedback to citizens taking part in its various initiatives, to show them their progress and impact and encourage them to continue. Initiatives using group work should be considered, as these are known to create social recognition and pressure that keeps the individuals engaged.

Enforce – after unifying the waste management system, the municipality should also unify its enforcement system. Existing penalties and fining system should be use more frequently. The municipality should also examine the possibility of implementing the system designed to ensure the quality waste separation, offering yellow and red card as warnings, followed by fining the violator. In general, the municipality should consider using the enforcement tool more frequently, especially in areas where the willingness to cooperate with the municipal goals does not exists. Enforcement of voluntary agreements if no progress has been achieved for a set ahead period of time should also be considered.

Also, the municipality must work faster. It should define CE as a priority in its policy agenda; it should increase the budget and employees working on the subject; enlarge the team working on waste prevention and significantly increase the amount of prevention and reuse initiatives; promote more radical changes at the local level, showing the government that it is possible, leading the national level to set goals based on Amsterdam’s existent achievements, like in the example of reversing the legislation on the mailbox sticker. The municipality should also continue to cooperate with the national level, the other 3 big cities, knowledge institutes and other relevant stakeholders in order to develop widely agreed upon circular indicators for the whole CE transition but also specifically for the waste management domain, focusing on the quality of the separated waste and on indicators measuring the scope of prevention, reuse, repair, maintenance and other initiatives on the higher levels of the circular waste management hierarchy.

Nevertheless, as local authority’s capacity to change the global economy and resources and material flows is quite limited, significant changes should also happen on the national and

international levels. Although this thesis analyzed the local level, the author hopes that such an analysis, as Petit-Boix & Leipold (2018) state “...could also help to work towards generally favorable conditions for a CE as some developments in cities might be transferable to national/regional strategies.” (p.1278).

The EU and even the Dutch national government activities directly aimed at private households are quite limited. Nevertheless, the recommendations of the different instruments are quite transferable if the target group of for each governance level is thought to be the governmental level right below it. Thus, the EU aiming its initiatives at its member states and the Dutch government aiming its initiatives at its municipalities. As this thesis focused on the local level, very little information on the international level was gathered. Thus, when no clear references to the international level made, the assumption is that the national recommendation should be transferred to the international level aiming at the EU member states as the target group.

Enable – the Dutch governmental “enabling” organization is the Rijkswaterstaat. The government invest a lot of money and effort in initiatives like knowledge generation and exchange platforms; provision of information and technical tools for different infrastructural system implementation; organization of courses for municipal representatives, training them and supplying them with skills and support in promoting citizens behavior change and much more.

Engage – the government is very active in engaging its municipalities. Rijkswaterstaat benchmark and its training courses to engage municipalities are financed; meeting and information days are organized from time to time; Rijkswaterstaat electronic newsletter is spread through email to everyone how ever took any part in any Rijkswaterstaat activity; successions with municipalities director and even the Mayors are held on a regular basis, and more. Engaging initiatives have to be constant, leaving the municipalities no choice but to join and contribute to the national transition.

Exemplify - the most important recommendation would be to acknowledge the important role the national government has in setting an example, for municipalities but also for the private households. Additionally, the national government is already developing and promoting some important initiatives, for example a more circular acquisition process or designing the internal structure of the buildings in a way that will allow them to be less energy consuming, etc. (Interview, Senior Behavioral Expert, IenW, 2019), but a lot is yet to be achieved. But most importantly, the national and international level should be really devoted to the CE subject, setting it as priority in their policy agenda, creating a sense of urgency. Thus, exemplifying the importance of the issue and the wanted behavior of promoting CE to member states, the local authorities, the private market and even the private households, encouraging them to take part in this mutual mission of transition towards CE. Additional recommendation on the use of this instruments are quite transferable between the local and the national level.

Encourage - this is one of the instruments that can be used almost exclusively by the national and international governments. The initiatives at local level exist but are quite limited. The national and international level should offer grants to companies and initiatives promoting CE; they should promote smarter consumption patterns through bigger involvement in the private market. On the one hand, by enforcing higher taxes and levies on products that are harmful to the

environment in their production process, the materials they use or if they cannot be appropriately reused or at least recycled at the end of their life-cycle; and on the other, by subsidizing products that are environmental responsibly produced, their packaging may be refilled or they can be easily recycled. The Dutch government should create a peer pressure around the issue of CE among its municipalities, like it does through Rijkswaterstaat benchmark in the domain of waste. The international level should do the same for its member countries. “Naming, faming and shaming” is the techniques used by Rijkswaterstaat to create this peer pressure, and waste and circularity advisor at Rijkswaterstaat state it generates the wanted results (Interview, *ibid*, 2019).

Enforce – The EU directive banning the single-use-plastics is unfortunately more of an exception to the rule, indicating the regular conduct of the things through soft policies and voluntary agreements. The goals and the policies were defined years ago, but they are followed only partially, due to the absence of enforcement, among other things. The enforcement instrument is a relatively strong one and should not be abused. It should be used in a balanced, flexible and evolving way. One the one hand, national and international levels should promote more legislation and regulations, setting standards for ways of production, expanding producers’ responsibilities, banning the use harmful material and developing a variety of implications imposed for not following the voluntary agreements at the agreed upon period of time; and on the other hand, both level should not to hesitate to cancel or change outdated or delaying legislation, ones that imposes restriction on the transition towards CE.

Overall, the national and international governments have wider authorities and influence level. They should make bigger and more radical changes to the existing economy. They should take the leading role, steer the technological developments in CE direction, promote CE as an urgent priority of their policy agenda, inspiring the member states and the local authorities and guiding and facilitating their process of transition to CE.

Directions for future research:

Other cities’ initiatives should be analyzed using the 5E instruments framework, because as Ferrara & Missios (2005) claim – “By collecting and examining data from several communities with different (...) options, it is possible to test whether theoretical predictions have been found to be effective in practice” (p.222). For the same purpose, Amsterdam’s and its partners’ patterns of use of the 5E instruments should be analyzed again in 4 years, in order to see whether the city indeed changed its priorities and what effect did it have. The city’s transition process from the existing socio-technical waste management system into a more circular one should also be analyzed in 4 years’ time, allowing to determine whether the future, wished for changes indeed took place and whether initiatives on the higher levels of the circular waste management hierarchy are promoted. Thus, it will be possible to define whether the present trends were part of the gradual route of transformation to CE, as claims Geels (2004) or whether Amsterdam’s activity is part of the general tendency of municipalities to facilitate rather than lead the transition process, as was found by Prendeville et al. (2018). Additional important areas for future research would be the evaluation of the efficacy of the 5E instruments used for the behavioral change of the private households’, examining which tools have better effect then others, which

are more effective in the long-term and which have more of an immediate effect. The behavioral change of the society as a whole, which is essential in achieving a long-term normative change, should also be further researched, including all 3 level of behavior – individual, organizational and systemic (Darton et al., 2006).

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Appendix 1

Appendix A: Overview interviewees

Name	Role	Organization	In the text referred to as-
Mirko van Vliet	Strategic Advisor	Amsterdam Economic Board	Strategic Advisor, The Board
Virpi Heybroek	Program Developer "Circularity in Urban Regions"	AMS Institute	Program Developer, AMS
Max Narinx	Trainee, Policy Advisor	NVRD	Trainee, PA, NVRD
Natascha Spanbroek	Policy Advisor Waste and Resources and Circular Economy	Waste & Resource Department and Environmental Policy Department, municipality of Amsterdam	Advisor CE, Amsterdam
Edward Lemenschot	Business Developer, focusing on recycling separation of streams	AEB Amsterdam	Business Developer, AEB
Weenk Addie	Waste and Circularity Advisor	Rijkswaterstaat	Waste and Circularity Advisor, Rijkswaterstaat
Peter de Boer	Strategic Advisor and Project Manager for Innovation	Waste & Resource Department, municipality of Amsterdam	Strategic Advisor, Amsterdam
Suzanne Pietersma	Senior Behavioral Expert, Behavioral Insights Team	Ministry of Infrastructure and Waste Management	Senior Behavioral Expert, IenW
Kyron Olmeijer	Behavioral Psychologist	D&B	Behavioral Psychologist, D&B
Floor Kuiper	Policy Realization Advisor	Waste & Resource Department, municipality of Amsterdam	Policy Realization Advisor, Amsterdam
Sander Leeuwen	Senior Policy Officer, directorate circular economy and sustainable environment.	Ministry of Infrastructure and Waste Management	Senior Policy Officer, IenW

An email exchange was conducted with:

Name	Role	Organization	In the text referred to as-
Quirine Kramer	Project Leader	Ministry of Infrastructure and Waste Management	Project Leader, lenW