

Master's Thesis

Transforming package into package; a case study into the drivers and barriers to a circular economy in the Dutch plastic food packaging industry.



Figure 1 circular economy (Sustainablebrands, 2015)

Transforming package into package; a case study into the drivers and barriers to a circular economy in the Dutch plastic food packaging industry.

Master's thesis 30 ETCs

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Abstract

Disposable plastic packaging contributes to many problems. These include the depletion of resources, litter pollution of soil and sea and micro plastics coming into the food chain. This paper will contend that a circular economy (CE) could address these and other problems by relieving the pressures on natural resources and reducing the waste problem. The Netherlands has a relatively well functioning waste infrastructure, though has not yet reached a closed loop. While CE is not a new subject, and waste management has been extensively studied over the years, it has mostly been done on the output side and many scattered approaches to a CE exist. This *explorative* research studies the waste problem from redesigning of the supply chain perspective and combines the many scattered approaches. Moreover, it addresses the knowledge gap of the influence of awareness of the producing industry of the need for a CE. From these problems the research question is formulated: *To what extent are the main stakeholders in the Dutch plastic food packaging supply chain exhibiting the behavioral alternatives attributing to a circular economy, and which drivers are influential in overcoming the barriers towards a circular economy from an institutional theory perspective?* This will be studied through an embedded case study approach on the consecutive actors in the Dutch food packaging supply chain. Based on a literature study, the economic actors of the chain are interviewed through a semi-structured interview. Consumer behavior is studied in a literature study, and the relevant legislation is identified through desk research. Built on the extended conceptual model of sociological institutional theory by Zhu and Geng (2013), the drivers and barriers for the behavioral alternatives for a CE are explored. Based on the interviews and consumer literature study it can be concluded that many improvements need to be made before a CE can be accomplished. Costs, hindering regulations and policies, lacking technology and simple refusal to change are the most encountered barriers. However, these barriers can be overcome. The most progressive actors are often normatively influenced, and the actors who are both normatively and coercively driven encounter fewer barriers. This paper will demonstrate the importance of these drivers to overcome the barriers and show that mimetic driven actors do not usually undertake new initiatives. Hence, normative and coercive drivers seem to be most influential means to overcome the barriers to a CE.

Preface and acknowledgements

The last few months of my academic career have been centered around the following research. It was the last part to be completed of the Sustainable Development – Environmental Governance program. This research has been combined with an internship opportunity at the Technopolis-group, where I spend six months writing my thesis, collecting data, and working on their project on the circular economy. After finalizing my thesis, I would like to thank all who contributed to this research in some way.

First of all, I would like to thank my two supervisors Dr. Walter Vermeulen and Joost van Barneveld for taking the time to read this research multiple times and provide constructive feedback, corrections and new insights. Your contributions were of great help. I would also like to thank the Technopolis-group for giving me the opportunity to work on and learn from their research on the regulatory barriers for a circular economy, and providing me the environment to conduct this research. Furthermore, I would like to thank my two reviewers, Lingxi Zhong and Joel Williams who sacrificed their free time to provide feedback and corrections on my English and made sure my English is of a decent level. Moreover, I would like to thank my family for their support in general.

Last but not least I would like to thank all interviewees who shared their experiences with the drivers and barriers for a circular economy. Without them this research would not have been possible.

Overall, I think I provided more insight in the drivers and barriers for a circular economy with this research.

Table of contents

Abstract	i
Preface and acknowledgements	ii
Table of contents.....	iii
Part one – Research approach and theoretical conceptual framework.....	1
1. Introduction.....	1
1.1. Societal relevance	1
1.2. Scientific relevance	2
1.3. Research objective	2
1.4. Main question.....	2
1.4.1. Sub-questions.....	3
2. Methodology	4
2.1. Literature review	4
2.2. Sampling technique	5
2.3. Case study.....	6
2.4. Data analysis.....	6
3. Conceptual Framework.....	7
3.1. Circular economy	7
3.1.1. The concept of circular economy	8
3.1.2. Historic overview	9
3.1.2.3. Reversed Logistics	12
3.1.2.4. Conclusion.....	12
3.1.3. Development of corporate strategy for CE.	12
3.1.4. Environmental policy development.	13
3.2. Stakeholder identification	15
3.3. Behavioral alternatives for the various actors in the chain.	16
3.4. Theories addressing behavioral changes of companies and consumers	21
3.4.1. Sociological institutional theory.....	21
3.4.2. Consumer theories: Worldviews, attitudes, theory of planned behavior, and the reasonable person model.....	23
3.5. Conceptual framework.....	26
3.5.1. Divers.....	27
3.5.2. Barriers	28
Part two – Results and Analysis	30
Introduction to part two.....	30
4. Regulatory and policy context.....	31
4.1. Relevant EU regulations and policies	31
4.1.1. Regulations and policies on waste	32
4.1.2. Regulations and policies on recycling.....	32
4.1.3. Regulations and policies on packaging.....	33
4.1.4. Regulations and policies on food contact materials	33
4.2. Relevant Dutch regulations and policies.....	34
4.2.1. Regulations and policies on waste	34
4.2.2. Regulations and policies on recycling.....	35
4.2.3. Regulations and policies on packaging.....	36

4.2.4.	Regulations and policies on food contact materials	37
4.3.	Conclusion	37
5.	The plastic producers	39
5.1.	Sustainability	39
5.2.	CE behavior and the drivers and barriers.....	40
5.3.	Sustainable strategy.....	40
5.4.	Mapping the material stream.....	42
5.5.	Design for durability and recyclability	43
5.6.	Taking back materials	44
5.7.	Collaboration throughout the supply chain	45
5.8.	Conclusion	46
6.	The food producers.....	48
6.1.	Sustainability	48
6.2.	CE behavior and the drivers and barriers.....	48
6.3.	Sustainability strategy.....	49
6.4.	Green purchasing	51
6.5.	Extended producer responsibility.....	52
6.6.	Green packaging	53
6.7.	Increased durability of products.....	54
6.8.	Limit excessive packaging.....	55
6.9.	Mapping the material stream.....	56
6.10.	Collaboration throughout the supply chain	57
6.11.	Conclusion	58
7.	The Retailers.....	60
7.1.	General sustainability	60
7.2.	CE	60
7.3.	Redesigning the value chain and sustainability strategy	61
7.4.	Purchasing green products	63
7.5.	Collection point.....	64
7.6.	Gate keeper	65
7.7.	Collaboration throughout the supply chain	66
7.8.	Conclusion	67
8.	The waste managers	68
8.1.	General sustainability	68
8.2.	CE	68
8.3.	Sustainability strategy.....	69
8.4.	Investing in efficient waste processing techniques	70
8.5.	Forecasting	71
8.6.	Collection infrastructure and sorting.....	72
8.7.	Reuse, recycling, recovery	74
8.8.	Collaboration throughout the supply chain	75
8.9.	Conclusion	76
9.	Consumers.....	78
9.1.	Policy studies	78
9.1.1.	Consumers opinions in regard to sustainability, waste separation and recycling	78
9.1.2.	Green products.....	78
9.1.3.	The reuse of packaging.....	81
9.1.4.	Waste separation for recycling	81
9.1.5.	Returning packaging waste.	84

9.1.6.	Conclusion	85
9.2.	Academic research	86
9.2.1.	Green products.....	86
9.2.2.	The reuse of packaging.....	88
9.2.3.	Waste separation and recycling	89
9.2.4.	Returning packaging waste	92
9.3.	Analysis: Policy studies and link to the academic literature	92
9.4.	Conclusion consumer literature study	94
10.	Analysis.....	96
11.	Discussion and Conclusion	100
11.1.	Answering the research questions	100
11.2.	Recommendations	106
11.3.	Reflection on limitations and implications for future research	108
12.	References	110
Appendix A - Topic list interviews.....		118
Topic list plastic producers		118
Topic list food producers		119
Topic list retailers.....		120
Topic list Waste managers.....		121
Topic list The Government.....		122
Topic list NGOs.....		123
Appendix B – List of interviewees.....		125

Part one – Research approach and theoretical conceptual framework

1. Introduction

Cheap and easily available resources formed an important aspect of the rapid European economic growth in the 20th century (Seyfang, 2004). However, due to the depletion of resources and the resultant price increases, there is more need for resource security and efficiency to achieve future economic competitiveness. Additionally, the climbing consumption patterns placed high pressures on ecosystems and pushed natural systems to their limits, making them vulnerable to external shocks.

During this period of growth, many companies developed an economic model that generates a large amount of waste (Ellen MacArthur foundation, 2013), and packaging is ever increasing (Babader, Ren, Jones, & Wang, 2016). It is estimated that by 2020, 65 billion tons of raw materials will be imported in the industrial system. Food packaging, especially plastics, are highly problematic and have a negative impact on the environment (European Commission, 2016a). In 2012, 151 million tons of plastic waste were produced in the European Union (EU) (European Commission, 2015b), and 39.5% stems from packaging (NKR-recycling, 2015). Plastic poses several problems (European Commission, 2016a). 50% of the European plastic waste ends up landfilled and consequently energy is lost despite the Council Directive 94/62EC on packaging and packaging waste which aims to reduce and prevent packaging waste and its harmful environmental effects (Aarnio & Hämäläinen, 2008). This illustrates the general problem this research is addressing: barriers limiting supportive CE regulations. However, this research also addresses possible drivers working towards a CE, which could also include regulations.

1.1. Societal relevance

The EU has recognized the growing environmental problems facing Europe. The EU wants to expand its commitment to sustainable development (European Commission, 2016b). This is evidenced by the EU opting for a *zero waste strategy* in 2020 through the circular economy-working package: *Towards a circular economy: a zero waste for Europe* (European Commission, 2016b). CE is relevant for Europe as its industry and society depend on the import of raw resources. Yet their prices are becoming rather high and the political relations between the EU and supplier countries are unstable. Hence, investment in a more resource efficient economy is necessary.

Focusing on the Netherlands, where plastic collection is relatively well developed, around 2% of the plastic packaging is landfilled with a recycling rate of 45% and energy recovery rate of around 52% (PlasticsEurope, 2015). However not all packaging is collected, ending up on the Dutch street and beaches as litter (Mileucentraal, 2015). The plastic litter cannot decay, causing pollution in both urban and natural settings. This litter is so small that collection afterwards is frequently difficult. Plastic packaging is additionally problematic in three ways. First, the litter is transported by water and wind, ending up in the North Sea polluting soil and water. 30% of this waste annually stems from consumers. Second, animals can end up entangled in the plastic waste and suffocate. Lastly, energy is lost as the plastic is not recovered, which is problematic in the light of resource depletion. Plastic packaging thus forms a societal problem. Targeting this problem would not only reduce environmental problems but would also provide jobs. The current plastic recycling sector provides 30,000 jobs, which could increase if the sector were to be stimulated through CE. Hence there would be many societal benefits from closing the plastic packaging loop.

1.2. Scientific relevance

The circular or green economy is not new (Vermeulen, Witjes, & Reike, 2014). Vermeulen et al. (2014) state that most products are already designed to be recycled, but not always reused; the repair of products only takes place in niche markets. Additionally, European policies regarding CE distribute a large amount of responsibility to consumers and producers (Ghisellini et al, 2016; European Commission, 2016b). This is especially the case when it comes to food packaging. After being designed by producers the packaging needs to be recycled and reused, then sorted and collected by consumers and subsequent actors in the chain. If products are made greener, the prices often increase, and circular products require a behavioral change (Liu, Anderson, & Cruz, 2012; Zhu & Geng, 2013). Consumers must thus be willing to pay extra and change their behavior, which in turn influences the feasibility of these production schemes, as companies do have to make profit. According to Liu et al. (2011), a positive relation has been found between the environmental level of citizens' awareness and their willingness to pay. Yet, these findings remain controversial. Ghisellini et al. (2016) question the level of awareness of both producers and consumers, and suggest more research is needed on this. Awareness studies of consumers and producers regarding CE to-date have focused on China, not Europe. There is thus a *knowledge gap* regarding the influence of awareness of European stakeholders concerning CE. This research aims to contribute to the current scientific debate by filling this knowledge gap, with a focus on the Netherlands. Further, this research adopts a different perspective on waste reduction than conventional waste management by looking at redesigning the plastic packaging supply chain (Liu et al, 2012). Looking at waste management literature, many different approaches exist on closed loop systems including CE, reversed logistics, industrial ecology, industrial symbiosis and environmental economics. However, these different disciplines have not been combined before, as will be done in this research to identify behaviors leading to a CE. Lastly, this research builds on the analytical model of Zhu and Geng (2013), which focusses on institutional drivers towards environmental corporate strategies and extends it by taking more barriers and drivers into consideration.

This research is conducted in the context of a larger research from the Technopolis-group, Wuppertal institute, thinkstep, Fraunhofer is (2016) about the regulatory barriers to a circular economy in the EU. This Master's thesis will add an extra dimension to one of the cases of the Technopolis research by not only looking at regulatory barriers but also institutional ones and drivers, with a focus on the Netherlands to get more in-depth information about a single member state. This research thereby aims to provide a more in-depth picture, with a more limited scope. It is thus an *exploratory research* with a smaller unit of analysis; the consecutive actors in the Dutch plastic packaging supply chain. The following research objectives and questions are formulated:

1.3. Research objective

The research objective is to contribute to the understanding the roles of drivers and barriers for a circular economy in the Dutch packaging sector and explore which driver and barrier is most influential by extending and applying the institutional model of Zhu and Geng (2013).

1.4. Main question

The central research question in this research is:

To what extent are the main stakeholders in the Dutch plastic food packaging supply chain exhibiting the behavioral alternatives contributing to a circular economy, and which drivers are influential in overcoming the barriers towards a circular economy from an institutional theory perspective?

1.4.1. Sub-questions

The sub-questions related to this research are:

1. According to the sociological institutional theory, what are the drivers towards behavioral alternatives (for the main stakeholders in the Dutch plastic food packaging supply chain) as discussed in the literature?
2. What are the relevant national and European legislations for plastic packaging recycling for the Dutch plastic food packaging supply chain?
3. To what extent are the main stakeholders in the Dutch plastic food packaging supply chain exhibiting the behavioral alternatives?
4. What are the main barriers towards exhibiting the behavioral alternatives according to the main stakeholders in the Dutch plastic food packaging supply chain?
5. To what extent are awareness and pressure by their surroundings stimulating the main stakeholders in the Dutch plastic food packaging chain to participate in the behavioral alternatives according to the main stakeholders themselves? (Normative)
6. To what extent can imitation and competition between the actors in a stakeholder group enhance the behavioral alternatives, according to the main stakeholders in the Dutch plastic food packaging chain themselves? (Mimetic)
7. To what extent are EU and national legislation supportive for CE according to the main stakeholders themselves? (Coercive)

The dependent variables are the required behavioral changes for CE of the stakeholders. The independent variables are the mimetic, coercive, normative drivers and the barriers.

2. Methodology

This research is exploratory and practice-oriented as it is aiming to contribute to a practical problem. Namely, that there is a difference between the wanted and actual situation (Verschuren & Doorewaard, 2010). It focusses on the problem-analyzing phase as it is aiming to establish what the barriers and drivers are for CE, and to generate more understanding of the situation of CE in the Dutch food-packaging sector as a whole, requiring in-depth information. Moreover, the study seeks to map the relation between the different steps in the plastic food packaging supply chain. For this, a case study methodology is a logical choice as it paints an in-depth picture (Ibid.). For practice-oriented research, a case study approach has several advantages. First, it allows obtaining a general picture. Second, it is flexible, as not much pre-structuring is required. Finally, results might be more applicable and usable for the main stakeholders, as they are interested in what happens in the field (Verschuren & Doorewaard, 2010). This Master's thesis is focusing on what the actors in the chain are doing now, and how they can be driven to more sustainable behavior or why this is constrained. Due to practical reasons and time constraints, a focus on The Netherlands is adopted. It is not possible to investigate the food packaging supply chain in all EU member states. Selecting a feasible amount of interviews in the available time would lead to highly contextual answers.

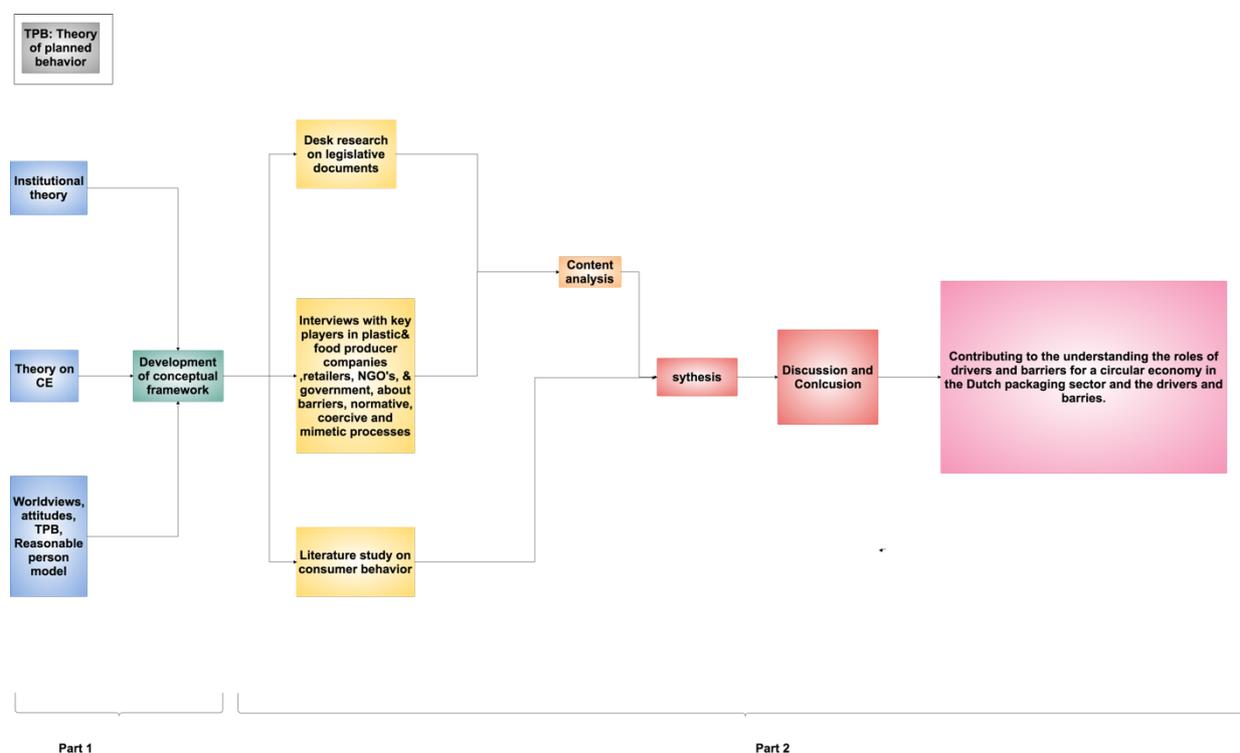


Figure 2 Research approach

2.1. Literature review

The first step and method is a literature review. This literature review has three purposes:

1. Providing input for the interviews questions, which can be found in Appendix A.
2. Building a conceptual framework to steer the analysis.
3. Consumer behavior research.

First, an overview and development of the term circular economy is presented. In this overview, the different historical approaches to waste management are combined. This is done to provide better

understanding of the concept and its workings. After the general overview of CE and the policy context in The Netherlands, the focus is on the different actors in the chain. Per actor, specific behavioral alternatives which are facilitating a CE are identified and presented. These behavioral requirements will form the foundation of the interviews.

In order to answer sub-question 1, the drivers and barriers according to the sociological institutional theory are discussed and operationalized and translated into a conceptual framework in section 3.5. This conceptual framework will serve as a guiding tool of where to look for in the interviews. Moreover, the conceptual framework will be the basis for the coding of the interviews.

By viewing the supply chain, it becomes clear that consumers are one type of the actors in the Dutch food packaging supply chain. However, interviewing a small number of consumers would risk leading to highly contextual answers. Surveys would allow the opportunity to reach a large amount of respondents, though a survey is not feasible in the given time (21.5 weeks). Undertaking a survey of the necessary size would be too large to be practical, and its execution would be difficult. For example, obtaining a sufficient sample size and a representative, non-biased sample. Therefore, the survey is replaced by a literature study, using secondary resources, as a significant amount of research has already been conducted on this topic (Euro Barometers for sustainable behavior and attitudes; GfK, 2014; Mira onderzoek & Marintel BV, 2015; Van de Burg & Visser, 2014; Van Grootheest & Den Ouden, 2014). Secondary empirical research will be used to explore if the consumers are exhibiting the behavioral alternatives (Figure 5), or comparable behavior, and the theoretical lens on consumer theory will be applied in explaining why or why not the behavioral requirements are performed. Academic consumer research will also be reviewed to assess the theoretical approaches on the study of consumer behavior.

The last part of the literature review is conducted to answer the second research question; to identify the regulations surrounding food packaging and recycling. This is done to provide the regulatory context in which the sector operates (Chapter 4).

2.2. Sampling technique

Before conducting the interviews, the respondents have to be selected. As mentioned in section 2.1, the required behavioral changes are identified for all actors in the chain. Both primary and secondary actors influence the workings of the chain. Respondents will be selected based on the categories of the stakeholder classification provided by Henriques and Sadorsky (1999): existing regulatory stakeholders, organizational stakeholders, community stakeholders, and the media. Due to time constraints, the media will be excluded. So will government and NGOs, which would require a different theoretical lens to provide for a broader situational context. In section 3.2 these stakeholder categories will be elaborated. After having identified the stakeholders, the respondents per stakeholder groups need to be selected. The unit of analysis will be the consecutive actors in the Dutch plastic packaging supply chain. Due to this relative large research unit, a sample of a single case will be conducted. In this case the respondents are selected based on a non-probability purposive sampling technique, based on respondents being part of the Dutch food packaging chain (Bernard, 2011). This method is used as specific groups are needed for this research; plastic producers, food producers, retailers, waste managers NGOs and the government. After identifying and approaching possible respondents, individuals that replied and were deemed as appropriate candidates served as respondents. A total of 4 respondents per category are selected. While this sampling technique is appropriate for explorative research, it has drawbacks, especially in combination with the small sample size. A consequence is that the sample cannot be determined to be representative of the entire Dutch plastic packaging supply chain. This should be kept in mind when drawing conclusions.

2.3. Case study

In the case study, mixed methods will be used: existing desk research on food packaging legislation, semi-structured interviews with experts from the stakeholder categories, except for the consumer category for which a literature study will be conducted. By setting the research up in this way, a triangulation of sources is guaranteed which enhances the external validity of this research (Verschuren & Doorewaard, 2010). As this research aims to map the connections between the various successive steps in the chain. Hence the different actors function as sub units of analysis. This combined with the different data collection methods provides an embedded case study method (Yin, 2013).

The interviews function to explore the barriers and drivers for the identified behavioral alternatives of the stakeholders. Semi-structured interviews are conducted as they generate as much input from the respondents as possible. It combines the benefits of unexpected responses from the respondents with the structure for the later content analysis (Bernard, 2011). Per stakeholder category, plastic and food producers, retailers, waste managers, the government and NGOs, four respondents will be interviewed, making a total of 24 interviews. The respondents are experts in the sustainability field. Quotes will only be used after consent. The interview guidance will roughly look as followed. First the respondents will be asked to introduce their company, their position and in general their attitudes and behavior towards CE. Secondly, they will be specifically questioned to what extent the company exhibits the required behavior, and how it is influenced, operationalized in the different drivers and barriers. This is required as the needed behavior differs per stakeholder category (Figure 5). The topic list of the interviews will also differ per category. The interview guides can be found in Appendix A. To combine all stakeholders and come to a synthesis, the actors will be asked what they think the other actors in the chain should do, why and how. Moreover, as a check, the interviewees will be asked after the open question per behavioral alternative, about all the identified barriers and drivers in the literature by each specific behavioral alternative, to account for their possible selective memory. The interviews will be held in person if possible and otherwise through telephone. During the interviews notes will be taken and they are later on processed.

2.4. Data analysis

In the data analysis, the gathered data will be analyzed to explore the influence of the different drivers and barriers on the stakeholder's behavior. NVIVO software will be used to analyze the data. Different codes will be generated in NVIVO. The barriers and drivers as identified in the conceptual framework, and the different Rs (recycle, reuse, refuse, recover, reduce etc.) will be used as codes. First the interviews will be coded based on the different Rs, to explore the different interpretations of sustainability of the various actors. After this is done, each interview will be coded per behavioral alternative looking at the barriers and drivers. Hence per behavioral alternative it will be coded which drivers and barriers are expressed. In the results section, for each behavioral alternative it will be mentioned whether the actors are performing the behavior and what barriers and driver they encounter. In the analysis, the output from the content analysis and literature study on consumers will be combined together with the interviews of the NGO's and the government to see to patterns can be identified, and what the implications are.

3. Conceptual Framework

In this chapter an overview and explanation is given in regard to the theories used to build the conceptual framework, and the theoretical lens of this research. This research aims to explore the barriers and drivers of a successful CE in the Dutch plastic food packaging sector. Therefore, it is necessary to understand and define what is meant by CE. To understand required changes, one needs to know where these ideas stem from. For this reason, a brief overview will be presented of the development of the concept and the developing policies surrounding it as this research is focusing on explicit actions towards a CE.

After reviewing and defining the concept CE, the actors dealing with CE in the supply chain need to be identified. These actors are usually companies. As Hsu, Tan, & Zailani (2016) mention, in order for organizations to change their behaviors stakeholders are often influential and determine corporate policy to a great extent. Moreover, to induce a change in corporate policy, a change in corporate strategy is required which in turn demands long-term commitment, investment, and engagement of all stakeholders. Hence, stakeholder theory is necessary to identify the relevant stakeholders in the Dutch plastic food packaging supply chain.

After the key actors are known, it should also be established what it is they need to do. For this, CE literature is used to identify the required behavioral changes. It should also be understood why the actors change their behaviors or what could be possible barriers. Sociological institutional theory will be used to form the bridge between the actors and CE. Institutional sociological theory focusses on the influences that shape organizations (Li & Ding, 2013). It does this by identifying the drivers and barriers for organizations to adopt certain practices which are acceptable within their organizational field. While there is a knowledge gap regarding the influence of awareness and the adoption of CE practices, sociological institutional theory also acknowledges other drivers as mimetic and coercive ones, which will be explained in section (3.4). Therefore, it is a fitting theoretical lens for this research.

Consumers are an important influence on the chain via demand and supply yet do not function the same as organizations. Therefore, a different theoretical lens is necessary to understand the motives of consumers. The behavioral changes for consumers often imply a change in lifestyle and thus it is important to understand where these life styles are rooted in. Hedlund-de Witt, de Boer, & Boersema (2014) point to worldviews which are explained in section (3.4). Worldview theories would allow understanding consumer lifestyles in their cultural context. Worldviews and lifestyles are connected through attitudes as Hartmann & Apaolaza-Ibáñez (2012) state that the degree of sustainable consumer behavior is determined by environmental values and attitudes. The theory of planned behavior (TPB) relates to attitudes and aims to explain and predict consumer behavior (Paul, Modi, & Patel, 2016; Wang, Fan, Zhao, Yang, & Fu, 2016). This is also the general aim of this research; the drivers and barriers for exhibiting the required behavioral changes. However, an action value gap between attitudes and actual behavior still exists. The reasonable person model will shed light on this in section (3.4). These theories together will form the analytical framework which is presented in section (3.5).

3.1. Circular economy

In this section the concept of circular economy is explained. First the concept itself is introduced, after which the different streams or origin are described. Moreover, the development of Dutch CE policy is briefly described. The section will end with a small conclusion regarding the concept of CE.

3.1.1. The concept of circular economy

In “popular use” a distinction is made between the circular and linear economy, which are posed as opposites (Murray, Skene, & Haynes, 2015). The concept linear economy is thus deliberately designed to boost the term circular economy. While the term linear economy might be a marketing tool, it can help explaining the circular concept. The linear economy is defined as a production system based on the extraction of raw resources, conversion into products and later on the production of waste. These systems are thought to be linear and stable. However, they do not take system evolution including the sociological and organizational processes into consideration (Bermejo, 2014). This kind of economy is harmful to the environment in two ways: 1) by the extraction of natural capital, and 2) by pollution through waste or through the extraction process (Murray et al., 2015). Boulding (1966 in *Ibid.*) also referred to such an economy as a cowboy economy. The circular economy is hence the opposite and aims to restore the natural capital, while simultaneously producing as little waste as possible. The circular part of the term refers to two kind of cycles, biogeochemical cycles and recycling. The biogeochemical cycle refers to the molecules and atoms cycling on the planet, which human activity has disrupted (Murray et al., 2015). A CE could help restore these natural cycles and manage the excessive output of these materials in the eco system. However, the origin of the term CE is heavily debated and thereby the meaning of the concept. (Murray et al., 2015). The common theme in these definitions is that they all refer to closed loop systems.

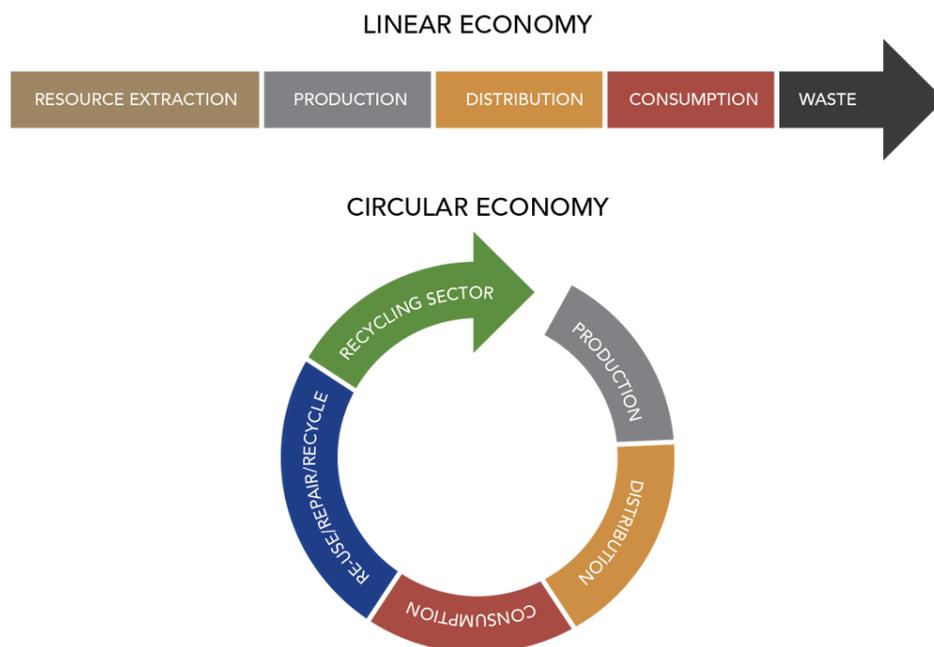


Figure 3 Linear and circular economy (Exportleadership, NN).

CE is also criticized. The first point of critique focusses on the term linear economy (Murray et al., 2015). This term is not only a commercial term, but has been associated with many different theories as the linear-stages-of-growth model of Rostow, which refers to the development of states. Second, social aspects are missing in CE. CE mainly focusses on the environmental and economic pillars, but does not explicitly mention the social pillar. This is something that should be included. Lastly, CE is said to have unintended consequences and over-simplistic goals. A few examples of these unintended by-effects are the dependency of green technologies on rare metals as neodymium, of which the mining is environmentally damaging, or the green fuel use, which led to the deforestation of Borneo. The over simplistic criticism refers the reductionist thinking and the mathematical modeling of systems, while nature is difficult to reduce to simple variables.

Despite the criticisms identified (Gale, 1989, Fitzherbert et al., 2008, Muray et al., 2015), CE is promising. A CE is of restorative nature and aims to minimize economic damage. While some criticism is offered, the current alternative, the “linear economy” is unsustainable by requiring many resources and producing massive amounts of waste. Therefore, CE is a worthwhile option for transforming the economy and restoring natural resources. In the next section the several streams of CE will be discussed in an historic overview of CE.

3.1.2. Historic overview

Discussion remains concerning the origin of the term CE. According to O’Rourke and Lollo (2015) CE is a relatively new name for closed loop systems. This renaming, and the previously mentioned discussion make it important to note the development of the concept. As it has been said, there is no general consensus of the origin of the term CE (Murray et al., 2015). Some claim it came from Boulding’s (1996 in *ibid.*) notion of energy saving, material reproducing cyclical ecosystems. Yet the term first occurs in the 1980s mentioned by Stahel and Reday-Mulvey (1976 in *ibid.*) who were inspired by Boulding’s notion, and thus mentioned a closed-loop economy.

3.1.2.1. *Early developments of CE.*

The recent development of CE is better documented. CE developed from multiple historical, ecological and economic areas (Murray et al., 2015). Starting with the economic aspect, it developed from the Pshyioocrats School, which translates as the government of nature. This school of thought assumed that agriculture is the source of wealth (Murray et al., 2015). Further analogies of the economy were drawn from the circular blood flow of the human body. Together with the Greek meaning of economy; household management, they came to the conclusion that the economy should not damage the “house”. Hence the economy should be restorative and non-damaging. Later on, in the 19th century, the industrialists developed the notion of industrial metabolism. In industrial metabolism, industries do not exist of separate acting entities, but functions as a large organism. In this industrial metabolism the notion of waste as food occurs. This comes back in industrial symbiosis (IS), which is explained in section (3.1.2.2).

In the 1970s, environmental economics developed as a separate stream from CE. Environmental economics is built on the idea of managing the environment in such a way that it allows for economic growth (Murray et al., 2015). In this stream, Boulding’s (1966 in Ghisellini, Cialani, & Ulgiati, 2016) notion of circular systems serve as building blocks for sustainability forming the foundation of environmental economics. Environmental economics are neoliberal in their beliefs that environmental problems stem from failure of the economic system, maximize human well-being and secure the natural resources that are necessary for this well-being (Pearce, 2002).

Environmental economics developed as a response to environmental economics in the 1980’s (Murray et al., 2015). The difference is that they adopted a more ecological centered approach instead of an economic one. In addition, ecological economics were more concerned about environmental problems and put more emphasis on resource limitations than the environmental economists (Pearce, 2002) Moreover, ecological economists believe less in neoclassical economic solutions. In general, ecological economics is based on the idea of the global human society should be seen as a metabolic organism which exists within the biosphere and survives by the extraction of resources and returning waste to the biosphere (Røpke, 2016). If this way of living is to be maintained, it can only occur on a certain scale. Hence, good measurement is needed to understand what the limits are. In addition, due to these limits, sharing becomes ethical concept. This means a social dimension is added by striving for equal resource access. These different streams could explain the lack of school surrounding CE.

3.1.2.2. Industrial ecology

The industrial ecology (IE) movement originated from two events in 1989; the publication of Strategies on manufacturing, using waste as a raw material, and the start of the Kalundborg industrial ecosystem, which is the most well-known example of IE (Bermejo, 2014). IE can be seen as a field of knowledge; a combination of environmental sciences, ecology, and engineering as a way towards sustainable development (Dinçer & Zamfirescu, 2011; Vermeulen, 2006). This means that energy and material flows must follow the natural biogeochemical cycles. It is based on the assumption that industries can resemble natural systems and would thereby inflict less environmental damage (Dinçer & Zamfirescu, 2012; Leigh & Li, 2015). IE has mainly focused on material flow accounting and industrial symbiosis (IS) or industrial ecosystems (Bermejo, 2014). Material flow accounting is a methodology which is not used in this research, and hence not discussed.

There are many opinions on IE (Bermejo, 2014). Some argue that IE should be normative, as it is inherently connected to sustainability, but the idea is discarded by others who claim that if it is used normative, IE will impose absolutes on a complex process and system, which is problematic. Another perspective is to frame IE as an analogy between nature and the industrial system and its relationships; ecological systems existing of several food webs using other actors waste. This indicates production systems are not complex systems, yet, recent acknowledgement of the evolution of systems indicates a complex system. Another topic of discussion regarding IE is mutualism, which comes from the biological concept of symbiosis. Mutualism is a form of symbiosis which is beneficial for both parties. In IE mutualism would lead to new interactions and industrial structures. Moreover, in biology, this relationship is often necessary for survival, yet in IE it refers to cooperation. Yet a common thread in these different approaches is the use of natural resources without disturbing the system's balance, which is used as underlying idea to change the society (Vermeulen, 2006).

While IE is subject to criticism, there is agreement on the three Rs. The three Rs stand for *reducing* the input of materials per product unit, the *reuse* of products, and the *recycling* of the product at its end of life. Hence it is about loops. Moreover, they come back in the waste hierarchy (Figure 4). The waste hierarchy shows the hierarchy of most energy efficient ways of waste treatment. Prevention is most energy efficient and disposal in landfilling is the least energy efficient.

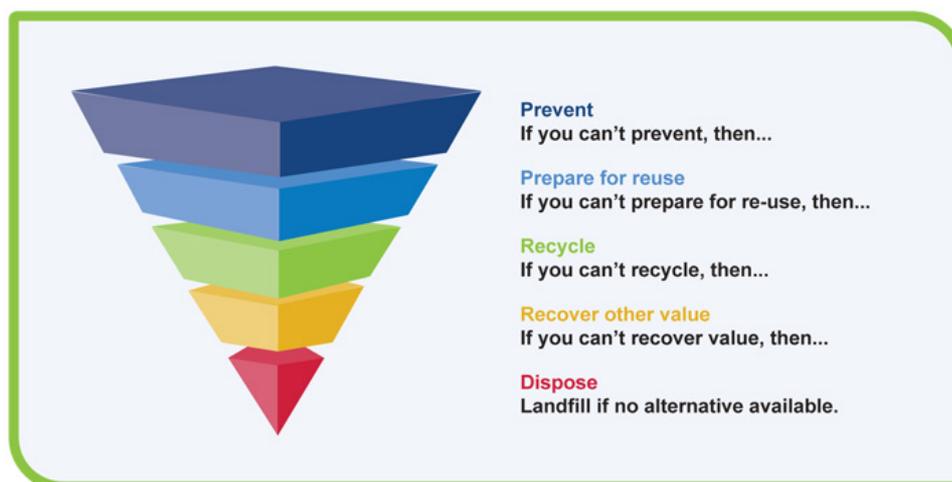


Figure 4 Waste hierarchy (Environment Scotland, 2014)

The three Rs can be complemented and extended to nine Rs (Vermeulen et al., 2014), meaning nine different loops exist. Vermeulen et al.'s (2014) classification starts with *refuse*; non-consumption. Followed by *reduce* and *reuse* as Murray et al. (2015) mentioned. *Repair*, the repairing of the product, and the *refurbishment* are the next options (Vermeulen et al., 2014). Lower on the waste hierarchy

are *remanufacturing*; using components for other products, and *repurpose*; using the product for a different purpose. These options are followed by *recycling*; reusing the materials. A last circle is *recovery*; energy *recovery*, usually in the form of incineration in the context of plastic packaging.

The most energy efficient option would be the refusal and reduction loops. Using less natural resources is a task of the producers of the product. While reduction requires effort from the food producer and consumer opting for products with less packaging. The repairing and refurbishment are problematic when it comes to food packaging. Regulation (EC) No 1935/2004 sets strict rules on materials coming into contact with food. These rules are so strict that repairing and refurbishment is not an option. Repurpose is therefore more likely to be an option, yet single use plastics are fragile and therefore unlikely to be repurposed before recycling. Hence recycling is the most probable option. Energy recovery occurs if the separation for recycling does not happen correctly. Vermeulen et al. (2014) contends that in The Netherlands, reuse, repair and refurbish are not occurring on a large scale. Moreover, when products are reused, it is not monitored as thoroughly as recycled materials. Hence, more emphasis should be placed on reuse in order to transition to a more circular economy. Recycle seems to be the most successful loop as the recycle rate in 2014 was on 50%, while recovery was 7% (KIVD, 2014).

These Rs can be translated into more practical implications (Vermeulen, 2006). First, the production must be designed into a zero-emission process. Hence not only the product is important, but the whole supply chain. Secondly, the life cycle of the product must be designed in such a way that it has minimal environmental impact. I.e. designing for recycling or reuse of the product. Thirdly, the existing infrastructure must be adjusted to facilitate a minimal impact production system. This is both on the individual as regional level. Fourthly, recycling systems and networks are to be designed in such a way that they facilitate the exchange of materials. Lastly, a switch from fossil fuels to renewable energy to meet society's energy supply is needed. These are general practical implications which form the basis for the required behavioral changes in section 3.3.

IS is thus a part of IE and often described as resource exchange between companies or industries (Bermejo, 2014). The difference between the concepts is that the focus of IE is on facilitating exchange between and within systems, while the focus of IS lies on the cooperation between firms to achieve natural like systems (Leigh & Li, 2015). Eco-innovation and long-term cultural exchange are the central goal of IS (Bermejo, 2014). This is to be achieved through this knowledge sharing and mutual benefits. The concept can be more specifically applied to the sharing of natural resources combined with the goal of sustainable development (Ashton, 2009). Yet more aspects of IS are worth mentioning, and Boon and Spekkink (2012 in Bermejo, 2014.) identified five factors for the development of IS: strategic visions and learning processes, diverse interdependent actors, trust, coordination authorities, and "an enabling context" as culture and institutions (Boon & Spekkink, 2012 in Ibid.:298). Bermejo (2014) adds resource scarcity, price risings, isolation factors and proximity. IS has developed in several areas spread across the world. Consequently, the definitions of terms as industrial and eco-park and the source of IS links differs across the globe. Yet a pattern can be identified in the development of IS relationships: sprouting, uncovering, embeddedness, and institutionalization. Sprouting refers to exchange between parties, while no stable relationships yet exist, but do grow stronger over time. The second level starts with the uncovering of the now complex exchanges by an outside party. The exchanges slowly get embedded and institutionalized. IS relationships are helpful as they allow for closer collaboration within the supply chain (Leigh & Li, 2015). To have a IS relationship, three different companies must exchange a minimum of two kinds of resources. These relationships and IS in general could give a supply chain a competitive advantage as it improves the environmental performance while simultaneously lowering the costs.

3.1.2.3. Reversed Logistics

Industrial ecology focusses on the different R's and thus both the input and output side of the chain. However, recently the output side is receiving more attention as recycle and reuse. This is mainly done in Reversed Logistics (RL), which refers to an environmental conscious management system that is similar to CE as it focuses on a reversed flow and thereby closing the material cycle (Gonzalez-Torre, Adenso-Diaz, & Artiba, 2004). Due to its similarity to CE and the possibility to identify behavioral alternatives, this concept will be discussed briefly. The concept can be defined as "The process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal" (Agrawal, Singh, & Murtaza, 2015:77). RL thus aims to keep the value within the system, and by doing so, less waste is produced (Hsu et al., 2016). RL is built on four concepts: reduce, substitution (substitution of raw materials), reuse and recycle (Jayaraman, Patterson, & Rolland, 2003). The R's concept suggests that IE is also present in reversed logistics. Moreover, reversed logistics differentiates two types of supply chains; a forward and a reversed one. The forward supply chain is comparable to the "linear economy". The reversed chain however, is more similar to the circular economy as in this chain the products, after usage, are returned to the producer to either be repaired, refurbished or recycled. To make reversed logistics successful, it must follow the waste hierarchy (Figure 4) (Silva, Santos Renó, Sevegnani, Sevegnani, & Serra Truzzi, 2013). The corporate strategies developed from three kinds of initiatives: consumers returning the products, companies intending to recycle the products, and government initiatives promoting closed-loop systems (Gonzalez-Torre et al., 2004).

Reversed logistics brought companies two key advantages in terms of the environment and the economy. The environmental advantages involve having a lower environmental impact (Agrawal, Singh, & Murtaza, 2015; Gonzalez-Torre et al., 2004). It logically follows that this could enhance the corporate image of the company when consumers demand more green products (Agrawal et al., 2015; Jayaraman et al., 2003). The economic benefit stems from less dependency on natural resources, less value loss due to discarding products and thereby having a more sustainable economic business (Gonzalez-Torre et al., 2004; Jayaraman et al., 2003). More benefits of reversed logistics can be identified including the restock of products, consumer satisfaction and recalls (Silva et al., 2013).

3.1.2.4. Conclusion

In this section the concept of circular economy was discussed and a historical overview of the concept presented. While different interpretations exist, general consensus exists on closing the cycle. However, multiple cycles exist according to IE: refuse, reduce, reuse, repair, refurbishment, remanufacture, repurpose, recycle and recovery. Of these different loops, refuse, reduce, recycle and recovery are the most practical loops for the plastic food packaging sector. Yet as mentioned, more emphasis should be placed on the shortest loops of reuse and refuse, as there is currently fewer policy on these loops. The recycling loop has gained a lot of attention and seems to be the most successful loop, while incineration is actively discouraged. In order to expand these loops, changes throughout the supply chain need to occur. As briefly mentioned, the different loops require different actors to take action. Hence the different actors in the chain need to be identified, and their required behavioral alternatives. This will be done in section 3.2. First, to place CE in a more practical context, its development in corporate life, and policy is presented.

3.1.3. Development of corporate strategy for CE.

CE has to be placed in the broader view of sustainable development. CE has the same underlying assumption as the definition of sustainable development of the Brundtland commission of a balance

between the environment and economic growth based on finite resources (Murray et al., 2015). However, it only covers a specific area. The focus of CE is on closed loops in combination with the redesign thinking (Murray et al., 2015). This allows the CE to be restorative as it designs waste out of the production system by the production reusable and recycling materials. Concepts as cradle-to-cradle show the restorative nature of the concepts where waste is used as a resource. However, CE focusses not solely on the optimization of components, but of systems as a whole. It is thus about value design. By reducing dependency on virgin resources, the economy should become more sustainable (Accorsi, Manzini, Pini, & Penazzi, 2015). Hence, adopting CE is arguably good for corporate life. A successful circular economy would show new notions of economics, value, production and consumption (Murray et al., 2015). Therefore the development of CE in corporate strategy and policy (3.1.4) is discussed below.

In the 20th century, scholars started to argue that companies should look beyond profit generating activities (Vermeulen & Witjes, 2016). In the 1970s this led to the formulation of corporate social responsibility goals, focusing on both the social and environmental impact of corporations. This in turn led to environmental agenda setting as cleaner production, industrial ecology and eco-efficiency goals. In the 1980s and 1990s this resulted in practical experiments and by the 1990s corporate social responsibility came back on the academic and political agenda. In north-western Europe, the main focus was on eco-efficiency strategies. Globalization and outsourcing practices, resulted in intensified interconnectedness between companies. Hence, collaboration is needed for sustainable business strategies. In the 1980s a rational approach developed towards sustainability strategies. These approaches aimed to step-wise move towards cleaner production and zero waste, confirming to the ISO standards (Vermeulen & Witjes, 2016). Yet these steps had to be in line with the short term profit goals.

The brief historical overview above is focused on sustainable corporate policies in general, However, CE is one of the many topics requiring attention in corporate social sustainability. While CE might focus mainly on environmental aspects of sustainability. Sustainable development is based on three pillars: social, economic, and environmental sustainability. As mentioned, CE is mainly focusing on the economic and environmental one and not so much on social sustainability (Murray et al., 2015). Social sustainability, as giving back to one's community, is important for many companies (Vermeulen & Witjes, 2016). Companies are influenced by consumer demands and governmental policies (Vermeulen, 2006). The priority of these two groups might not always overlap, and consumer priorities can shift. As sustainable corporate strategies involve long term goals and commitment, not all sustainable practices can be adopted. Some tradeoffs might have to be made, for example a focus on CO₂ reduction or waste reduction. For these several reasons, CE has to be seen in the broader idea of sustainable development. Special attention has to be paid to governmental policies as it forms the operational context for companies to operate. Therefore, the development of environmental policy in the Netherlands is taken into consideration.

3.1.4. Environmental policy development.

Next to this historical overview of the development of CE, the policy history of CE should be reviewed as this research focusses on a circular economy management of the Dutch food packaging supply chain. This section covers general possible policy interventions and more specifically the actual history of environmental policies focusing on waste management.

From the early 1960s, policy makers realized that the consumption demand was bigger than the planet could offer (Vermeulen 2000). This led to the implementation of a variety of environmental policy interventions. Overall, the Netherlands is one of the leading countries when it comes to the recycling rate of household waste with a 51% recycling rate (Goorhuis et al., 2012). Moreover, the recovery rate has increased to 83% and the landfill rate lowered to 4%. Despite the growing recycling

and recovery rates, the Dutch waste generation has also increased 27% since 1985. By 2010, 5 million tons out of 9.8 million tons was recycled, 3.2 million tons incinerated, 0.03 tons was landfilled and the destination of the remaining amount was unknown. Focusing specifically on plastic packaging, recycling increased from 2000 tons in 2001 to 82000 tons in 2010. With this, Dutch policy has been influencing European policies in regard the waste management (Milios, 2013). An example is the *Lansink Ladder*, which translates into the waste hierarchy in the waste framework directive (Directive 2008/98/EC).

In the 1980s, an interactive policy intervention of consulting with the market of was developed in addition to the centralized policy interventions as taxes and subsidies, (Vermeulen, 2000). Subsidies used to be one of the main policy interventions to drive corporations to opt for more sustainable practices. Yet the effect of these subsidies was limited as there was no clear national policy and there is a limit on these subsidies stemming from the EC. An example of an EU principle is the polluter pays principle, which stipulates that polluters must pay for their environmental consequences instead of receiving funding to engage into alternative behavior. Despite this, the amount of environmental subsidies grew as the Dutch government followed the international trend. However, only one third of the cases the subsidy turned out to be the main reason for behavioral changes.

In terms of waste management, before the 1990s the main waste management option was disposal. This started to change in 1993 with mandatory waste separation and the collection of organic waste. The separation of other kinds of recyclable waste were promoted via the separate collection of households program (Goorhuis et al., 2012). This resulted in the separate collection of cardboard, glass, plastics, WEEE, and hazardous waste in most municipalities. For plastic packaging this amounted to 5kg per capita in 2010.

In the 1990s policy transformed slowly into a private actor based interventions, known as an interactive policy approach (Vermeulen, 2000). These private interventions developed as a reaction to governmental policies. Partnerships such as the *Convenant Verpakkingen*, with whom agreements to reduce the amount of packaging, were made. Also the standards developed by ISO, the non-governmental International organization for standardization, became more important. These ISO standards illustrate the institutionalization of environmental management. Hence the role of the government shrunk. However, these different interventions have a downside. For one they do not always complement each other well and different agendas exist, making it difficult to prioritize.

Despite the privatization trend, waste management was centralized in the 1990s (Milios, 2013). The responsibility of waste management changed from the provincial level to the central state level. This resulted in a new waste management plan every six years by the ministry of housing, spatial planning and the environment. So far, two waste plans have been developed. The plan until 2015 focusses on reducing waste generation and its environmental impact, and reducing the impact on the environment from supply chains in general. The provinces and municipalities are still responsible. For instance, the provisions must take care of the closed landfills and restore the environment. Municipalities are responsible for the collection of municipal waste. With these developments it is important to place in perspective the European targets of 50% recycling by 2020. This target was already achieved in the Netherlands by 2007 and reached 51% in 2010. If the same growing rates continue, this is estimated to be between 55%-60% in 2020.

Another important development in Dutch waste management policy is the landfill ban issued in 1995 (Milios, 2013). This specific ban allowed for landfilling when no other waste management option was possible. The EU then issued a landfill directive (Directive 1999/31/EC) in 1999. The Netherlands already reached the targets set for 2016 (35%) in 2006. In 2010 the percentage of waste landfilled was less than 10%. After the introduction of the landfill tax in 1995 and the raised tax (11 Euro per ton) in 2002 which placed a negative economic incentive on landfilling, the amount of waste landfilled

decreased. By 2010 only 0.03% of the waste was landfilled. Since January 1st 2016, the tax is at €13,07 per ton waste (Rijksoverheid, 2016a).

In the early 2000s other perspectives developed. For one, the environmental targets became more ambitious (Vermeulen 2007) and a shift concerning environmental taxes occurred. These were no longer company bound but product bound, which implied better cooperation throughout the whole supply chain. Reflecting back on the policies in the 1990s, some conclusions can be drawn of what should have happened: (1) policies were short-term focused on compliance, combined with a long-term approach on innovation; (2) delayed companies were punished, while innovative ones were supported; and (3) a short-term focus on the company level occurred with a long-term focus on the sector level.

At the end of the 2000s the focus was on redesigning of production processes, products, infrastructure, reuse, and a switch to renewable energy (Vermeulen, 2007). Hence a more holistic approach was adopted. The consumer was mostly influenced by NGOs instead of the government (Vermeulen, 2007). This was a more communicative approach. A special policy targeting packaging was adopted in 2005, which aimed for more producer responsibility, and thereby enhanced packaging recycling rates (Milios, 2013). There has been a difference in the recycle rate of the various material streams. Plastic packaging for instance grew from 2000 tons in 2001 to 8200 tons in 2010. For glass these numbers are 335000 to 351000 tons, paper and cardboard 1013000 to 1063000 tons, while the recycling rate of metals did not change.

The Dutch national policy plan was to increase the recovery rate from 83% in 2010 to 85% in 2015 and the recycle rate from 51% to 60%. Data on 2015 is not available yet. However, as the recycling rate in The Netherlands has been rather stable over the past 10 years, Goorhuis et al. (2012) state that this increase cannot happen through the current waste management system and innovations have to occur. Thus the 9% increase needed cannot be met by enhancing and optimization of the present waste management system.

This section showed the policy development of waste management throughout the years and briefly mentioned prospects for the future. The Netherlands has been a leading country in waste management for decades and therefore has functioned as a role model for the rest of Europe. The high recycling rates also show that in general, the Netherlands is in transition to a CE. However, this process is not complete Goorhuis et al. (2012). New innovations are necessary to fully close the loop. Actors in the supply chain thus have to act differently. The actors, and subsequently their behaviors, are identified in the next sections; 3.2 and 3.3

3.2. Stakeholder identification

In this section, stakeholder theory will be used as the basis of the selection of key actors in and surrounding the Dutch plastic packaging chain. Based on this selection, the required behavioral changes per actor are identified. Hsu et al. (2016) mention that stakeholders are of importance when it comes to influencing corporate strategies. Gao & Zhang (2006) agree and mention that sustainable development requires stakeholder cooperation. Stakeholder theory fits in with this line of reasoning as it argues in general that companies should be governed through the interests of all stakeholders (Laplume, Sonpar, & Litz, 2008). It refers to creating value of the company and its community (Parmar et al., 2010). If a company is to be managed in the interests of all stakeholders, it is necessary to define what a stakeholder is exactly. In the classical sense a stakeholder is “any group or individual who can affect or is affected by the achievement of the organizations objectives” (Laplume et al., 2008:1160). Hence stakeholders can also be found outside of the company. However, this definition was criticized for being too broad. Therefore, it has been narrowed down to individuals or groups that hold power over the company. Based on analyzing the supply chain, some economic actors can

already be identified: plastic producers, food producers and the waste managers are considered the primary stakeholders as these are actors which have a direct influence on the company (Garvare & Johansson, 2010). Yet the previous section indicated that the government has a big influence on the setting in which these supply chain actors operate. Hence it can be concluded that other actors might be influencing the supply chain. These actors would be considered secondary stakeholders. In order to identify them, stakeholder theory is used as a method.

Following Henriques and Sadosky (1999), four categories can be identified. First is the *regulatory stakeholders* consisting of informal networks, competition and the government. This research is limited to the latter. Second is the *organizational stakeholders* of employees, shareholders and consumers. This research is limited to the latter. Third is *community stakeholders* of lobbyists and NGOs. This paper is limited to examining NGOs, defined in this research as non-profit organizations which perform environmental or humanitarian tasks. Moreover, they monitor governmental policies or corporate behavior and act as watch dogs. Fourth is *the media*, yet due to time constraints the media is left out. Hence, the stakeholder theory is used in this research as a methodology.

Based on Henrique and Sadosky's (1999) classification, the following stakeholder groups are identified: the government, NGOs and the consumers, plastic producing companies, food producing companies, retailers and waste managers. Due to the limited time and the fact that NGOs and governmental organizations are not actually participating, they will only be used to describe the context in the case study. The other stakeholders will be examined on their required behavioral alternatives.

3.3. Behavioral alternatives for the various actors in the chain.

After having identified the stakeholders, their possible behaviors supporting a CE should be established. Figure 5 shows the required behavioral alternatives which were identified in a literature review. In this section the behavioral requirements of the primary actors will be elaborated and explained per category. Per stakeholder category, the different loops (Rs) are discussed. First on a management level, followed by specific actions. The required behaviors will be discussed per actor category in different paragraphs. However, all stakeholders in the supply chain must communicate and collaborate with each other to secure a circular chain (Agrawal et al., 2015).

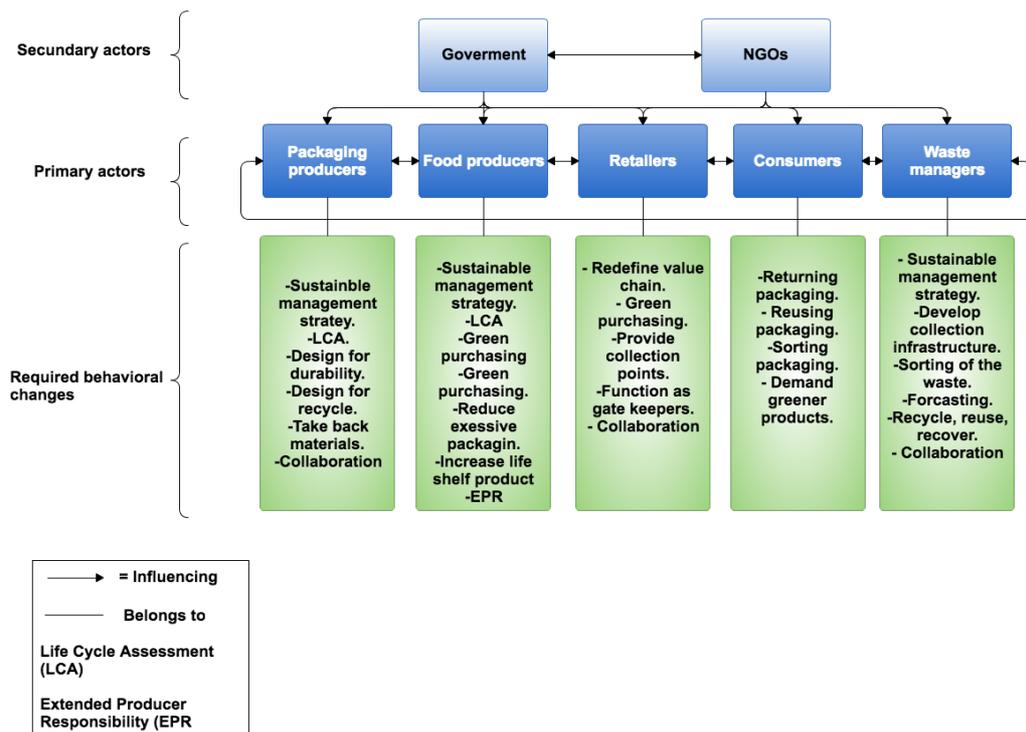


Figure 5 Supply chain actors and required behavioral alternatives per actor (Clustered).¹

3.3.1. Plastic producers

When adopting a “linear” supply chain perspective, the plastic producers are the first economic actors in the supply chain. Therefore, they will be discussed first.

Before engaging in sustainable activities, changes in firm strategies need to occur. Firm strategy determines for a large part the outward orientation of companies (Hsu et al., 2016). Following strategic choice theory, these strategies determine the business survival. These strategies do not solely develop internal, but are also stemming from governmental policies or consumer pressures. Important for CE is a corporate strategy that value eco-reputation and eco-innovation are adopted. From this eco-oriented strategy, more “green” products need to be produced (Hsu et al., 2016). The development of an environmental management strategy is thus important (Leigh & Li, 2015). This refers to a redesigned supply chain strategy. This should be combined with adopting product stewardships in which the principles of cradle-to-cradle are adopted and collaboration throughout the chain. (Accorsi, Cascini, Cholette, Manzini, & Mora, 2014). Overall the aim should be reducing the firms’ environmental impact.

These sustainable or ‘green’ strategies lead to specific behavioral changes. For instance, sustainable supply chain management requires collaboration between the successive actors in the plastic food packaging supply chain. This will lead to information and expertise sharing between stakeholders, which results in better monitoring, and a more efficient supply chain (Leigh & Li, 2015). Moreover, as products needs to be designed for sustainability, the knowledge of all actors is needed; products need to be remanufactured and designed for recycling or reuse. In addition, the emphasis should be on prevention instead of an end of pipe approach.

In order to facilitate the cradle-to-cradle strategies, lifecycle assessments (LCA) are useful to identify weak links in the chain, and enable to fix those (Leigh & Li, 2014). This can be combined with a material flow analysis which maps the in- and outcome of material flows (Dinçer & Zamfirescu, 2012).

¹ The non-clustered behavioral changes with references can be found in section(3.3)

Such technique stemming from IE allows to identify the stages of the cycle which should be improved to reduce the material input. Moreover, it can help designing systems to follow the patterns of natural systems.

Based on these managerial strategies, specific behaviors can be identified. Plastic producers for example should already keep in mind the end-of-life possibilities of the product at the designing stage (Accorsi et al., 2015; García-Arca, Prado-Prado, & Gonzalez-Portela Garrido, 2014). This means that packaging must be designed in such a way that it allows for the reuse and recyclability. In addition, the packaging should be designed in such a way that it is easy to separate for the waste manager (van Sluisveld & Worrell, 2013). Another option to reduce the amount of plastic being put on the market is lightweight packaging (Wikström, Williams, Verghese, & Clune, 2014). It would be optimal if this is combined with recycled materials, thus being designed for durability and sustainability (van Sluisveld & Worrell, 2013). It would be optimal if this is combined with recycled materials.

Reversed logistics could serve as a feasible management strategy to reduce a company's environmental impact. This also implicates that when the products are returned, they should be remanufactured or refurbished before recycling or recovery (Jayaraman et al., 2003). Reusing plastics is better from an environmental point of view (Al-Salem, Lettieri, & Baeyens, 2009). For instance, multi-trip plastics produce less CO₂, less nitrogen-oxides, less sulphur-dioxide and require less oil, as the material can be used multiple times.

To summarize, plastic producers should take action on the management and executive level. In short, they should develop a sustainable strategy, conduct LCAs, utilize reversed logistics design for sustainability, and collaborate throughout the chain.

3.3.2. Food producers

The second actors in the supply chain from a linear perspective are the food producers. Just like the plastic producers above they need to adopt green management strategy plans and care about their eco-reputation (Hsu et al., 2016; Leigh & Li, 2015). Moreover, similar to the plastic producers, they should monitor the products they put on the market, engage in life cycle assessments and adopt reversed logistics approaches. (Accorsi et al., 2014; Leigh & Li, 2015). As these alternatives are already discussed under the plastic producer section, it will not be repeated in this section.

Food producers are one step behind in the plastic packaging chain than plastic producers. Therefore, they can influence green behavior of plastic producers by green purchasing while purchasing their packaging material (Leigh & Li, 2015). This entails close cooperation with plastic producers as they design and produce the packaging. This way, the food producers could have a positive effect on the plastic producers by emphasizing the refuse a reuse loops.

García-Arca et al. (2014) promote green logistics, which is an approach to add value to a combined system existing of the packaging and logistical system. In this system the packaging is supportive of the logistics and the two systems can together become more competitive. This later on developed into "sustainable packaging logistics", focusing on people planet and profit. For instance, packaging tailored to the need of the several steps in the logistics process is more economically efficient because less packaging is needed, which is simultaneously more environmental friendly. Green packaging would mean scrutinizing the current packaging system, and looking for aspects which can be approved as using left over packaging, making packaging more space efficient and designing in such a way that the packaging can be recycled. In the same vein, excessive packaging should be eradicated. For instance, more efficient packaging by limiting void spaces, lightweight packaging refilling, and packing in larger volumes (van Sluisveld & Worrell, 2013). Yet the need for packaging

can also be reduced, with more efficient packaging, prolonging the shelf life of products (van Sluisveld & Worrell, 2013). Less new products are needed and thus less packaging is required.

Jayaraman et al. (2003) argue that when the responsibility of producers is extended by accepting the products destined for recycling, reuse or disposal, the environmental impact of the company can be reduced. This should occur as a cradle-to-cradle approach is adopted.

In short, food producers should design sustainable business strategies, adopt green purchasing, employ reversed logistics, reduce excessive packaging, adopt EPR and employ green packaging.

3.3.3. Retailers

The retailers are the third actor in the supply chain and this section focusses on the behaviors expected of them. First, the strategy options are discussed which flow over in specific behavioral changes.

The most important strategic change for retailers is to redefine the value chain. Retailers and food producing companies set the product prices ensuring a beneficial situation for both parties (Govindan, Soleimani, & Kannan, 2015). For CE to work, the retailers, together with the food producers, must redefine the value chain to make space for returning products, which still hold value, meaning they have to develop a sustainability strategy. Yet extra costs are imposed on the retailers as they must serve as gatekeepers and collection points.

From their sustainability strategy, they should, just like the food producers, adopt green purchasing (Hsu et al., 2016). Green purchasing is a purchasing approach in which only products are bought that meet the retailers' environmental goals. As retailers decide which products and brands they sell, they could influence food and plastic producer companies to invest in "green" packaging.

The other required behaviors stem from reversed logistics. In order for reversed logistics and CE to work, the products have to return to the distribution channels (Jayaraman et al., 2003). A central collection point is thus needed. Retailers could provide collection points as this is the place where consumers usually purchased their products and are inclined to return. Besides functioning as a collection place, retailers should also serve as gatekeepers (Agrawal et al., 2015). This means that the retailer decides which products are taken back to the system for further processing and which products are still usable and the consumer can thus keep. This product acquisition takes thus place before the collection.

Very briefly, retailers should redefine their value chain, employ green purchasing strategies, provide collection points for used packaging, and function as gate keepers.

3.3.4. Consumers

Consumers are the fourth actor group in the plastic packaging supply chain. They are an important stakeholder group as food consumption patterns have caused the increased packaging waste (Accorsi et al., 2014). Especially more "to-go" foods, which are often one person portion sizes requiring more plastic, gained popularity. Consumers do not have the change their strategy, as they are not an organization, but their lifestyle. Lifestyles are explained in section 3.4.2. In this paragraph the focus is on specific behavioral changes.

Consumers are the first actor group to start the circular or reversed flow, and must fulfill an important task of actually returning the used packaging (Gonzalez-Torre et al., 2004). Without this, the

packaging cannot be recycled. Yet they can also engage in a smaller loop, the reuse loop. The reuse of packaging decreases the need for new materials (van Sluisveld & Worrell, 2013).

Besides their direct role, there is also an important (indirect) role when it comes to changes in business strategies. Companies are dependent on their market, the consumer, for their survival. Hence, when consumers demand greener products, the companies will follow a greener path to secure their customers (Jayaraman et al., 2003; Prahinski & Kocabasoglu, 2006). This way, consumers can indirectly green the supply chain.

In conclusion, consumers need to return their packaging, sort their packaging, reuse their packaging, and demand greener products.

3.3.5. *Waste managers*

Waste managers are the final stakeholder category and from a “linear” perspective. In the Netherlands there are a few options to process plastic waste. The waste sorting and processing techniques greatly developed in the past 10 years, consequently, there is little rest plastic. However plastics are still incinerated to some extent, and improvement is needed. The required behavioral changes are again discussed from a management level followed by practical implications.

Starting with changes on the strategy level, it is important for waste managers to adopt corporate values as eco-reputation and eco-innovation to move towards a more circular waste management system instead of focusing on incineration and landfilling (Hsu et al., 2016). Hence the strategy must be committed to relieve environmental pressures (Al-Salem et al., 2009). Following from this sustainable objective, several implications are identified.

Waste managers must collect the plastic and transfer it to the waste processing facilities before further processing can occur (Rigamonti et al., 2014). Plastics can be collected through a separate separation scheme (SS), consumers separate the plastic themselves and bring it to the designated collection points, after which the plastic is moved to sorting facilities where sorting of poly ethylene terephthalate (PET), poly ethylene (PE), isotactic poly propylene (I-PP), film, mixed plastics (MP) are sorted. This is called source separation. The other option is commingled collection (CC) scheme together with municipal waste, which is also called post-separation (Luijsterburg & Goossens, 2014)

Sorting is the most important step in the recycling loop (Al-Salem et al., 2009). One of the main barriers waste managers face is the removal of coating materials as the paint can be embedded in the plastic, which leads to contaminated recyclate. Unfortunately, currently it is not possible to remove the coating completely.

This sorting brings up the need to communicate with the other actors in the chain. Black plastics for instance, cannot be detected. The plastic residue that cannot be sorted, is currently incinerated, and thus forms a barrier towards a CE (Rigamonti et al., 2014). Other cooperation is needed for the investment in a recycling infrastructure and secondary markets. This must be done together with the government, plastic producers and consumers (Al-Salem et al., 2009).

In order to receive the plastics and process it efficiently, waste managers should also estimate their income flow as the reversed chain is more complicated than the forward chain; there is no stable flow of materials (Agrawal et al., 2015). For this reason, forecasting is important to be prepared on the coming waste flow in terms of transportation and recycling. For waste managers this can be done by gathering quantitative data from the producer and observing consumer behavior.

The technological difficulties show the need for developing more efficient waste technologies (Babader et al., 2016). This includes the tailoring of waste treatment plans to several aspects. For one, it should be as easy as possible for the consumer to contribute to a CE, meaning the waste treatment facilities should be tailored to their users' needs (Thøgersen, 1996). Meaning waste managers should invest in new and efficient processing technologies.

In order to close the cycle and reuse the materials in new products, the plastics must be recycled. Mechanical recycling refers to the recovering of plastics to re-use it in the production of new plastics (Al-Salem et al., 2009). A drawback is that it can only be done on single layered plastics. Moreover, the plastic needs to be separated and washed beforehand. These treatments are costly and energy intensive. Mechanical recycling is usually meant the everyday use of the term recycling.

To summarize the required behavioral alternatives of waste managers, the waste managers need to also develop a sustainable management strategy, develop/support the collection infrastructure, sort the waste, forecast the inflow of waste, and recycle the waste into new materials.

This section showed the behavioral alternatives of the actors in the supply chain. Most important is the communication between them, and adding sustainable management strategies. The other activities differ per action. Now it is known what it is the actors should do, it is not clear why they do or do not do it, which is the main question of this research. In order to analyze this. A theoretical lens needs to be applied which can help explaining their actual behavior and rationalities. This is done in the next section (3.4)

3.4. Theories addressing behavioral changes of companies and consumers

After having identified the required behavioral changes, it must be analyzed what causes these behavioral changes. Hence, a theoretical lens is needed to view the changes of the supply chain actors. Sociological institutional theory is used as the theoretical lens to analyze behavioral changes for the organizations in the supply chain. Meaning, the plastic producers, food producers, retailers and waste managers. In short, this theory looks at drivers and barriers for adoption corporate behavioral changes, and focusses on the influences that shape organization (Li & Ding, 2013). It views companies as embedded in their social environment. Consumers consist of individuals and behave differently as organizations. It logically follows that a different theoretical lens is required for consumers. From section 3.3.4 it becomes clear that consumers need to change their lifestyles. As these are often rooted and related to worldviews and attitudes, worldview theories, theory of planned behavior (TPB), and the reasonable person model are used to explain their behavioral changes. TPB explains the intention to change behavior, while the reasonable person model shows that the direct environment and state of mind are important determinants for behavioral changes. After discussing these theories, they will be used to build the conceptual framework in section 3.5. This section will help answering sub-question one.

3.4.1. Sociological institutional theory

First a small historical overview of institutional theory. In the 1970s a change in organizational analysis occurred (Abrutyn & Turner, 2011). Organizations were no longer seen as a separate entity, but as a part of their environment, which entails several aspects as resources. A new focus had developed on markets, networks, ideologies, culture, and policies. Hence the idea of the organizational field arose. Organizations were not a result from evolution like processes, but from rules, norms and ideologies that made up the organizations environment. Yet this new approach is criticized for cherry picking explanatory factors. Therefore, Abrutyn and Turner (2011) argue that this new institutionalism can learn from the old one. For instance, symbolic exchange through different mediums as money or power, and the circulation of these media between different institutions. While

this can be argued to true, sociological institutional theory still proves to be a useful theoretic lens as it helps to limit the scope. Moreover, due to the limited time of this research a selection has to be made of what criteria to include. Yet Abrutyn's and Turners' (2011) criticism should be kept in mind when drawing conclusions.

On the other hand, Diermeier and Krehbiel (2003), view institutional theory less than a theory and more like a method. It can be used as a tool to guide analysis of institutions and organizations and thereby helps to understand their outcomes. The new institutional theory in this research is also used as a method; a guide to identify drivers and barriers for organizations to exhibit behavior supportive of a CE. More specifically, it is based on DiMaggio and Powell's (1983) version of institutional theory, which will be explained in the following paragraphs (Scott, 2005).

There are two different strands in the institutional theory: an economic one and a sociological one (Li & Ding, 2013). Both strands look at the environmental influence on firm behavior. Yet the economic strand emphasizes changes in the macro-level institutional framework e.g. regulations. Moreover, together with the rational choice theorists, regulatory aspects are emphasized (Scott, 2005). The sociological strand emphasizes the role of isomorphic influences, and is followed in this research. Isomorphism refers to a process where a unit is forced to mirror other units in the populations under the same environmental situation (Dimaggio & Powell, 1983). Moreover, the focus is the cultural-cognitive aspects. Hence on an organizational level, this means that the organization adapts to its environment in order to be harmonious. Later on the different types of isomorphism will be explained.

In this research the sociological institutional theory is adopted because the economic one tends to overlook the social aspects, while companies do need social legitimacy to flourish in their environment. This social legitimacy is gained by resembling other companies in the field (Li & Ding, 2013). Sociological institutional theory thus stresses that organizations restructure their behavior and strategies to their organizational field. DiMaggio and Powell (Scott, 2005) were inspired by Bourdieu's (1977 in *ibid.*) social field or space and the societal sector by Scott and Meyer, (1983 in *Ibid.*). Bourdieu's social field refers to the social space in which actors are located based on their habitus, the mental filter for ones' social experiences, and ones' cultural and economic capital, non-material and materials assets (Appelrouth & Desfor Edles, 2008). The societal sector refers to a group of organizations which provide similar services, and the agencies that aim to influence the organization through either support, interaction or attempts to govern them (Meyer & Rowan, 2012). DiMaggio and Powell (1983:148) understood the institutional as the organizations/actors that from the "recognized area of institutional life". Which leads to the conclusion that changes in organizational behavior are not solely internal. Moreover, it is based on the assumption that the field emerged from cultural and network systems. Hence, there was room for agency (Scott, 2005).

Organizational fields start as diversified fields (Dimaggio & Powell, 1983). However, the more eminent the field becomes, the less diversity remains. There is a force towards homogeneity. One should keep in mind that the existence of the organizational field is institutional defined. The institutional definition process contains of several parts; more interaction between different organizations, the development of inter organizational patterns and structures, an increase of information for which the organizations compete, and increased awareness of different organization that they are field. After this field is structured and exists of different companies with similar lines of business, the forces driving to homogeneity in an organizational field become active. These forces are the isomorphism's.

Of these isomorphism's, three different types exist; coercive, normative, and mimetic isomorphism (Li & Ding, 2013). These are the formal and informal pressures on organizations (Dimaggio & Powell, 1983). These pressures are forcefully changing organizations behavior. Coercive isomorphism refers to political influences and developed out of the necessity of legitimacy (Li & Ding, 2013). Following this isomorphism, companies are directly shaped by governmental rules and regulations.

Mimetic isomorphism refers to changes stemming from ambiguity and uncertainty (DiMaggio & Powell, 1983; Li & Ding, 2013). Uncertainty can come from little understanding of technologies, vague goals, or symbolic ambiguity in the companies' environment. Out of this uncertainty, they mimic others in order to seem more legitimate and thereby keep up with the competition (Li & Ding, 2013). This modeling does not have to be known to the organization and might happen unconsciously. It leads however, often to positive effects. Legitimacy again is a determining factor, organizations often model themselves after other companies that they view legitimate or more successful (Li & Ding, 2013). Besides the search for legitimacy, competition is another driver to mimic others behavior. Practices are adopted to become serious competition.

The last isomorphism is the normative one. These are the norms that steer organizational behavior (Li & Ding, 2013). This relates to professionalism. Professionalism is collective definition of members of an occupation to establish the conditions of their job and to create a cognitive legitimate autonomy for their occupation (DiMaggio & Powell, 1983). According to DiMaggio et al. (1983) professionalism creates two types of authority for isomorphism. First, formal education which is seen legitimate as it stems from university specialism. Second, the spreading and expansion of these norms through professional networks. This creates an environment of like-minded persons which in turn reinforces the legitimacy of the shared norms. Li and Ding (2013) illustrate this somewhat more practical as individuals from the same profession developing common norms and in this way guide organizational behavior. It thus refers to the diffusion of norms and a common understanding knowledge on what is legitimate action. It is about common ground and understanding (Li & Ding, 2013). A company must be aware of these norms. Hence awareness is an indicator for normative isomorphism, just as well as pressures from their peers.

In this research, sociological institutional theory is used as both a method and theoretical lens. It helps to identify and focus on the types of drivers. The main elements to take away of this theory are the different isomorphism's (pressures) that lead to institutional change, and the fact that the theory can serve as a method. The isomorphism's are operationalized in section 3.5.1 to build the conceptual framework.

3.4.2. Consumer theories: Worldviews, attitudes, theory of planned behavior, and the reasonable person model.

Consumers are not institutions. Therefore, consumer theory is needed for the understanding of consumer reasoning. For this reason, worldview theories, TBP and the reasonable person model are used to explain consumer behavior change. The overlap with institutional theory is mentioned at the end of this chapter.

3.4.2.1. *Worldviews*

Figure 5 shows that consumers' need to change their lifestyles to facilitate a circular economy. In order to understand lifestyle change, it must be understood where they are rooted in. Hedlund-de Witt et al. (2014) point to worldviews. Worldviews refer to the "foundational assumptions and perceptions regarding the underlying nature of reality, proper social relations or guidelines for living, or the existence or non-existence of important entities" (Hedlund-de Witt et al., 2014: 40). Worldviews are thus deeply rooted systems of interpretation and giving meaning to their environment. It forms the context of environmental attitudes.

Worldviews are built on five different aspects; ontology, epistemology, axiology, anthropology, and a societal vision (Hedlund-de Witt et al., 2014). Ontology contains the basic assumptions on reality and

the environment. This is often the understanding of the creation of the universe. Epistemology refers to the construction of knowledge and what it exactly is. For instance, does knowledge come from scientific inquiry or from a divine supernatural being? The third aspect, Axiology, refers to the valuation of life through morals and quality of life. It's about one pursues in life. The anthropology aspect concerns ones' view on human nature and its role in the universe. Lastly, societal vision entails ones' ideas on society and how societal issues should be tackled.

Two historical streams can be identified that lead to the current worldviews; the enlightenment, and romanticism (Hedlund-de Witt et al., 2014). Following romanticism, nature and society should live in harmony. Understanding came from experience, creativity and individualism. The enlightenment on the other hand aspired a systematic understanding of everything (Hedlund-de Witt et al., 2014). Nature is viewed external. These historical contexts are combined with the self-determination theory, which focuses on intrinsic and extrinsic motivations (Hedlund-de Witt et al., 2014). Intrinsic motivation refers to satisfying internal needs and interests, while extrinsic motivation refers to acting due to an external reward. Intrinsically motivated individuals are more likely more likely to show more pro-social behavior which connects to sustainable behavior.

These theories combined with the five different aspects resulted in a typology of five different worldviews (Hedlund-de Witt et al., 2014). (1) *Inner growth* refers to personal development, and institutions. Individuals with this worldview are often socially engaged and are conscious of their surroundings. (2) *Contemporary spirituality* refers to individuals experiencing the world around them contemporary spiritual; the universe created intelligence (Hedlund-de Witt et al., 2014). (3) *Traditional god* views the divine from a top-down perspective. Moreover, they have a dualist perspective between humans and the rest of creation. Hence they view nature as a distinct category. Furthermore, life is created with purpose. (4) The *secular materialism* worldview is based on dualism of the body and mind, and only believes in utilitarian meaning. Moreover, science is the source of knowledge. (5) *focus on money*, which is actually not an encompassing worldview. Individuals with this worldview believe that the goal of life is to earn as much money as possible.

For sustainable behavior, two aspects are important; willingness to change and instrumentalism; the conviction that nature can be controlled. Worldviews more likely to engage in environmental friendly behavior correlate strong with willingness to change, and weak with instrumentalism (Hedlund-de Witt et al., 2014). *Inner growth* and *contemporary spirituality* correlated both positive with the pro-environmental aspects and negatively with instrumentalism (Hedlund-de Witt et al., 2014). It can thus be expected that individuals in these worldviews are more likely to adopt the required behavioral changes. *Traditional god*, also scored positively on the willingness to change and connectedness to nature, yet also on instrumentalism. *Secular materialism and focus on money* solely correlated positive with instrumentalism and individuals with this worldview are thus unlikely to change their behavior. However, worldview theory is limited as world views are the underlying foundations for certain behavior, hence they do not relate directly to lifestyles. Therefore, it is important to look at consumer attitudes and how attitudes relate to actual behavior.

3.4.2.2. *Attitudes and theory of planned behavior*

Worldviews do not directly link to lifestyles. Attitudes are the linking aspects and should thus be discussed. Attitudes refer to “the collection of beliefs, affect, and behavioral intentions a person holds regarding” certain issues or activities (Hedlund-de Witt et al., 2014: 40). Hence, attitudes are the building blocks of worldviews. According to Hartmann & Apaolaza-Ibáñez (2012) attitudes are causing sustainable behavior, which can be explained by the theory of planned behavior (TPB).

TPB, developed from the theory of reasoned action (TRA) which assumes that behavior stems from intentions (Park & Ha, 2014). Intention in turn refers to the commitment to the behavior. It is related to attitudes as one's intention is determined by its attitudes towards the action. However, attitudes cannot fully explain behavior, and therefore TPB adds two other explanatory factors; subjective norms and perceived behavioral control. TPB views humans as goal oriented beings and they act because they intend doing so (Botetzagias, Dima, & Malesios, 2015). The biggest advantage TPB has, is that it also takes practicality into consideration. Yet recently, TPB is criticized for having a narrow view. Therefore Moral/personal norms are added to the factors that predict intention (Botetzagias et al., 2015).

A person's attitude determines one's expected outcomes (Rex, Lobo, & Leckie, 2015). Moreover, positive attitudes towards an action increase the likelihood of actually exhibiting the behavior. Yet attitudes are also shaped by the experienced rewards. Following Hartmann & Apaolaza-Ibáñez (2012), two types of influential benefits exist, utilitarian ones and psychological benefits.

The utilitarian benefits refer to the practical benefits the consumer gains when opting for the greener option (Hartmann & Apaolaza-Ibáñez, 2012). These practical benefits refer to both consumer health for instance through cleaner air, but also a healthier planet. Other benefits are psychological as the "warm glow" of doing something good which stems from the intrinsic. Another psychological benefit is the ability for self-expression, by showing pro-environmental behavior. Individuals hence want to show their altruism. The third psychological benefit is labeled nature experiences. When the required behavioral change is associated with nature, which is said to activate positive emotions which positively reinforces the pro-environmental behavior.

Another behavior predicting factor are subjective norms. Subjective norms are the norms of others important to the individual mixed with one's willingness to comply to others' expectations. Hence their feelings towards the social pressure (Paul et al., 2016). A positive subjective norm is most likely to lead to the action. Social pressure is thus effective due to two reasons. 1) people tend to express what they believe are the right and socially accepted attitudes (Park & Ha, 2014). 2) There is no right attitude. Hence it is about the perception high valued people possess. In uncertain situations, individuals use others' behavior as guidelines for their own. Similarities with the mimetic isomorphism can be found.

Borrowing from the Norm Activation Model (NAM), personal norms result from awareness and ascription of responsibility (Park & Ha, 2014). These norms are the self-expectations for one's behavior, and are rooted in the norms and values someone has regarding a type of action. In order for norms to lead to behavior, one must be aware of the impact his behavior has on others (awareness of consequences) and he must feel responsible for the results of his actions (ascription of responsibility).

The third factor, perceived behavior of control refers to the individual's idea whether he has the ability to actually perform the required action (Rex et al., 2015). When an action is easy to perform, it is more likely that it will actually be performed. Kaplan and Kaplan (2009) explain in more detail how this works with their reasonable person model.

3.4.2.3. Reasonable Person model

Even if consumers have the "right" attitudes to adopt the required behavioral changes, often, there is still a value-action gap (Park & Ha, 2014). The reasonable person model (RPM) of Kaplan and Kaplan (2009) could shed light on this. Especially on the perceived behavior of control.

The RPM is an alternative to the rationality framework, and shows the role of reasonableness in civil behavior (Kaplan & Kaplan, 2009). Unreasonableness can be found in environmental problems; using resources for profit, while leaving nothing for future generations. It can be said that individuals should

be in a reasonable mind set to engage in a pro-environmental behavior. However, reasonableness is situational. Zimbardo's (1973 in *ibid.*) prisoners experiment and Milgram's obedience research showed that normal reasonable people can turn unreasonable in certain situations. Hence, ones' environment is influential. An important aspect of environments is that they send of information (Kaplan & Kaplan, 2009). Humans are information processors and prefer environments in which information is easy to process. It can be said that easy interpretable situations lead to more reasonable persons.

Building further on humans as information processors, humans have three types of informational needs (Kaplan & Kaplan, 2009). First, individuals build mental models, which refer to the mental representations of the reality, and from which behavior derives. However the environment can inhibit the working of these models, by an information overload or too less information. Humans are keen to explore, yet want to avoid confusion and are likely to go back to "safe" familiar situations. Second, meaningful action; humans are social creatures and need to feel like their actions matter (Kaplan & Kaplan, 2009). If not this results in frustration. Hence participation is important; it allows to exhibit meaningful action. Yet the participation has to be visible to others. Third, humans need to feel effective, and for this they need to be clear-headed and have the right abilities (Kaplan & Kaplan, 2009). As information is the basis for human functioning, information needs to be correctly managed to be effective. Hence clear-headedness is needed as it allows one to capable of acting reasonable. For example, when one is tired it is harder to maintain attention. However, one also needs to right skills and motivation (be capable).

How does this relate to circular economy or even sustainability? Climate change for example. There is not massive action taken on such a big problem although many behavioral alternatives are presented (Kaplan & Kaplan, 2009). Often it is perceived as a big problem in their mental model, which is unlikely to be solved by individual action. Hence their action towards it is perceived as ineffective. Awareness campaigns should present problems in such a way that it alters ones mental model and problems become solvable. Hence, they need to feel like they can control the problem in order to act (perceived behavior of control) Moreover, clear-headedness and attention are important for reasonable action. If one is tired after a long working day, he is more likely to not engage in pro-environmental behavior if this requires too much effort. This shows that pro-environmental behavior should be made as easy as possible to reduce the action value gap. Reasonableness is hence the bridge between ones environment and ones' behavior.

3.5. Conceptual framework

Now these theories must be combined into a conceptual framework. The conceptual framework presented here is based on the framework designed by Zhu & Geng (2013) but is extended with extra barriers as identified in the literature. The drivers are mainly based on the sociological institutional theory. Figure 6 illustrates the conceptual framework.

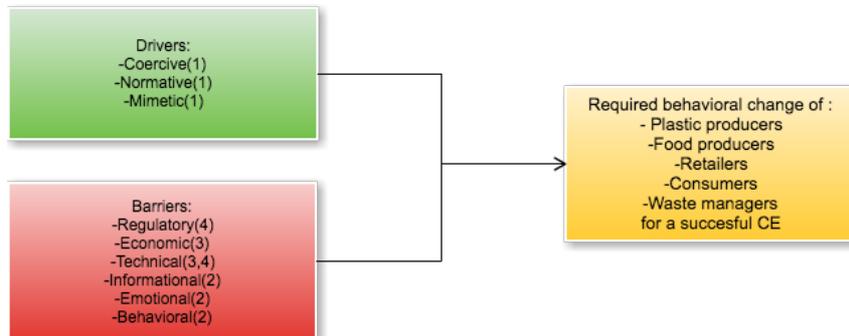


Figure 6 Conceptual framework based Zhu & Geng (2013)¹, (Lozano (2012,2013)² & Vermeulen (2006)³ Technopolis-group et al.(2016)⁴.

3.5.1. Drivers

The Drivers of this framework are the operationalized isomorphism's from the sociological institutional theory. The formal and informal pressures of the coercive isomorphism are operationalized in government rules and regulations as these are often directly enforced on organizations, hence directly influencing corporate strategies (Dimaggio & Powell, 1983). *Coercive drivers* are operationalized as rules, regulations and policies from the government. In the consumer theory no other coercive drivers were identified. Hence governmental influences are also for the consumers operationalized as the coercive drivers.

The *mimetic isomorphism* is operationalized in mimicking their successive competitors in uncertain situations companies will mimic successful companies to remain successful and not fall behind the competition and cease to exist. While the underlying mechanism is the same, consumer mimetic drivers stem from high valued people, which individuals are more likely to mimic in uncertain situations (Li & Ding, 2013). To be more specific, for organizations following market trends, and mimicking the competition in uncertain situations are operationalized as mimetic drivers. As this is purely about copying successful competitors, this kind of isomorphism is likely to follow the status quo and unlikely to lead to innovation.

Normative isomorphism refers to two things; pressure from stakeholders and awareness. This is both true for organizations and consumers. Companies are pressured by external stakeholders to seem more legitimate (Li & Ding, 2013). These stakeholders are their business relations as their purchasers or customers. The same is said for the consumers, only then in relation to their peers. The second form of it is Companies and consumers act a certain way as they are aware of that the action is legitimate; it is the right thing to do. Awareness are ties into the knowledge gap of this research. Its influence on sustainability is partly unknown and remains controversial. Hence it is important to analyze this driver. Concrete this means whether individuals are aware of what is the right thing to do, and pressures from stakeholders.

Table 1 Graphical overview of the operationalized Drivers (Based on section 3.5.1).

Theoretical driver	Operationalized driver companies	Operationalized driver consumers
Mimetic	Mimicking the strategies of successful competition; following general trends	Behavior induced by uncertainty.
Coercive	Behavior induced by regulation and governmental policies.	Behavior induced by regulation and governmental policies.
Normative	Behavior induced by awareness of legitimate actions and pressures from stakeholders.	Behavior induced by awareness legitimate actions and social pressure.

3.5.2. Barriers

Next to the drivers, barriers are in place that inhibit certain behavior (Zhu & Geng, 2013). These barriers could besides hindering change even hinder the efforts of the drivers (Lozano, 2012). Zhu and Gengs (2013) article mainly focusses on drivers. Therefore, the barriers in this theoretical model are complemented with barriers stemming from other articles. Yet Zhu & Geng (2013) mention financial, management support, and human resource capabilities as barriers. These are complemented with Lozano' (2012) barriers and Vermeulen's(2006) practical implications.

Lozano,(2012) seems to have the most clearly formulated barriers and will therefore serve as basis for the development of the conceptual framework. His classification comes from Luthans' (2002 in *ibid.*) categorization of attitudes. Following Luthans, three categories of attitudinal barriers exist; behavioral, emotional, and informational.

The behavioral aspect refers to ones' actions regarding an idea. This is the easiest barrier to identify as it can be directly observed (Lozano, 2013). Specific examples are extra work that comes from the pro-environmental behavior, not institutionalizing sustainability in corporate management, externalizing costs, not using authority, and failing to incorporate sustainable behavior. Hence the behavioral barriers are operationalized in behaviors that are actually hindering a circular economy.

The emotional aspect refers to either the positive or negative feelings regarding the idea or action. Concretely this means not willing to change, not accepting ones influence on the environment, negative appraisal concerning possible solutions, inflexible thinking structures, not deeming CE important, rational thinking, lack of commitment on the management level (Lozano, 2013). Having faith in market driven solutions. Hence, the emotional barriers are operationalized in barriers stemming from non-rational thinking or emotional reactions.

Finally, *the informational* aspect indicates the information/knowledge one has regarding the idea or action (Lozano, 2013). More specifically, this refers to a lack of awareness, unclear business strategies, limited focus on sustainability, and lacking learning options. Subsequently, the informational barriers are operationalized in barriers resulting from or in a lack of information or the inability to gain new information.

Vermeulen (2006) identified six types of implications which can also be translated into barriers. For instance, companies need to accept changes and the risks that accompany it. Hence risk avoiding behavior is a barrier, yet this can be seen as a behavioral one. The second implication is the need to

look beyond short term gains and goals. Only focusing on short term economic gain is translated into an *economic barrier*.

Moreover, Vermeulen (2006) stresses that cooperation between actors in the chain are needed for a well-functioning CE. If not, then this poses a behavioral barrier. The fourth mentioned implication is that innovation is needed, while he might not be talking about technological innovation, the Technopolis-group et al. (2016) study showed that technical innovation is needed and it can also serve as a barrier. Hence *technological barriers* are operationalized in a lack of technology and investment in technological developments.

Moreover, the Technopolis-group et al. (2016) research shows that *regulatory barriers* as hindering legislation or a lack of legislation might be in place. The fifth implication is the need for decision-making tools, which indicates a lack of clear information and can hence be classified under the informational barrier. Lastly, one strategy should be adopted throughout the supply chain by all actors. If not the case, this can be seen as a behavioral barrier.

In this chapter the conceptual framework is presented. The drivers; coercive, normative and mimetic isomorphism and the barriers; regulatory, economic, technical, informational, emotional and behavioral are discussed and operationalized. As this is a conceptual framework, it will be used as a guidance where to look for barriers and drivers in the interviews. With the guidance of this conceptual framework, the drivers and barriers for a CE and in plastic food packaging chain will be discussed.

Table 2 Graphical overview of the operationalized barriers (based on section 3.5.2.)

Theoretical barrier	Operationalized barrier in companies	Operationalized barrier consumers
Behavioral	Actual behaviors that hinder the transition towards CE.	Actual behaviors that hinder the transition towards CE.
Emotional	Negative evaluation towards CE activities as not excepting ones influence on the environment, inflexible thinking and externalizing costs.	Negative evaluation towards CE activities as not excepting ones influence on the environment, inflexible thinking and externalizing costs.
Informational	Lacking knowledge regarding the alternative.	Lacking knowledge regarding the alternative.
Economic	Focusing on gain and short term goals.	Focusing on gain and short term goals.
Technological	Inadequate technology or the lack of investment.	
Regulatory	Hindering legislation.	Hindering legislation.

Part two – Results and Analysis

Introduction to part two

In this part the case study is presented, comprising a desk research on European and Dutch regulations and policies on packaging waste and a literature study consumer behavior. The results of the interviews are also presented for the economic actors. Part two starts with an overview regarding what the Dutch government and the EU are doing currently in regard to packaging and packaging waste regulations as described in chapter 4. This chapter answers research question 2. The government is addressed first as it sets the operational context for the economic actors. The policies and regulations can set targets which the economic actors need to reach, or the government can limit the economic actors' actions. Hence it is important to establish how these policies and regulations target the actors in the chain. After the operational context is known, the results from the interviews with the economic actors and the consumer literature study are addressed in chapters 5-9. It will be explored to what degree the economic actors are demonstrating the behavioral alternatives described in section 3.3 and what the drivers and barriers are in a first step to answer research questions 3-7. Each economic actor has its own chapter. The data in chapter 5-8 data will mainly be based on the interviews.

4. Regulatory and policy context

In the theoretical chapter it became clear that governmental policies and regulations set the context in which the supply chain operates. Moreover, in the previous chapter in the section on barriers (3.5.2), it became clear that regulation can work as barriers towards a CE in the Dutch food packaging sector. While a historical overview of the policy development has been provided in section 3.1.4, showing the long history of waste management and the emphasis on packaging through covenants, an overview of current regulations and policies is yet to be provided. In order to better comprehend why stakeholders are acting in a certain way, the current operational setting consisting of policies and regulations needs to be identified. As the Netherlands is an EU member state, its regulations cannot be seen separately from EU regulations. As mentioned in section 3.1.4, the Dutch regulations on packaging and waste are influenced by the European regulations and Directives. Interestingly, the Netherlands is a leader when it comes to waste management. On that area, it was national regulation that actually influenced the European one. Nevertheless, all these regulations shape the operational settings. Therefore, this section will start out broad by presenting relevant EU regulations and policies, after which the scope will be narrowed down to Dutch regulations and policies. A short overview of these regulations is provided in Figure 7. This sub chapter will end with a small schematic overview of all the policies and regulations and whether they apply to the consumer or the economic actors in the chain.

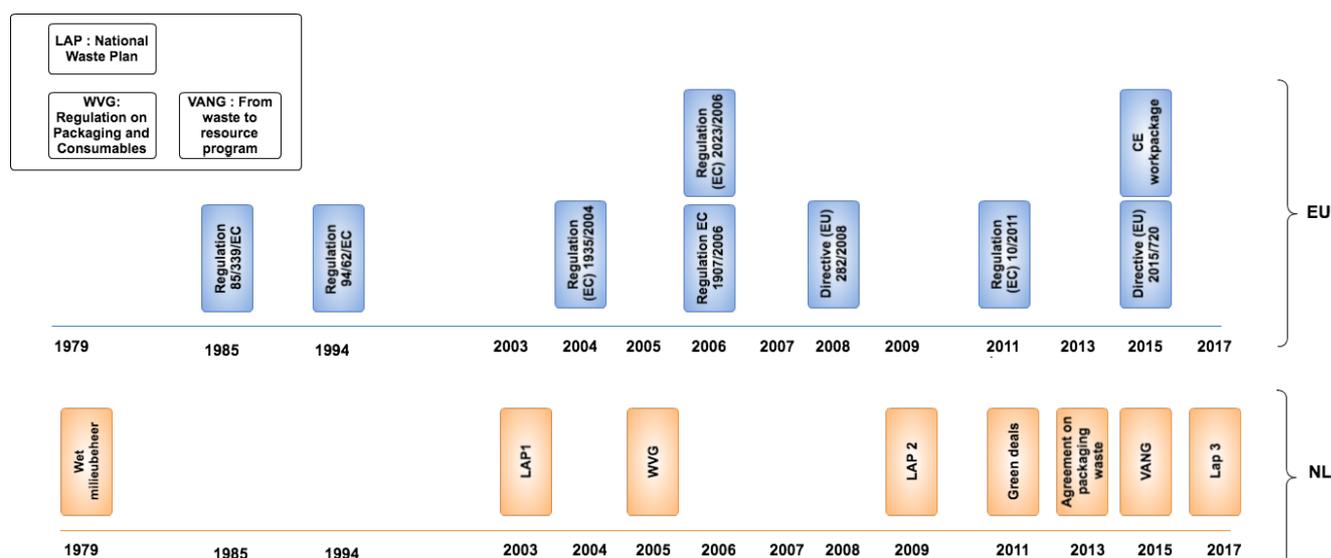


Figure 7 Timeline enforcement of relevant regulations

4.1. Relevant EU regulations and policies

Several EU regulations and directives are to be considered for the CE in the plastic food packaging sector. They range from the general directives on waste management to specific food contact rules. This section will start out with the first more general regulations and directives, which will be narrowed down more specifically.

At the end of 2015 the European Commission adopted a Circular Economy Package which aims to steer Europe towards a CE and simultaneously leads to more jobs and economic growth (European Commission, 2015a). This package is initiated by the EU to remove regulatory barriers for the transition towards a CE. The target formulated in this package includes:

- 65% of the municipal waste needs to be recycled by 2030 (European Commission, 2016b).

- 75% of the packaging waste needs to be recycled by 2030.
- Landfilling needs to be reduced to a maximum of 10% by 2030 for packaging waste.
- Harmonization of definitions and the recycle rate calculations in the EU.
- Promoting reuse, industrial symbiosis, economic incentives to reduce landfilling and the production of greener products, and recovery and recycling schemes.

In order to reach these targets, the Commission is relying on an active attitude of national governments, consumers, and market actors (European Commission, 2015a). The ultimate aim of the package is to completely close the loop for all products with an emphasis on recycling and reuse (European Commission, 2016b). According to the commission, this will lead to both environmental as economic benefits.

4.1.1. Regulations and policies on waste

The most important general directive of waste is the EU Waste Framework Directive (WFD); Directive 2008/98/EC *on waste*. This directive was issued in 2008 and defines the essential concepts in regard the waste management such as recycling, recovery, repair, reuse, and recovery (European Commission, 2016c). Perhaps more important are the criteria for the definition of waste which distinguish by-products, which allows for a less strict criterion for handling than waste. Some basic principles exist:

- Human and environmental health should be ensured.
- The prevention of nuisance.
- The waste hierarchy (Figure 4).
- The polluter pays principle.
- The extended producer responsibility.

Aside from these principles, the directive sets new targets for recycling and recovery, which are to be obtained by 2020 (European Commission, 2016c). These targets state that 50% of the waste should be prepared for recycling and reuse of household waste. 70% of demolition waste needs to be prepared for reuse, recycle and recovery. As it is a directive, national governments are free to implement their own waste prevention and management plans. While member states are free to fill in their own conditions and terms of their waste reduction and management strategies, they do need to reach the targets set for 2020. Therefore, the WFD influences national policies of waste management. Yet as seen in the section on environmental policy development, the Netherlands already reached these targets for municipal waste. Moreover, the waste hierarchy is influenced by the Dutch “ladder van Lansink”. Hence it can be argued that this directive does not have a big influence on Dutch national policy. However, it does illustrate the broader European context and the fact that coercive forces exists in a movement towards a circular economy. Not only on a national level, but also internationally.

4.1.2. Regulations and policies on recycling

An important regulation which influences recycling and the use of recycled materials is the REACH regulation (Regulation EC 1907/2006). REACH stands for registration, evaluation, authorization, and the restriction of chemicals (European Commission, 2016d). This regulation is in place, to protect human and environmental health. This is done by better understanding chemical substances and their consequences for human health and the environment. On a practical level, if the composition of chemicals in a product cannot be guaranteed, the product is not allowed to enter the market (European Commission, 2016d). This responsibility lies with both the manufacturers of the product and the importers.

The regulation was implemented in 2007. As this is a regulation, all member states have to comply. It also directly influences the plastic recycling sector. For instance, recyclers need to comply to this regulation when mechanical processing of the material leads to a mix of substances or when a product is not considered waste anymore (Plastic recyclers Europe, 2016). This means that recyclers have to register all substances and have to follow the set conditions for substances. It logically follows that this leads to extra bureaucratic requirements on recyclers.

4.1.3. Regulations and policies on packaging

Regulations on packaging also exist on the EU level in the form of directives. The first EU directive dates back to 1985 with the Directive 85/339/EEC *on containers of liquids for human consumption* which laid down the rules producing, marketing, recycling, using and refilling of packaging used for products intended for human consumption (European Commission, 2016e).

Directive 94/62/EC *on packaging and packaging waste* was introduced to harmonize the waste management options of packaging for all member states in 1994 (European Commission, 2016e). Again this directive is in place to protect the environment, but also aims to regulate the internal market of by avoiding trade obstructions. The directive was amended in 2004 to clarify the term packaging, and added stricter targets for the recycling and recovery of packaging. The Directive aims to enhance, reuse, recycle and recovery rates. For instance, plastic packaging should be recycled for at least 22.5% by 2008 and 65% by 2025. Moreover, it set criteria for the maximum weight of packaging, the substances and a prohibition on hazardous substances, requirement to design for either reusable or recoverability of the packaging. The most recent version of this Directive is *Directive (EU) 2015/720 amending Directive 94/62/EC on the consumption of lightweight plastic carrier bags*, enforced in 2015.

These directives are important for the Dutch plastic packaging waste management context as certain targets need to be met. Again, the Dutch government is free to decide on the details of their policies, yet these policies are based on the requirements set in the directive.

4.1.4. Regulations and policies on food contact materials

This research is focusing on food packaging specific. As packaging is not allowed to endanger human health, one can imagine that additional legislation is needed on food contact materials. Several legislative acts exist designed to protect consumer safety. The general regulation on food contact materials is regulation (EC) No 1935/2004, which was implemented in 2004 (European Commission, 2016f). This regulation entails rules as:

- Materials are not allowed to discharge hazardous substances.
- The material does not influence the food in regard to taste and smell in an unacceptable way.
- Rules for intelligent packaging, hence packages which mention the storing conditions.
- Rules to allow extra EU regulations for certain materials as plastics.
- Criteria of the safety assessment of the food contact materials.
- Standards for the labeling and usage directions.
- Rules for transparency and traceability.
- Rules set up for compliance.

This legislation is important as it directly influences all producers of food packaging as they have to comply to these rules. For the use of plastics, a special regulation is in place. This is Regulation (EU) no 10/2011, enforced since 2011, which is in place to harmonize the food contact rules for plastics (European Commission, 2016f). Not only is it applicable for actual food contact plastics, but also when it is likely that this will be the case. Furthermore, the regulation provides a list with materials that are prohibited to come into contact with food. In order to ensure safety, specific migration limits exist. The general migration limit is of 60mg/kg food. This regulation only applies to new plastics. For recycled

plastics *Regulation (EC) No 282/2008 on recycled plastic materials and articles intended to come into contact with foods* is in place since 2008. This regulation sets criteria on the materials that are to come into contact with food.

To ensure good quality of food contact materials, there is Regulation (EC) no 2023/2006 *on good manufacturing practice for materials and articles intended to come into contact with food* is in place since 2006. This regulation harmonizes the production conditions of materials that are to come into contact with food (Europe-lex, 2006).

The regulations presented above are relevant this case as they set the standards to which food packaging have to comply throughout the EU. Both plastic producers and recyclers have to meet strict criteria when they are to be used for food packaging. This may entail extra work or documentation.

4.2. Relevant Dutch regulations and policies

Some of the national Dutch regulations and policies are derived from the EU Directives and regulations. Therefore, after having presented the EU rules, the Dutch ones are discussed.

4.2.1. Regulations and policies on waste

One of the regulations is the “Wet Milieubeheer”, enforced in 1979, and in specific chapter 10, which focusses on waste. This regulation is influenced by the European waste framework directive, and was therefore amended in 2011 (Wetmilieubeheer, 2016). Specifically, it states that everyone must act environmentally conscious in regard to their waste. The landfill ban is mentioned in this regulation. It states that a national waste management plan should be designed. This plan will be elaborated on later. This regulation appoints the responsibility of municipal waste collections to the local government, sets criteria for waste water treatment, corporate waste and international transport of waste.

After the amendment of the European WFD, Wet Milieubeheer also had to be changed in 2011 (Wetmilieubeheer,2016). This amendment brought more emphasis on waste reduction and reuse to reduce the pressure on finite resources. Moreover, waste management should be viewed in a more holistic picture of climate change and more sustainable production and consumption methods. The important aspects of this regulation for this case are the landfill ban, which provides an incentive to move towards a CE as simple disposal is not an option anymore. Moreover, it shows the important role of local municipalities, who are responsible for the collection of waste. This also indicates that municipalities are to take an active role in this process and be in contact with waste managers.

The LAP (Landelijk afvalplan translated as national waste scheme) is the Dutch general waste management policy. It stems from the required actions described in the “Wet Milieubeheer”. Since 2003, two LAPs have been designed. The first lap was in force from 2003 till 2009 and the current LAP lasts from 2009 until 2015, and has sets targets 2021. It adopted material policy plan, focusing not on waste, but on material stream and their management (Ministerie van Infrastructuur en Milieu, 2015). Currently a third lap is under development, and is likely to enter force in 2017 (Rijkswaterstaat, 2016).

The LAP has shifted from a waste management approach to a supply chain approach (Ministerie van Infrastructuur en Milieu, 2015). The emphasis is not solely on the end of the chain, but throughout the whole chain as it is difficult to attribute waste to just one step in the chain (Ministerie van Infrastructuur en Milieu, 2015). Several targets relevant to this case study are set which are to be reached in 2015:

- A 95% recycling rate of waste in general.
- A 60% recycling rate of municipal waste.

- Landfilling of residual waste that can be incinerated should be reduced to 0Mton in 2012.
- Adopting cradle to cradle strategies.
- Favoring incineration when products cannot be recycled.

In order to reach these targets, several policy interventions are held. Examples include taxes on disposal, required standards for high quality waste management and permits for these standards. This is applicable for both waste managers and collectors and the separation of municipal waste.

Next to Regulations, there are different policy initiatives in the Netherlands, under the 'green deals'. The green deals were conceived by the Dutch government in 2011 as it realized that it could not tackle sustainability problems on its own and needed innovation and ideas from both citizens and the market (greendeals, 2016).

One of these green deals is the green deal *The Netherlands; hotspot for circular economy*. This green deal involved multiple parties including CircleEconomy, MVO Nederland, (social corporate responsibility Netherlands), the Amsterdam economic board, the minister of economic affairs, and the state secretary of infrastructure and environment. Together these parties aim to transform The Netherlands into a circular economy hotspot and thereby function as a role model for the rest of Europe (Rijksoverheid, 2013). This green deal is active for three years and in these three years, the cooperating partners invest and set up 50 circular projects. This green deal focusses on the investment in a CE, learning of diverse projects, and sharing the acquired knowledge. This green deal is active until the end of 2016.

Another green deal is *the green deal circular purchasing*. 32 public and private organizations are active in this (Rijksoverheid, 2014). These parties started two pilots on the purchase of circular products in which they share information amongst each other and other purchasing actors. The aim is to start 64 pilots and show other purchasing actors in The Netherlands that circular purchasing leads to less wasted resources, CE knowledge, and energy and cost savings. Collaboration in the chain is highly important for this, in which good agreements are needed. Some problems are encountered including reducing the risks of the new earning model due to lease contracts instead of a one-time purchase, a lack of knowledge of the actors and difficulties in learning when interacting in a big group.

4.2.2. Regulations and policies on recycling

The VANG (*van afval naar grondstof*; from waste to resource) program developed out of the second LAP in 2015 (Ministerie van Infrastructuur en Milieu, 2015). This program aims for an enhanced recycle rate as well as more sustainable production and consumption patterns. This program combines the management of resources and materials. Moreover, it was designed to reach the targets set in the LAP. CE has a central position in this program through the following targets:

- 75% recycling of municipal household waste (VANG, 2014);
- 100 kg residual waste per household.
- Reuse of materials and better separation.
- Polluter-pays principle.
- Room for innovation.
- Addressing of market failure.
- Material efficient product and packaging design.
- Bringing the various actors in the chain together.

Extended producer responsibility is stressed for both companies, and consumers. For consumers this is done in several municipalities through the so called diftar-system, in which consumers pay for their amount of residual waste. While municipalities are responsible for waste management, they are

allowed to outsource this to market actors, which is often the case. However, companies still responsible for the recycling and collection of corporate waste.

The VANG program is an initiative of the Ministry of Infrastructure and Environment, Rijkswaterstaat, the union of municipalities, and the Royal NVRD (Koninglijke vereniging voor afval en reinigings management, Royal union for waste and purification management) (VANG, 2014). These parties are required to steer the program in the right directions. They are presented in both the steering group and the program office, which is responsible for the execution of the program as well as monitoring.

In order to reach the targets, various steps are taken:

1. The target formulation of waste preventions, waste separation, and recycling by the municipalities. The municipalities are also responsible for the formulation of action plans and have to be transparent.
2. The municipalities are enabled to act on their targets with the needed knowledge and tools.
3. Citizens are being motivated through the provision of knowledge.
4. Collaboration of actors in the chain to close the cycles (VANG, 2014).

In order to recycle, waste needs to be separated. For this, the green deal on separated waste is formulated (Welink, 2015). The knowledge platform for sustainable resource use, collecting organizations, Milgro, ministry of economic affairs, agriculture and innovation and the ministry of infrastructure and environment are active. Together they stimulate separate waste collection by providing information for consumers on this via their own built website. The central government provides a helping role by spreading the website among the municipalities.

4.2.3. Regulations and policies on packaging

The agreement on packaging (*Raamovereenkomst verpakkingen*) aims to lower the environmental pressure of packaging through recycling and prevention of packaging waste (Ministerie van Infrastructuur en Milieu, 2012). This agreement sets the responsibilities for the packaging companies, the municipalities and the central government. The framework is valid from 2013-2022 and concerns, plastics, glass, paper, wood, metals, and cardboard (Ministerie van Infrastructuur en Milieu, 2012). This framework is also influenced by the European WFD.

An important consequence of this agreement is the financial responsibility of the packaging sector (Ministerie van Infrastructuur en Milieu, 2012). This financial responsibility is organized in the so-called waste fund (*afvalfonds*), which covers the processing of packaging waste. Every year on the 1st of January, the costs for the processing of plastics, metals, paper carton, wood, and glass are set based on the consumer price. In order to determine the contribution to the waste fund, the costs of collection have to be known of 20-30 municipalities which are representative for the Netherlands in 2012. This sets the contribution for 2013. Following a study of the costs for collection, separation and processing of the waste is done. The contribution is based on the costs of the second study for the year 2018. The contribution for the years 2014, 2015, 2016, 2017 is determined by overcoming the difference between 2013 and 2018. In this research, members of the packaging sector are the food producing companies, which require packaging for their products. Municipalities receive compensation from the waste fund if the plastic waste is collected and recycled. Furthermore, the framework stresses the importance of reduce, reuse, and recycle. In the framework, only targets for reuse are mentioned. By 2022, 52% of the plastic packaging should be reused.

The collection, and waste separation systems is also influence by the packaging framework. For one, if a municipality is to switch to post consumer separation, the level of reuse cannot reduce. From this framework contract, an awareness campaign targeting consumers also developed; the plastic heroes

program. This is an initiative of the corporate world to raise awareness that waste is a resource (Ministerie van Infrastructuur en Milieu, 2012).

This agreement is relevant for this research as it shows the responsibilities per actor in the supply chain. The main point is that beside the responsibility of the municipality to collect the waste, the packaging sector is actually financial responsible for the amount of packaging they put onto the market. There is thus a coercive pressure on the packaging sector to reduce the amount of plastic waste. Yet this is not a purely coercive pressure. While some strict agreements are made, there is also a negative economic incentive on the amount of packaging produced. More packaging equals more costs. Hence this packaging agreement seems to have a large influence on the operational organization of the food packaging supply chain.

4.2.4. Regulations and policies on food contact materials

The national regulation WVG (Warenwetbesluit Verpakkingen en Gebruiksartikelen; Regulation on packaging and consumables), enforced in 2005, stems from the EU Regulation (EG) 1935/2004 on food contact rules and Regulation (EU) 10/2011 on plastics specific (Warenwetbesluit Verpakkingen en Gebruiksartikelen, 2005). The WVG implements these European regulations in national legislation. However, the national regulation is stricter than the European one as some materials are not mentioned in the EU regulation, but are included in the Dutch one. For plastics this is not the case, as there is a special EU regulation on this (Section 4.1.4). The Dutch regulations conform with EU regulations concerning the definition of packaging and consumables (Warenwetbesluit Verpakkingen en gebruiksartikelen, 2005). As the relevant aspects are similar to the EU regulations and directive, they will not further be discussed here.

4.3. Conclusion

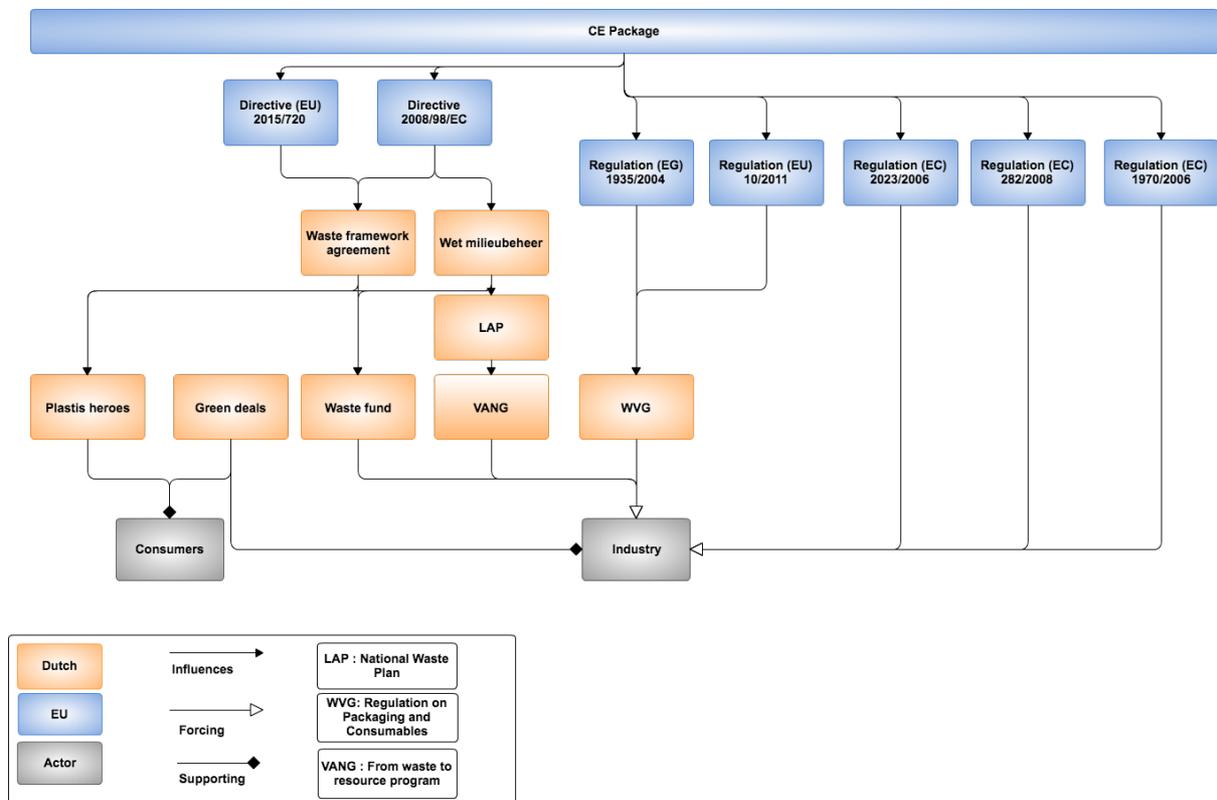


Figure 8 Overview connections between the relevant Directives, Regulations and policies and their impact to the industry and consumers

Figure 8 presents an overview of all the relevant Directives, Regulations and policies. As can be seen, the EU's circular strategy with the CE package forms the broader policy setting in which the actors and other policies operate. The Commission expects the industry, consumers and member states to actively work towards a CE. Fitting into the EU CE strategy are the WFD, and the packaging Directive, which set targets for recycling and the reuse of materials which the individual member states need to meet. The WFD is incorporated in the Dutch Wet Milieubeheer, and led to the adoption of multiple LAPs and the VANG program. The VANG program sets requirements which the various industrial actors in the supply chain have to meet, and hence expects certain behaviors. Together with the packaging directive, the WFD led to the packaging waste framework agreement. This resulted in the waste fund, posing requirements on the industry, and the plastic heroes system, which supports consumers to more recycling. The food contact materials and the special regulation of plastic food contact materials resulted in the Dutch WVG, which places strict demands on the materials the industry can use for food packaging. The food contact materials and plastic food contact Regulations led to the adoption of the WVG in The Netherlands, these, together with the REACH regulation, set requirements on the transparency of the materials, and what materials can or cannot be used for food packaging. The green deals is an initiative of the Dutch government, which facilitates the transition towards a CE for both the industry and consumers. However, not all legislation is supportive of CE. The regulations on food contact materials put strict criteria on the conditions of recycled materials which are to come into contact with food out of food safety concerns. Whether these regulations are indeed constricting the movement to a CE or facilitating it, has to be shown in the interviews. Figure 8 also shows that the Regulations, Directives, and policies demand different things from consumers and the industry. For this reason, the industry actors will first be addressed after which the consumers will follow.

5. The plastic producers

From a linear economy perspective, plastic producers are the first actors in the chain and thus will be analyzed first. First of all, it will be assessed how the respondents perceive sustainability, and what action they take to meet their own perception of it. Following, it will be explored to what degree the producers are exhibiting the behavioral alternatives required for a CE. When this has been described, the drivers and barriers for these behaviors as mentioned by the respondents are discussed. This will be done for all the following actors. It should be considered that the data presented here is purely based on self-reporting.

5.1. Sustainability

When asked about sustainability and their actions towards it, all plastic producers said it needed to be taken into account, yet in varying degrees. A minority considers it as their responsibility and want to contribute to a better environment. However, the majority, sees it as a market driven trend which creates a win-win situation, whereby the producers obtain a positive image, while they are not damaging the environment.

Placing their sustainable behavior in the context of the 9 Rs as described in Vermeulen et al. (2014), it seems that the plastic producers are mainly focusing on Refuse, Reuse, Recycle and Recovery to varying degrees. Reduce is mentioned the most as from of sustainable behavior. The reduce aspect mainly concerned the reduction of plastic materials in the form of lightweight materials, CO₂-emission reduction, and to reduce the amount of energy needed for reduction.

The second most mentioned R is recycling. However, only one respondent mentioned that they use recycled granulate for their production. The rest only mentioned recycling in the context of recycling their production. They do keep in mind that their products can be recycled at their end of life. Hence they include recycling in the design phase, but actively using recycled materials is not done by 3 out of 4 respondents.

Refuse is the third most mentioned R. In each case, the refuse referred to not using petro-chemical materials as oil for plastics, but to the process of bio-plastics. 2 out of the 4 respondents are producing bio plastics. However, one of the respondents is still in the beginner stage of bio plastic production as they are “trying” to make more products from bio plastics. The other respondent claims to already produce bio plastics in order to anticipate on the future. Yet bio plastics only take up 1% of the total plastic production. While this is a first step, it not mainstreamed yet.

The least mentioned R is recovery as it is only mentioned once in the context of thermic recycling, which is energy recovery. One of the respondents mentions this as he claims this to be more energy efficient compared to cleaning the plastic packaging before it can be recycled. This producer noticed this in their pilot project of transforming waste into new packaging; it costs them too much energy to clean the used food packaging. It should also be mentioned that the questions focused on what the respondents are doing themselves in regard to CE, hence working with recycled materials, bio plastics, etc. This could explain why recovery is not mentioned more often.

Table 3 Interpretation of sustainability plastic producers

Interpretation sustainability in R	Times coded
Reduce	11
Recycle	5
Refuse	2
Recovery	1

Plastic producers mainly focus on materials, CO₂, and energy reduction to contribute to sustainable development, as can be seen in Table 3. It could be argued that this is a win-win situation, by reducing materials and their energy consumption, the costs are also reduced. Recycling seems to play a role in the designing process mostly, and to a lesser extent in their own production line. Yet only as one respondent uses recycled granulate, it is certainly not mainstreamed. Bio-plastics are seen as a future development, and some developments are made towards that direction. The next section will elaborate in more detail on the behaviors supporting a CE.

5.2. CE behavior and the drivers and barriers

After having discussed the general view on sustainability of the plastic producers, it is necessary to explore the degree to which the plastic producers are participating in CE facilitating behavior as described in section 3.3.1. Very briefly these behaviors entail: the development of a sustainable corporate strategy, mapping the material streams, designing products for reuse or recycling, taking back materials and cooperating with the other actors in the supply chain. For each behavioral alternative, first the companies with the best practices are discussed, followed by the rest and a possible explanation for the differences between the actors. The drivers and barriers will be discussed per behavioral alternative.

One of the first questions asked during the interviews was what barriers they encounter for a CE, and what them motivates to work towards a CE. The research showed that there is a difference in the producers' understanding of the concept CE. Respondent A immediately understood the term and also claimed the biggest barrier to be that every step of the circle has to match the next one in order to create a cycle. Producer B immediately understood what was asked, and Producer C was also aware of the term CE and already mentioned that sustainability can be addressed from different perspectives; being as energy and resource efficient by either reducing the amount of materials put on the market, or recycling the materials. This company specifically opted for the first option for economic and technical reasons. Yet it shows an understanding of CE. Plastic producer D claimed not to face any barriers as they do not have a demand for circular products, yet when asked about the specific behavioral alternatives, the producer did comply with some of the behavioral alternatives. These included making sure their plastic can be recycled, producing light weight products, and having a sustainability strategy, which will be addressed in the next sections. This shows that the knowledge of the CE concept differs. This particular producer understood CE as recycling, and not the other Rs.

This shows that the interviewed plastic producers have varying understanding of the concept of CE. The difference in understanding CE can partly be explained by personal interest, as the second plastic producer mentioned that he used to be "bio crazy", showing a personal interest in sustainability. This particular producer also wants to be a role model for sustainable plastic production. The other two companies aware of the CE concept also understood the need for CE both for the economic benefits it brings as it gives them a competitive advantage on the market and because they want to contribute to the environment. Hence they view CE as an opportunity. The company which initially was not aware of CE mainly views it from an economic perspective; light weight plastics are cheaper. Moreover, the respondent mentioned that it is up to the consumers to demand CE products, and only then the market will expand. Hence it seems that the producers with a better understanding of CE view it not solely as a "obligation", but also as an opportunity to distinguish themselves in the market.

5.3. Sustainable strategy

All respondents claim to have a sustainability strategy and follow the ISO: 26000 guidelines, but the content of it differs. ISO 26000 has the following implications for producer D: (1) adopting the 7 principles of CSR; accountability, transparency, ethical behavior, respecting stakeholders, regulations,

international standards of conduct, and human rights (MVO Nederland, 2014). (2) identifying and collaborating with stakeholders, (3) integrating the 37 CRS themes, and (4) implementing CSR throughout the organization. It should be kept in mind that NEN-ISO 26000 does not entail requirements and can thus not be used for certificates.

Producer A also works in accordance to the ISO 26000 guidelines. In addition, the producer has a more elaborated sustainability rapport. Moreover, producer A also uses 100% green electricity, their transport is CO₂ neutral and they work with mentality and physically disabled people. More practical examples are the focus on light weight and bio based materials, and claims to not use recycle as the technique does not allow it yet to meet the strict legislation (Regulation EC 10/2011). Hence this producer looks mainly at the reduce and refuse loop.

Producer C also following the ISO 26000 guidelines and just as producer A, it as an elaborate sustainability report. Also Producer C focusses on reduce by opting for lightweight packaging, and thereby reducing energy. In addition, the producer does not use laminates, which is using multiple layers of plastics on top of each other. This makes recycling difficult and expensive.

Producer B also follows the ISO 2600 guidelines; however, their sustainability report cannot be found on the website. Nonetheless, producer B is the only respondent who works with light weight plastics, and recycle.

Producer D follows the principles of NEN-ISO 26000:2010. The producer is registered by MVO Netherlands (Corporate social responsibility (CSR) organization) and allows them to monitor their compliance to the ISO guidelines. Producer D has no other specific sustainability strategy. Producer D also focusses on the reduce loop by investing in lightweight materials. Moreover, its production waste, the waste that is generated during production, is used for non-food products to avoid regulation EC 10/2011. While this is not closing the plastic food packaging chain, it does minimize the production waste.

Producer D purely acts from a cost-benefit approach, which could explain why this producer is solely focusing on lightweights, thereby reducing costs. Hence for producer D, is mainly mimetic driven. Producer C, also solely focusses on lightweight packaging, but sees lightweight packaging as a way to reduce energy and CO₂ emissions. This producer claims to take sustainability very serious, but again mainly because their customers demand it nowadays. Thus they are normatively driven.

Producer A on the other hand produces bio plastics next to light weight plastics. Next to the competition argument and anticipating on future market developments, this company also claims that they want to bare their corporate responsibility. They view the competitive advantage that it brings with it as a beneficial side effect. Hence a normative driver can be identified. Producer B, who also produces with recycle, also states that their sustainability program is mostly economic and image driven. However, when asked about producing with recycles the producer mentioned that it was very expensive, but they want to function as a role model. This seems to stem from both a normative as a positive image argument.

Several barriers were also mentioned by the producers. Most noticeable was producer D, who claims to encounter no barriers for their sustainability strategies. Producer C does encounter barriers, mostly economic barriers as the respondent mentions that it must be affordable. However, he does view the sustainability strategy as a long term investment. Moreover, he sees it as a different approach to investing.

While producer A has a more elaborate sustainability strategy as shown in their sustainability report, it also encounters more barriers. Besides the economic barrier, as consumers are not always willing the

pay the extra price, he sees the technology as a limiting factor. For one, there is a technical limit as to how thin the plastic can be made, and second due to the different materials in bio based plastics, the production process is slower. This makes it more expensive, and it cannot be used for all products. For example, bio plastics are less heat resistant. Regulatory barriers are also mentioned; there are too many different regulations and certificates, which makes it hard to know what is right.

Interestingly, all producers, except B, claim that it is not possible to work with recycle as the technology does not allow to meet the standards from Regulation EC 10/2011. However, as producer B shows, while it is expensive, it is possible. Hence for the other 3 producers an informational barrier can be identified. Producer B on the other hand, sees the high cleaning costs as a barrier.

Table 4 Sustainability strategy plastic producers

Producer	ISO 26000	Systematic strategy	Uses recycles	Uses bio plastics	Using light weights
A	+	+		+	+
B	+		+	+	+
C	+	+		+	+
D	+				+

Table 5 Drivers sustainability strategy plastic producers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C		+	+
D		+	

Table 6 Barriers sustainability strategy plastic producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A	+			+	+	+
B	+			+	+	+
C				+		
D	+					

Producer A, B, and C seem to have the most elaborate sustainability strategy in place. The difference between these producers and producer D might come from the fact that A, B, and C not only are motivated by mimetic drivers, but also normative ones. They also see more opportunity in having this strategy. Regarding the barriers, producer D claims not to face any, yet as the others do face them, it could be questioned whether this is a socially desirable answer. However, this can be said for all respondents. The main faced barriers are economic, technical, and regulatory ones according to the respondents themselves. Nevertheless, a technical barrier mentioned by A, C, and D is proven by B to be an informational barrier.

5.4. Mapping the material stream

The respondents were asked to what extent they are conducting LCAs for the products they produce. All respondents answered no. Producer A mentioned that they use LCAs in their designing phase, but they do not conduct LCAs themselves. Producer D and B also mentioned that they do not conduct LCAs. Hence a behavioral barrier is in place. They do monitor the amount of plastic materials that are put into the market, but it stops after that. Producer C is planning to do this in the near future, as more of their customers are asking for LCAs. Hence producer C is normatively motivated to start conducting LCAs.

Producer	LCA	No LCA
A		+
B		+
C		+
D		+

Table 7 Drivers designing for recyclability and durability plastic producers

Producer	Coercive	Mimetic	Normative
A			
B			
C			+
D			

Table 8 Barriers recyclability and durability plastic producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A		+				
B		+				
C		+				
D		+				

5.5. Design for durability and recyclability

As all producers take the recyclability of their products into account, so does producer A during the production process, but not durability. The producer places emphasis on lightweight products and tries to reduce resources in that way. Also Producer D claims that his products are fully recyclable, and that no further developments are needed there. However, he does not mention design for durability at all. The products of producer C are also recyclable, yet the respondent makes it seem like it is a coincidence as they do not work with laminates and focus more on the reduction of materials by producing lightweight packaging. Producer B as well solely focusses on the production of lightweight materials.

Producer A takes recyclability into account as it creates an extra source of income. By ensuring that his products are recyclable, his production waste can also be recycled. If he was just throwing his waste away, he would waste money as the materials are not sold. Now that his production waste is recyclable, he can sell it to an external actor, who buys his waste and in turn sells it to a recycling company. This falls in line with a cost reducing, and profit enhancing trend and hence a mimetic driver can be identified.

Producer B's focus on lightweights can be explained by their aim to produce as advantageous as possible for their customers. This results in being cheaper whilst using the least amount of materials possible. As cost reduction is a general market trend, a mimetic driver is in place. According to producer D the production of recyclable materials is market driven. Some of his customers ask for it as it is a society relevant subject. Not wanting to lose customers, recyclable products are produced. Hence producer D is normatively driven.

None of the respondents claimed to encounter any barriers. In explaining why they were not focusing on durability, producers A and C said it was because they are not in the market. Hence this is a behavioral barrier. Producer B claims that the biggest barrier to transform their food packaging in new food packaging that the cleaning process is it being too expensive. They indicated this level of

expense was not only in monetary terms, but also energy wise. The respondent therefore argues for energy recovery through incineration. Aside from the expensive cleaning process, the plastic prices are currently very low, which makes it even less cost effective to recycle their products. This shows that there is also an economic barrier in place.

Table 9 Designing for recyclability and durability plastic producers

Producer	Recyclability	Durability
A	+	
B	+	
C	+	
D	+	

Table 10 Drivers designing for recyclability and durability plastic producers

Producer	Coercive	Mimetic	Normative
A		+	
B		+	
C			
D			+

Table 11 Barriers recyclability and durability plastic producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A		+				
B				+		
C		+				
D						

All producers favor lightweight plastics over durable plastics to reduce the pressure on natural resources. This behavior mostly stems from mimetic drivers. Except for producer D who is normatively driven, and producer C for which it is accidentally that their products can be recycled. As the producers are commercial companies it is logical that they opt for the cheapest reduction possibility as they need profit to sustain themselves and thereby following the market trends of competition. The normative driver also makes sense as they need to secure their customers, therefore they produce what is asked of them. While this can be a push factor, only acting on consumer demand can also function as a limiting factor if companies are not willing to go further than the consumer demand. This is for instance the case with recyclable plastics. Even though the materials are recyclable, it does not necessarily mean that they will or even can be used for food packaging again. The only and main barrier mentioned here is an economic one. The cleaning costs are too high, while the virgin plastics are too cheap. The producers do not design for durability due to behavioral barriers from simply not being in that market.

5.6. Taking back materials

The respondents were asked if the plastic they put on the market also returns to them. As three out of the four producers only work with virgin or bio based materials, their answer was no. The only producer who does use recycle, producer B, who uses recycle from bottles which they do not produce themselves. However, producer B is currently also involved in a project to use recycles stemming from food packaging. They do this as they believe it is the legitimate thing to do and want to demonstrate that it is effective, hence being a normative driver. However respondent B does not believe that this project will be successful as there are several barriers. The main barrier is that the

cleaning process is too expensive and the waste stinks as there are still leftovers in them. It is hard to remove the smell and hence an economic barrier is in place. For the rest of the producers there is an informational barrier in place as they believe it is not allowed or possible to get recycled food contact approved.

Table 12 Taking back the produced materials plastic producers

Producer	Yes	No
A		+
B	+	
C		+
D		+

Table 13 Drivers designing for taking back the materials plastic producers

Producer	Coercive	Mimetic	Normative
A			
B			+
C			
D			

Table 14 Barriers for taking back the materials plastic producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A	+					
B				+		
C	+					
D	+					

As Table 12 to 14 show, materials are not taken back by the plastic producers to be transformed into new packaging. Producer B is the only producer who is actually trying to turn this into a pilot project and showed this is mainly an informational barrier. The other producers have a misconception about the current techniques and regulations. While in the previous section it was mentioned that normative drivers could function as a limitation, it shows that the other side of the normative drivers, being aware of what is the legitimate action, can make companies go further than what is expected of them.

5.7. Collaboration throughout the supply chain

A final but important precondition for CE is that every step in the cycle fits to its sequent step in the chain. This requires collaboration to achieve. Producer B is the only producer who is in contact with other actors in the chain. This is because of their project with a recycler to get recycle from food packaging food approved again as described above. This contact originated from two drivers. First of all, the society prefers recycling. To maintain their image and customers through that image, as a company you have to respond to such a demand, hence a normative driver. Second, there are governmental policies that demand CO₂ reduction. Hence it is a combination of mimetic and coercive drivers.

Producer A has contact solely with its direct customer. While he does take the demands of his customer into account the contact with other actors stops after that. He does not see the added value of having contact with other actors. Also producer D mentions to only have contact with the parties they are trading with. The only time they have contact with waste managers is when their own

production waste is collected. Producer C does not mention it at all. The producers are simply not taking action to get into contact with other actors in the chain, while there is no strong informational or economical barrier in place. Hence a behavioral barrier can be identified.

Table 15 Collaboration with other actors in the chain

Producer	Yes	No
A		+
B	+	
C		+
D		+

Table 16 Drivers for collaborating with other actors plastic producers

Producer	Coercive	Mimetic	Normative
A			
B	+		+
C			
D			

Table 17 Barriers for collaborating with other actors plastic producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A			+			
B						
C		+				
D		+				

Based on the four interviews, it could be said that there is limited collaboration with the other actors in the chain. This mainly stems from a behavioral barrier. The producer who is initiating collaboration is the same producer that proclaims to be a big supporter of bio . Hence there might also be some normative drivers at stake, which makes them respond sooner to recycling demand from the market and governmental pressures. However, it must also be noted that this producer is the only respondent who was aware that recycle can indeed be made food approved. Informational barriers should thus not be underestimated.

5.8. Conclusion

Based on the section 5.1 to 5.7, a summary can be provided in Table 18 to 20. The main points of improvement are the LCA, taking back materials, and cooperation in the chain, while normative and mimetic drivers and economic barriers seem most influential.

Table 18 Overview of conformity to the behavioral alternatives plastic producers

Producer	Sustainable strategy	Mapping the materials	Design durability/recycling	Taking back materials	Cooperation in the chain
A	+		+/-		
B	+		+/-	+	+
C	+		+/-		
D	+		+/-		

Table 19 Overview amount of drivers plastic producers

Coercive	Mimetic	Normative
4	15	17

Table 20 Overview amount of barriers plastic producers

Behavioral	Emotional	Informational	Regulatory	Economic	Technical
4	1	4	7	11	6

6. The food producers

The second category of economic actors in the plastic food packaging chain are the food producers. These are the actors that actually pack the food. The same approach is used as it was for the plastic producers. Briefly, the behavioral alternatives for food producers are opting for a sustainability strategy, green purchasing, extended producer responsibility, green packaging, extension of product shelf life, limiting excessive packaging, mapping the material streams and collaborating with other actors. These will be discussed in the following sections.

6.1. Sustainability

One step further along the chain, food producers seem to have a similar approach towards sustainability as the plastic producers demonstrate. When solely looking at the coding pattern only a slightly different pattern appears as Table 21 shows.

Recycling is the most mentioned R. Recycling plays a role in the designing phase, designing packaging so that it can be recycled at its end of life, but also in the use of recycled materials, which did not play a large role at the plastic producers. Moreover, the food producers claim that technology is currently so far developed that the recycled PET meets the food contact materials requirements.

Reduce is a later step in the chain. Again the focus here is on lightweights. This frequently occurs in collaboration with their suppliers, which are the plastic producers. Hence the focus on lightweight packaging is logical. However, multiple times it has been mentioned that there is a limit as to how thin the packaging can be made. Product quality is the highest priority.

The refuse loop refers again to the use of bio based materials. Some food producers are already using PET made out of plants, while others are still reviewing their options. However, they do acknowledge that they have to move away from fossil fuel based plastics. It seems that they are already anticipating future trends and therefore already looking in alternative sources for packaging.

Table 21 Interpretation of sustainability food producers

Interpretation sustainability in R	Times coded
Recycle	7
Reduce	6
Refuse	4
Reuse	1

The interviewed food producers seem to be invested in sustainability. Currently the biggest focus is on the recyclability of their packaging and using recycled materials for packaging to close the loop. At the same time, they are focusing on reducing the amount of materials used through lightweight packaging and are future oriented by anticipating the move away from fossil fuels which they see as inevitable.

6.2. CE behavior and the drivers and barriers

In contrast to the plastic producers, all food producers were aware of what a CE is. Producer A immediately mentioned that CE is a very complex principle, and that the biggest barriers are to have every actor in the chain working together towards a CE. Consumer behavior was also mentioned as one of the biggest barriers. For this company it is common sense to not deplete the natural resources,

while at the same time they see CE as a way to anticipate on future trends. Hence, this seems to be mainly a normative driver.

Producer B also immediately understands what is meant by CE. Their focus is on renewable materials for packaging, while there are a lot of options and information available. This large choice makes it difficult to know what the right decision is. Hence an informational barrier is in place. This company specifically mentions that costs are the biggest barrier; even if they are committed to a CE, the customer still has to buy their products. The main problem with CE products is that the consumer does not always recognize the added value. This company still invests in a CE as they see it as their responsibility to the planet and the society. Partly this company is thus normatively driven. However, it is also mentioned that they need to secure the planet's resources as otherwise they don't have the resources to sustain their business anymore. They also feel pressured by the interest of retailers and consumers for green products.

Producer C also understands the concept of CE, but their main reason to participate in CE is pressure from the consumer side and the government. Moreover, this company mainly focusses on the reduction of plastic in order to save costs. Hence this company is mainly reacting on normative, coercive, and mimetic drivers. The mentioned technical barriers; you can only reduce your weight to a certain level, and the costs; CE products are more expensive according to this producer.

Producer D wants to demonstrate corporate responsibility, but at the same time mentions that they are vulnerable to consumer demands and questions. If consumers really demand something, the company has to address those issues. Additionally, they want to create a competitive advantage through sustainability. Hence normative drivers are in play. The main barriers they encounter are economic as for new materials new machines are needed, and regulatory as their packaging has to meet the food contact rules.

All of the food producers interviewed seem to be aware of CE, and are motivated to work towards it. Two out of the four companies see CE as a way to anticipate changes in the economy, and are hence long term focused. Producer B particularly claims to take its responsibility seriously as they are a large producer. The companies seem to be mainly vulnerable for market demands. Interestingly this section shows again that the companies who are driven by both sides of the normative drivers, seem to be more engaged in sustainability. Solely reacting on consumer demand seems can also serve as an excuse to not act sustainably yet.

6.3. Sustainability strategy

All food producers have sustainability reports, as with the plastic producers the content of it differs. Since 2011, producer A has a very broad sustainability strategy involving the following topics: women, environmental protection, water, well-being, sustainable packaging, human rights and sustainable agriculture. Moreover, they have set sustainability goals which are to be reached in 2020. For instance, at least 40% of their bottles should be produced from recycled PET, a goal which they already reached for the Netherlands, and 75% of their packaging should be recycled. In addition, they aim to reduce their CO₂- emissions by 1/3 per bottle. They report their progress through the GRI (Global Reporting Index) guidelines, which are international standards for reporting on a company's influence on the environment, society, and the economy. In addition, they comply with the ISO 14001 standards which is a plan to design the company in such a way that it reduces its environmental impact.

Producer B also has two sets of sustainability goals which need to be reached by 2020 and 2030. Moreover, they want their brand to be associated with sustainability. They have an elaborate sustainability plan setting goals for the health of their customers and employees, for their

environmental impact and aim to enhance livelihoods. Some examples of these goals are to reduce the environmental impact by half for all their products, sustainable agriculture and to reduce their impact to climate change. Their reports are elaborate, they are also reporting through the GRI index and are ISO 14001 certificated.

Producer C follows the same ISO 26000 standards as the plastic producers do. However, since 2012 there has not been a special sustainability report, but it has been incorporated in the annual report. Yet in the annual report, only 3 pages are dedicated to sustainability. A big part of their sustainability plan is attributed to social responsibility; providing healthy products for society, and ensuring proper and safe working conditions for their employees. Regarding environmental sustainability, they have set their own environmental standards to which their suppliers must comply. They also aim to have their supply chain completely sustainable by 2020 through reducing their CO₂-emissions. Moreover, they report their sustainability practices through the GRI system. For plastics specifically, the respondent mentions that they have a strategy in which they try to do their best by looking into materials that can be recycled for their packaging. They do this together with their supplier.

Producer D has a corporate sustainability strategy in which they look at the environment, nutrition, people, their agriculture and communities. One fifth thus looks at their ecological footprint in which they look at climate, water, and waste. In this waste section they specifically mention that they aim to reuse packaging waste in their supply chain. They also report their scores on sustainability through the GRI index, which is included in their annual report. However, their sustainability strategy only takes up 5 pages in their annual report. They are ISO 14001 certified.

Producer A appears to be one of the more-future oriented companies and sees the necessity of sustainable behavior to ensure future success. Moreover, they aim to be a role model with their and start the sustainable movement in the industry. Hence normative drivers are at play. The biggest barrier here is the consumer. In order for the company to return their products, consumers must separate them properly, which is not always happening. Hence a behavioral barrier is present.

Producer B sees sustainability as a key development. They formulate it more strongly by stating that if you not invest not in recycled products, you are too late to use the shift as a competitive advantage. At the same time the company aims to take responsibility and give back to the society. They claim that if you are only moving into sustainability from market demands you will not be very successful in it. Yet this pressure is important. Thus for this company normative drivers are also important. Both the costs and technique are the biggest barrier, yet it is also an informational barrier for consumers to understand the added value of CE products.

Producer C is mainly one-sided normative driven and coercive driven as the company acts on consumer and policy pressures. They claim not to encounter any barriers. While this could be because they have a good functioning system, it might also be that they have a less ambitious sustainability plan than producer A and B. Producer A and B seem to go further than meeting already existing criteria, but claim to set ambitious goals to start movement in the sector. Hence more barriers can be expected. While producer D mentions that everything extra other than pure the production process increases the costs, however they view it as a long term investment, as it in the end attracts more customers. For producer D, mainly one sided normative drivers exist

Table 22 Sustainability strategy Food producers

Producer	Certificate	GRI	Sustainability plan	Long term targets
A	ISO 14001	+	+	+
B	ISO 14001	+	+	+
C	ISO 26000	+	+	
D	ISO 14001	+		

Table 23 Drivers sustainability strategy food producers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C	+		+
D			+

Table 24 Barriers sustainability strategy plastic producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A		+				
B	+					+
C						
D						

While all interviewed food produces have a sustainability plan, producers A and B seem to have a more ambitious one than producers C and D. This difference also becomes visible when looking at the different drivers. C and D are mostly one-sided normative driven; they react on the market. Producer A and B are also acting on the other side of the normative drivers. As one of the respondents mentioned himself; purely reacting on the market is not enough, you must convince that it is the right thing to do. This statement could explain the differences in sustainability plans.

6.4. Green purchasing

Producer A stated that they have developed a packaging strategy as a first step to sustainability, together with their suppliers. Their main focus is on reducing the amount of materials used, as long as the technology lets them. They also use plant-based PET, and already reached their target of using 40% recycled PET for their bottles. Moreover, their packaging is 100% recyclable. Depending on the product their packaging is made between 50% and 25% from recycled PET, and 22.5% is made of plant based PET. Producer B mentions that the purchase of recycled packaging is their main focus. While it is increasing, it is not going as fast as the company would like. Hence they are also focusing on light weights. However, the company does not communicate about the specific percentages. Producer C also pays attention to green purchasing but mainly on the reduction level, not so much using products which are made from recyclate. 10% of their packaging is made of bio-based PET. Producer D combines both the use of light weights and recyclate, the specific percentages of the amount of recyclate is not known. However, 80-90% of their packaging is recyclable.

Producer A is driven by their main sustainability strategy and the same drivers thus apply. One of the most important barrier encountered is the food contact regulation, and the technology sets the limits as to far they can go. For producer B, the same drivers for their sustainability strategy also apply. The reason for producer B's self-perceived slow process is the difficulty with the sorting technique. Even if they opt for materials that can be recycled, there are many different sorts of plastics; PPE, PE, PET. In order to recycle them, a clean mono stream has to be created. Even if there is a mono stream of materials, it also needs to be color sorted. This is very complicated and the consumer cannot be asked to do this for all different types of plastic. Even then not all recyclate can be used for the same type of products. Hence there is both a technical and behavioral barrier. Moreover, the food contact regulations are hindering. According to this respondent each material has to be approved per country in the EU. Even materials that are already food approved in the USA must be tested in the Netherlands too.

Producer C seems to have a different priority than the two companies above. While the producer is actively looking into green packaging and the reduction of materials, their first priority is that it has to meet their quality standards, which implies a technical barrier, and a mimetic driver as it is following regular market strategies. For producer D, economic benefits and their desire to act corporate responsible are the main drivers behind their green purchasing strategy. Cost reduction is economically attractive. Yet again this is only possible to a certain extent. They further encounter problems with the food contact rules when it comes to recycled materials.

Table 25 Green purchasing food producers

Producer	Lightweights	Recycled materials	Biomaterials
A	+	+	+
B	+	+	
C	+		
D	+	+	

Table 26 Drivers for green purchasing food producers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C		+	
D		+	+

Table 27 for green purchasing food producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A					+	+
B		+			+	+
C						+
D					+	+

For many producers, green purchasing of the packaging falls under their broader sustainability strategy, hence the same drivers apply. The barriers differ per behavioral alternative. The main barriers here are the technology, which sets the limits to weight reduction without damaging the qualities of the product, regulatory barriers form the food contact rules, and the role of the consumer at the end of life of the product to ensure its return to the cycle.

6.5. Extended producer responsibility

Most producers mentioned their EPR, with only producer D claiming not to have an EPR. One of the producers with EPR, is producer B. As an international company, they experience different EPR requirement per country. This includes the green dot system in Germany and the required contribution to the *waste fund*. According to producer B, their responsibility does not stop after paying the required taxes as they also promote recycling, collection and the reuse of packaging. Producer A and producer C take only the governmental required responsibility. Producer C solely takes the required actions. Through the agreements in the packaging agreement, they have to participate in the *waste fund*, where packaging companies have to pay a tax over the packaging they use to cover the costs for the waste treatment. They do not encounter barriers here. Producer A on the other hand, also takes back their materials, but does this as it is required in the circular economy package of the EU. Producer A views EPR in the sense of ownership over the materials.

Producer A and C are coercively driven and while they take their EPR, they do not go further than the required action. Producer B is partly coercive driven through governmental policies. This, combined with their wish to take their own responsibility and take care of the environment, makes them go further than just the requirement. The barriers for producer B are again the extra costs, whether it is technical possible, and that the consumer does not always sees the added value of their EPR. The others did not mention barriers.

Unusually, the interviewee from producer D did not seem to be aware of their extended producer responsibility. The *VANG program* and the packaging agreement especially state EPR for packaging companies (Ministerie van Infrastructuur en Milieu, 2012). Hence it is likely that producer D indeed has EPR, but that the interviewee was not aware of it.

Table 28 EPR food producers

Producer	EPR	No EPR
A	+	
B	+	
C	+	
D	?	?

Table 29 Drivers for EPR food producers

Producer	Coercive	Mimetic	Normative
A	+		
B	+		+
C	+		
D	?		

Table 30 for EPR food producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A						
B	+			+		+
C						
D						

The companies take their EPR to different extents. Based on the small analysis above, it seems that a normative driver makes companies go further than just the required minimum standards. The other producers are motivated by governmental policies. The coercive driving companies did not experience any barriers, which can be expected if you follow a government mandated path. Producer B experienced again economic, regulatory, and an informational barrier.

6.6. Green packaging

For green packaging, producer A refers back to their packaging strategy in which they continuously look at possibilities for reduction, recyclability of materials and the reuse of their packaging. For consumer B, green purchase is one of its main interests and they are simultaneously working with other actors to optimize the packaging waste reduction. Producer C is also looking actively at products which do not need packaging. Producer D looks at their packaging procedures when introducing a new product. At that time the system is optimized. For already existing products, this is

done periodically. It often is done when their supplier presents new ideas to reduce the amount of plastic used.

The main reasons given by producer A to look into green packaging are the same as their reasons for the general sustainability; mimetic and normative. Producer B specifically mentions intention. According to the interviewee, without the right intention, you will not get the desired and needed results. Hence normative drivers are at work. Producer D sees it mainly as a way to optimize production and consequently optimizing profit, hence a mimetic driver. Sustainability is an identified benefit.

By reusing of the materials the food contact rules are hindering according to producer A; not everything is always possible due to regulations. For producer C the quality of the product is most important; without packaging the product is not protected and the producer is more vulnerable for food loss, hence income. Another barrier mentioned is that the retail is currently not set on non-packaged products. Furthermore, it requires consumers' extra attention and thus time in supermarkets to pick out non-packaged food, showing that two behavioral barriers are in place. Economic barriers play a role for producer D. As they focus on optimizing systems and optimizing profit, green packaging cannot be too expensive.

Table 31 Green packaging food producers

Producer	Green packaging	No green packaging
A	X	
B	X	
C	X	
D	X	

Table 32 Drivers Green packaging food producers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C	+		+
D		+	

Table 33 for green packaging food producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A					+	
B						
C		+		+		+
D				+		

While all producers have adopted green packaging, their motivations differ. Normative drivers seem to play the biggest role, followed by mimetic and coercive drivers. Concerning the barriers, economic barriers are most experienced, followed by regulations technical and behavioral drivers.

6.7. Increased durability of products

Only producer C and D commented on the question whether they look at the durability of the product itself in order to reduce the packaging. About producer A and B, little can be said. This could be

explained by the fact that A and B not necessarily sell fresh products, and their product generally have a longer shelf life than the products sold by B and C, for which shelf life extension could make a difference in both their sales and the packaging needed.

Both producer B and C point to the benefits of a prolonged shelf life. If the packaging helps to do so, there is less food loss during production and transport. Hence more can be sold and profits are likely to go up as costs are reduced. Producer C mentions to prolong shelf life for the consumers' interests. If their products are edible for a longer period of time, consumers are more inclined to buy it as it also saves them money. Hence it could create a competitive advantage. The producers are mainly driven in a mimetic sense for this behavioral alternative. Producer D also mentions that this is something that all of their competitors do.

The current state to technological developments is the biggest barrier for these two producers. However, Producer C also mentions that costs are a barrier, as for new techniques often new machines are needed. Then there is the fact that fresh products can only be kept edible for a limited amount of time.

Table 34 Increased durability of products food producers

Producer	Increased durability	No increased durability
A		
B		
C	+	
D	+	

Table 35 Drivers Increased durability of products food producers

Producer	Coercive	Mimetic	Normative
A			
B			
C		+	
D		+	

Table 36 for Increased durability of products food producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A						
B						
C						+
D						+

The main reason to invest in packaging to prolong shelf life does not have to do with sustainability or packaging reduction per se, but is commercially driven. Nevertheless, it has the same effect.

6.8. Limit excessive packaging

All producers are trying to limit excessive packaging of their products. This is often a part of their green packaging strategy, in which reduction plays an important role. For producer A for instance, reduction is the first step in their packaging strategy. For producer B the reduction stems from the reduce sustainability goals. The reduction of excessive packaging is part of this. The same is true for producers C and D.

The same drivers apply as for their general sustainability goals. However, Producer C mentions specifically that a win-win situation is created for them and their customers. There are economic benefits stemming from a reduction in plastics. Both costs are reduced, and they customers appreciate it, and there is a reduction in costs for the customers.

The technology sets the limits again of what is possible. However, for producer B the main barrier is the consumer perception barrier: you cannot change too much of the packaging of your product, otherwise the consumer will stop buying it. Hence the consumer poses a behavioral barrier. Moreover, investment in new technology is currently needed.

Table 37 Limiting excessive packaging food producers

Producer	Limits excessive packaging	Does not limit excessive packaging
A	+	
B	+	
C	+	
D	+	

Table 38 Drivers for limiting excessive packaging of products food producers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C	+	+	+
D			+

Table 39 Barriers for Limiting excessive packaging of products food producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A						+
B		+				+
C						+
D						+

The reduction of excessive packaging appears to be well-developed. This is mainly because it is part of their broader reduction plan. The encountered barriers the technological limits and associated costs, and the consumer perception problem.

6.9. Mapping the material stream

Monitoring the material streams through LCAs is not done by all food producers. Company A does preform LCAs. They are motivated to create a sustainable supply chain, and to reach this goal, they need a knowledge of every detail of their chain. Hence they are normatively driven and barriers are not mentioned. Producer B also preforms LCAs both internally as well as externally for every new product. This producer has developed a tool themselves to measure the environmental impact of their projects, which falls under their project management. Just as with producer A, LCAs are conducted to reach their sustainability goals. Hence they are also normatively motivated.

Producers C and D do not preform LCA's. Producer C uses the packaging which their customer asks for. Hence they only produce on a demand basis. For every packaging they look at quality, costs and appearances. Environmental factors are also taken into consideration, however no LCA is performed.

Hence a behavioral barrier is in place. Producer D also mentions that their company does not perform LCAs themselves. Moreover, the respondent does not know whether this is conducted by an external party. However, for producer D a behavioral barrier is also in place.

Table 40 LCA food producers

Producer	LCA	No LCA
A	+	
B	+	
C		+
D		+

Table 41 Drivers for LCA food producers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C			
D			

Table 42 Barriers for LCA food producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A						
B						
C		+				
D		+				

6.10. Collaboration throughout the supply chain

Producer A has intensive collaborations with the other actors in the chain as they are a chain company. They are depending on the actors before and after them in the chain. Because this company is dependent on their partners in the chain, reaching their sustainability targets is also dependent on their partners. Therefore, they share their knowledge, but also keep track of their partners' sustainability practices. If the partners are not performing well, they will audit them. Producer B collaborates with actors throughout the chain which varies from waste managers, to governmental organizations with who they work together to reach solutions.

In contrast, producer D is not collaborating throughout the chain. The company is focused on their collaboration with their suppliers and their customers, but not with for instance the waste managers. Their main focus is on delivering the best packaging for the best price for their customers and there is no time for surrounding activities. Hence a behavioral barrier is in place. For as far as the interviewee could tell, producer C is also only in contact with their suppliers and their customers, and is listening to their requests. Also here a behavioral barrier is in place.

Producer A is driven by their desire to be a role model for others in the sector, together with creating their own image. Hence they are normative and driven. Producer B is also mainly normatively driven and speaks of taking the shared responsibility together with the broader sector.

Producer A encounters mainly behavioral barriers, especially the companies which are performing poorly on sustainability. Sometimes this leads to a search for different partners who do share the same goal. Producer A is a big company, and therefore also has leverage over their partners in the

chain. This way they can also ensure that their partners will improve their practices. Producer B does not encounter any problems.

Table 43 Collaboration in the Chain food producers

Producer	Collaborating	Not collaborating
A	+	
B	+	
C		+
D		+

Table 44 Drivers for collaboration in the chain food producers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C			
D			

Table 45 Barriers for collaborating in the chain food producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A		+				
B						
C		+				
D		+				

For this behavioral alternative there is a clear difference between the actors. Interestingly, the producers which are also normatively driven are collaborating throughout the chain. The other two companies are solely collaborating with their direct partners for business reasons. The most often encountered barriers are behavioral ones.

6.11. Conclusion

Based on the section 6.1 to 6.10, a summary can be provided in Table 46 to 49. The main points of improvement are the LCA, and cooperation in the chain, while normative, and economic barriers seem most influential.

Table 46 Overview of the participation of food producers in the behavioral alternatives

Producer	Sustainability strategy	Green purchasing	EPR	Green packaging
A	+	+	+	+
B	+	+	+	+
C	+	+	+	+
D	+	+	?	+

Table 47 Overview of the participation of food producers in the behavioral alternatives (Continued)

Producer	Durability	Limit excessive packaging	LCA	Collaboration
X	-	+	+	+
X	-	+	+	+
X	+	+		
X	+	+		

Table 48 Overview amount of drivers food producers

Coercive	Mimetic	Normative
8	10	20

Table 49 Overview amount of barriers food producers

Behavioral	Emotional	Informational	Regulatory	Economic	Technical
4	1	4	7	11	6

7. The Retailers

Retailers are the third type of actors in the supply chain. They also have to change their behavior to be able to better support a CE. For the retail sector, these behavioral changes include: redefining the value chain and designing a sustainable strategy, purchasing green packaging, functioning as a collection point for packaging waste, serving as a gate keeper, and collaborating with other actors in the chain. Before exploring to what extent they are exhibiting these behaviors and why, their general sustainability and CE perceptions will be discussed.

7.1. General sustainability

It appears that the further down the chain, the more recycling is emphasized than reduction. Reduction was mentioned in the context of the abolishment of free plastic bags. This way supermarkets hope that consumers reduce the amount of plastic bags they use. Since the 1st of January 2016 a free plastic bag ban has existed in the Netherlands. However, prior to this time, supermarkets were already enacting this policy prior it to becoming legislation (Rijksoverheid, 2016b). Refuse is also mentioned in the terms of plastic bags, but in this case the supermarkets refused to provide plastic bags and instead promoted jute shopping bags. However, jute bags are more environmentally damaging. One of the retailers admitted to doing this as consumers believe it to be sustainable, even though it is not. Recovery is mentioned in the context of their own waste manager. One of the supermarkets works with a waste manager that mainly focusses on energy recovery. Recycling is mentioned by retailers in different settings, working with recycled materials for packaging, contributing to the recycle deposit system, and using recyclable materials.

Table 50 Sustainability perceptions of retailers

Recycling	Refuse	Reduce	Recovery
5	1	1	1

While all R's are except reuse are mentioned by the retailers, recycling seems to be the most dominant understanding of sustainability. How this translates into CE and the different behavioral alternatives will be shown in the next sections.

7.2. CE

Retailer A interprets CE as a natural system which used to be normal in the past, In this system every was taken into consideration during production. Through globalization and tender principles, getting services based on the price and quality of certain products, we have moved to a linear economy. This retailer has an understanding of the concept CE and sees the global economy as the reason for forgetting this process. He does recognize that there is a reoccurring trend of CE and ascribes this to a common growing consciousness occurring from two reasons; the responsibility to take care of the earth and believes that waste streams are cheaper to process in a CE.

Retailer B is a biological supermarket and a CE hence belongs in their general strategy. Their normative driver is also combined with a mimetic one as many of their customers expect it of them, and the market for it is growing. For retailer B, the barriers are the technological limits. As they inherently want to contribute to a CE, the costs are less of a barrier. Currently tradeoffs still have to be made between either recyclable or degradable packaging. The best would be combined, but this is not yet technologically possible.

Retailer C aims to be sustainable. They aim to be the best performing supermarket in this regard and driven by this competition. As barriers they encounter costs, including the low oil prices which make virgin materials cheaper. Ultimately the consumer has to pay for the more sustainable packaging, which in turn leads to a weaker position in the market. Moreover, in the business model they work with many small entrepreneurs who tend to be more focused on earning money. Hence it is hard to push sustainable plans through the whole branch.

Retailer D views CE as a verb and a process, which gradually has to be implemented. This supermarket's first priority is to supply customers with good affordable products, with sustainability being the second priority. They see CE mainly as something that comes from the societal discourse and as a way to gain a competitive advantage. Hence costs are the biggest barrier.

Overall, CE is known by all of the retailers interviewed. Three out of four are more normatively and mimetic driven while one is solely mimetic driven. Again it was expected that mimetic drives would be important as they are economic commercial actors. The main barriers are also expected of costs and technology.

7.3. Redesigning the value chain and sustainability strategy

All retailers have redesigned their value chain to some extent so that it is in line with their sustainability strategy. Retailer A is a firm believer in CE; according to him it is beneficial for the earth and the body. Despite the claim for sustainability, a sustainability strategy or report has not been made public. However, they have several sustainability projects including CE produced chicken eggs without any soy used, selling locally produced meat, fish, and fruit and vegetables. They also provide collection points for various products. He wants to transfer this message to the consumer, and offers local products. He is normatively driven as these action come forth from their believes that sustainability is the legitimate action. He also notices a demand for these products from his customers. Once they are aware of the CE qualities, they become enthusiastic towards them.

Retailer B has a specific sustainability strategy. In this strategy they pay special attention to waste and their own waste management. For their packaging strategy they aim to use biodegradable packaging materials. This resulted in a saving 78 km² plastics. Moreover, they monitor their value chain periodically, and actively looks for points of improvements. CE performance is one of these checks; they have the target to fully close their waste loops. For this they are ISO 14001 certified.

For retailer C, sustainability is one of their brand values. They aim to be the most sustainable supermarket. Therefore, they also have a sustainability strategy in which they pay special attention to their packaging. They aim for alternative packaging which can be easily recycled and aim to become climate neutral. Their assortment is being tested on sustainability annually, and report this through the GRI standards.

For this alternative, retailer D again stresses the gradual characteristics of sustainability. They do have a sustainability strategy, but the time and situation has to be right and the consumer must want it. The retailer does publish their progress again via the GRI standards. Their sustainability is mainly focused on social sustainability and less on environmental sustainability. In regard to packaging, this retailer makes use of recycled PET, for example for its meat packaging.

For retailer B, sustainability is one of the core fundamentals of their company. They do not just use it as a marketing tool, but they want to ensure that what they claim about sustainability is also correct. In the context of the general perception of CE and sustainability, retailer D, seemed to view it as a second rate priority, but the corporate social responsibility plan is taken serious. They are more focusing on the social aspect of sustainability. This can be attributed to the fact that this retailer mainly

operates in small communities. This way the retailer contributes to the livability of the village and is closely connected to the community. Their customers also expect them to be sustainable. Hence, they have to do it. A normative driver can thus be identified. The reason for retailer C to focus on sustainability comes from the market changes they notice. There is a growing demand for sustainable products. Being sustainable gives them a competitive advantage, hence are both mimetically and normatively driven.

Retailer A mentions that CE products are more expensive, but does not necessarily believe this to be a barrier. It is the small scale production technique that poses a greater barrier. Once CE production is scaled up, these costs will diminish. According to this retailer, you can't simply compare CE and conventional products one on one. The customers accept it and keep purchasing it. Also retailer B experiences a barrier of scale. The retailer is relatively small and therefore has little leverage over other actors in the chain. This makes it hard for them to find for example waste managers who like to experiment with CE procedures. Hence there is a behavioral barrier due to their small scale. The costs sometimes also function as a barrier. The consumer must be willing to pay for slightly more expensive products. Retailer D sees the costs not so much as a barrier, but as the deterrent of the pace of the transition. According to him the transition goes gradual. And they cannot switch in one day to all circular products, as consumers are not always willing to pay for this. The barrier for retailer C stems again from their business model with independent entrepreneurs. If for example the headquarters want to change the packaging for a certain product, the entrepreneurs are free to adopt or reject the idea. This sometimes leads to delays.

Table 51 Sustainability strategy and value chain retailers

Producer	Certificate	GRI	Sustainability plan	Sustainable initiatives
A				+
B	ISO 14001	+	+	+
C		+	+	+
D		+	+	+

Table 52 Drivers for sustainability strategy and value chain retailers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C		+	+
D			+

Table 53 Barriers for sustainability strategy and value chain retailers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A						
B		+		+		
C				+		
D		+				

The retailers are actively redefining their value chain and setting up sustainability program, yet they differ in the extent to which it is written down. For example, Retailer A has many sustainability projects, but does not have a public report on it. Retailer B is the only retailer with an ISO certificate, which makes him score best on this behavioral alternative. In regard to the drivers and barriers, one of the retailers are mainly mimetic driven, while the other three address sustainability from normative pressures. Economic, and behavioral barriers seem to be the greatest factors hindering the redefinition of the value chain.

7.4. Purchasing green products

“The greenness” of the packaging differs per retailer. Producer A is mainly looking into recycled materials and degradable materials for its products. Producer D tries to buy as much as possible packaging from recycled materials. They also use plastics from renewable resources as sugar cane, though this material is not degradable. Retailer C is constantly looking for sustainable packaging; their comparing their previous orders with more sustainable options. While retailer B also works with a purchaser, they still determine what is being bought. Surprisingly, as this retailer appeared to be very sustainable on the other questions, they claim to mainly focus on recyclable materials instead of using recycled materials. However, they are looking at possibilities to reduce packaging for products, and also look at biodegradable packaging

Retailer A does acknowledge that recycled materials are more expensive than virgin materials, but does not take the price difference into account when going for recycled materials. He is convinced that it is better and therefore takes the recycled materials. Hence the normative driver seems to trump the extra costs. From the previous sections it became clear that producer C is normative. The demand side of normative pressure becomes extra clear when this specific producer admitted that they implement practices of what the consumer thinks is sustainable, also when it is actually not. This shows that purely action on demand side normative drivers an also have a negative consequence, when the consumers do not have the right information. Retailer B is both mimetic and normative. They want to show that the world can live without plastics, and want to be a role model. On the other hand, they see a demand from their customers.

Retailer A experiences a technical barrier with degradable materials used for packaging and the material has different qualities and looks different. Consumers find this less attractive and less willing to buy products packed in these materials. For retailer D there is a cost and a behavioral barrier. Sometimes alternative packaging is too expensive for them. At the same time, they have a limited influence on what their purchaser buys. This seems to be a behavioral barrier of the purchaser, and of the retailer itself as they could pressure their purchaser more. For Retailer C, costs are also the main barrier, especially when it comes to getting the right certifications for recycled materials. They believe that the regulations are making it extra expensive. Retailer B also mentions the problems stemming from regulations including that it is not always possible to use recycles. Yet for them technology is also a barrier. As producer A already mentioned, the bio based materials do not have the same qualities as conventional plastics.

Table 54 Green purchasing retailers

Producer	Lightweights	Recycled materials	Biomaterials
A		+	+
B	+		+
C	+		
D		+	+

Table 55 Drivers for green purchasing retailers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C			+
D		+	

Table 56 for green purchasing retailers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
<i>A</i>						+
<i>B</i>					+	+
<i>C</i>				+		
<i>D</i>				+		

The retailers are mainly looking into recycled and recyclable materials or materials stemming from renewable resources. This is both normative and mimetically driven. It must be noted that when the retailers only act on consumer demands, this can lead to pleasing the consumer instead of educating them. Previously it was noted that purely acting on consumer demand can put up limitations, but it can also work as a barrier. The main barriers encountered are still the economic and technical ones. Regulation is mentioned as problematic by a few actors, yet others see the need of those regulations and do not view them as barriers.

7.5. Collection point

Every interviewed retailer functions as a collection point for either plastics or other materials such as batteries, clothing, or small electronic consumer goods. However, not all retailers immediately answered yes to this. A retailer who did answer yes right away is retailer A who collects plastics, batteries, and clothing. Most of the products are sold, and the profit is donated to charity. Producer D also functions as a collection point for both plastics and batteries. Retailer C was one of the respondents who initially answered no to the question as many municipalities offer collection services. However, after more questions it turned out that the retailer does function as a collection point for batteries, oil, medicine, and plastic drinking bottles. Retailer B initially answered that they function as a collection point for plastics and glass which are incorporated in the deposit scheme.

Retailer A says it primarily enacts these behavioral alternatives because it is driven by their corporate responsibility and is hence normatively driven. At the same time it attracts more customers, who appreciate the actions taken by the retailer. The retailer also sees it as a long term investment. For producer D the main reason to start serving as a collection point was that according to some monitoring systems, they were not scoring very well on this area compared to other companies, hence they conformed themselves to the market trend. Retailer C and B mainly offer these services as it is obligated by law.

Some practical issues are encountered by retailer A as needing the right permits for their collection site, but this is not experienced as a barrier. Barriers are also not experienced by retailer C, according to him low tech machines are needed, which are easy to put in the store. Only retailer B mentions a barrier. Collection points take up commercial space in the store, which are relatively small.

Table 57 Collection products retailers

Producer	Deposit	Plastic heroes	Clothing	Batteries	Oil	Glass
<i>A</i>	+		+	+		+
<i>B</i>	+					+
<i>C</i>	+			+	+	+
<i>D</i>	+			+		+

Table 58 Drivers for collection point retailers

Producer	Coercive	Mimetic	Normative
A			+
B	+		
C	+		
D		+	

Table 59 for collection point retailers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A						
B				+		
C						
D						

All retailers thus have collection points in their stores. The ones motivated by normative and mimetic drivers seem to collect more than the ones driven by coercive drivers. This could be explained by the normatively and mimetic drivers seeing it as an opportunity to attract more customers, while the other two act out of obligation and hence see it as a burden. This explanation is further strengthened by the observation that only the retailer who is acting out of obligation is experiencing an economic barrier.

7.6. Gate keeper

The gate keeper role is less actively performed by the retailers. It seems that the retailers function as gate keepers by providing collection facilities for specific products. Retailer A counts on consumers to correctly sort their waste themselves. Retailer B takes up a communicative and a correcting role. Meaning they communicate what the consumer can return, and if it goes wrong the retailer adjusts it. The same is true for retailer D and C. Retailer D specifically mentions that they only do the legally obligated. For retailer all retailers it seems that the same drivers as the ones for the collection points are applicable here.

A barrier can be found in wrongful sorting by consumers, which costs the retailer extra time. Retailer D addresses the discussion of the deposit system and the plastic heroes' system. Currently the two systems are coexisting. The branch organization for the retailers wants to abandon the deposit system as it is costly for retailers in terms of commercial space, while the plastic hero system is free. Yet the government insists of keeping the deposit system. According to retailer D, the plastic heroes system collects a broader variety of plastics. Hence it could be said that the extra costs coming from the deposit system function as a barrier for retailer D.

Table 60 Limiting excessive packaging food producers

Producer	Gate keeper	No gate keeper
A	+	
B	+	
C	+	
D	+	

Table 61 Drivers for collection point retailers

Producer	Coercive	Mimetic	Normative
A			+
B	+		
C	+		
D		+	

Table 62 for collection point retailers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A		+				
B						
C						
D				+		

This alternative seems to be quite similar as the previous one. Therefore, the identified drivers are the same. The only barriers identified are the behavioral one by wrong separation by consumers and the deposit discussion, which will not be elaborated further on, as it is outside the scope of the research.

7.7. Collaboration throughout the supply chain

Just as with the other actors, collaboration with the other actors in the chain seems to be the least exhibited behavioral alternative. Retailers B and A are one of the only retailers who is in contact with the other actors in the chain; from plastic producers till the waste managers. Retailer A is actively looking with producers together into what products will be sold in their stores, and they are in contact with waste managers to discuss how the waste can be best processed and to reduce waste as much as possible. Retailer C is not in contact with their plastic producers and seem to trust their supplier in that regard. However, they are in contact with their waste managers. Retailer D only has contact with their own purchaser, but not with the other actors in the chain.

Retailer B needs to do this as they are brand owner and therefore responsible to find the right plastic producers and waste managers. Retailer A is driven by the fact that they firmly believe in a CE and want to contribute to it. Retailer C is collaborating with their waste managers mainly to ensure they keep their end of the sustainability agreements.

For retailer B it was hard to find the right actors in the chain who are willing to experiment with sustainable solutions, as they are small. Retailer A mainly experiences barriers through regulations. According to them the regulations are not very clear and result in a shattered responsibility. It is not clear who in the chain is responsible for what. For retailer D an emotional barrier is identified. This producer simply does not see the added value of collaborating with other actors in the chain. According to this producer, they are connected indirectly with the other actors.

Table 63 Collaboration in the Chain food producers

Producer	Collaborating	Not collaborating
A	+	
B	+	
C		+
D		+

Table 64 Drivers for collaboration in the chain products food producers

Producer	Coercive	Mimetic	Normative
A			+
B		+	
C			
D			

Table 65 Barriers for collaborating in the chain products food producers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A					+	
B		+				
C		+				
D			+			

Two out of the four interviewed retailers are collaborating with all different actors in the chain, one retailer only with the waste managers, and one retailer does not collaborate with all the other actors in the chain. No coercive drivers are at work, but instead are mainly normative and mimetic. For this alternative, regulations are even mentioned as confusing the responsibilities. Yet the biggest reason to not collaborate with other actors in the chain was an emotional barrier; not valuing collaboration.

7.8. Conclusion

Based on the section 7.1 to 7.7, a summary can be provided in Table 66 to 68. The main points of improvement are the sustainability strategy and cooperation in the chain, while normative, and economic barriers seem most influential.

Table 66 Overview scores behavioral alternatives retailers

Retailer	Sustainability strategy	Green purchase	Collection point	Gate keeper	Collaboration
A		+	+	+	+
B	+	+	+	+	+
C	+	+	+	+	
D	+	+	+	+	

Table 67 Overview amount of drivers retailers

Coercive	Mimetic	Normative
2	8	22

Table 68 Overview amount of barriers retailers

Behavioral	Emotional	Informational	Regulatory	Economic	Technical
3	1	4	2	10	4

8. The waste managers

From a linear perspective, the waste managers are the last actor in the chain, yet in a CE they play a very important role, as they control what happens to the waste. Briefly, behaviors necessary for a CE are adopting a sustainability strategy, investing in efficient waste processing techniques, forecasting of the waste stream, providing a collection infrastructure, sorting the waste and following the steps of the waste hierarchy when processing waste. As with the other actors, first their general view on sustainability will be discussed followed by their understanding of a CE, and their participation in the behavioral alternatives.

8.1. General sustainability

The waste managers seem to follow the general pattern which has been identified so far; the further down in the chain, the more the focus is on recycling instead of the other R's. This is expected as there are several targets, both in the "Wet Milieubeheer", and the Waste Framework Directive, on recycling. These targets are directly influencing the waste managers daily operations. Reduce is mentioned in the context of the products some of the waste managers produce. The products they make from recycled materials, they also aim to produce as thin as possible, to save materials, and it comes back in their notion of sustainability. The same is true for the refuse. They see sustainability as not solely recycling, but also the reuse and reduce of the production of materials, and a transition away from fossil fuels.

Table 69 Sustainability perceptions of waste managers

Recycle	Reduce	Refuse
6	2	1

8.2. CE

All waste managers understand the concept of CE. Waste manager A started the company to help the transition towards a CE. He sees it as a solution for the waste problem. The main problems they encounter are the bad reputation of the waste managers, and their products; people expect cheap products, while the cleaning and sorting process is expensive. According to this waste manger, brand owners perceive recycled materials as the result from down cycling and expect them to be cheap, while the cleaning and processing is quite expensive. Brand owners are also reluctant to come out of their comfort zone, as they are afraid of their consumers' reactions as they want their packaging to be perfect. He also mentions that regulations make it difficult to get product food contact approved.

Waste manager B stresses that a CE for him involves avoiding the use of new materials, after which reuse and recycle play a role. This waste manager was inspired to make a change after All Gore's movie 'An Inconvenient Truth', and now wants to pass on this message to their customers. According to this waste manager, society's mindset focused on continuous production is the main problem. He is questioning the morality of the current society, where the current production system saddles the future generations with problems the current generation causes. Besides his moral arguments, he brings up benefits of a CE; less waste, job creation, and less CO₂- emissions.

Waste manager C sees CE not as a simple circle, but in a circle in which all actors are crosswise connected. He also mentions that society has already moved away from a linear economy, but has not reached a CE yet. Therefore, we have to accept that some waste is still incinerated. They are also driven by their aim to contribute to a sustainable society. Also for this waste manager regulations pose difficulties; waste cannot easily be transported outside the national borders, and again the food

contact rules limit what can be done with the granulate. Another general barrier are the laminates which are difficult to recognize for their machines and hence pollutes the mono stream needed for recycling. Moreover, it is difficult to keep consumers motivated to separate their waste. Lastly some of the waste managers have the image of getting rich at the expense of others. While it is not a rich sector, some companies went in with this idea and damaged the image of delivering low quality services.

Waste manager D is motivated to work towards a CE. Their policy is inspired by the waste and recycle regulations of the EU. This strategy also leads them to see several barriers. The first one he mentions the contradictory regulations for import and export, and the reach regulation which makes it difficult to use granulate. According to this waste manager, these regulations create an insecure future for recycling, which keeps investors away. Moreover, they are dependent on companies that have a green corporate strategy, of which there are little.

All interviewed waste managers are aware of a CE and actively try to work towards one. However, their drivers differ. Waste managers A, B, C, are more motivated by normative drivers, while waste manager D is more coercively driven. For these actors, the general barriers stem from regulations, behavior, and a lack of information.

8.3. Sustainability strategy

Waste manager A is a new company, less than a year old, and was launched by people with a history in the petro chemical industry to provide an alternative for the waste surplus. The biggest challenge for waste manager A is to convince the brand owners that they produce quality products.

Waste manager B claims to have a conviction in striving to be ecofriendly. According to this waste manager it is common sense to work with recycled materials and he aims to transfer this message to its customers. In their view the pathway to a CE is in through awareness. This company has a sustainability strategy and is also ISO 14001 and 9001 certified. ISO 9001 certifies the quality of management systems. No barriers are mentioned.

Waste manager C started a sustainability strategy as a reaction to the depleting resources and wants to look for alternative waste management strategies. However, there are complexities both on the consumer and food safety side. The consumer for instance, can only be expected to separate its waste to a certain extent; he/she cannot recognize all the different types of plastic. Moreover, when it comes to food safety, disposable plastics are ideal. This waste manager has the most elaborate sustainability plan in which they focus on CE, the more efficient collection, and collaboration throughout the chain. Moreover, they are ISO 9001 certified and OHAS 18001 for the optimization of water cycles and design and maintenance of water purification plans and report according to the GRI standards.

Waste manager D does not have a sustainability strategy, but claims to work every day to ensure their processes are sustainable. According to him, sustainability is the general market trend. He views sustainability as long lasting, which means they have to be sustainable if they want to exist as a company in ten years. Moreover, their core business is recycling. This all is done without a sustainability plan. No barriers are mentioned.

Table 70 Overview sustainability strategy waste managers

Producer	Certificate	GRI	Sustainability strategy	Sustainable initiatives
A			+	+
B	ISO 14001/ 9001	+	+	+
C	ISO 9001 / OHAS 18001	+	+	+
D				+

Table 71 Drivers for sustainability strategy waste managers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C			+
D		+	

Table 72 Barriers for sustainability strategy waste managers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A			+			
B						-
C		+				+
D						

Table 70 shows that waste manager B and C score best on this behavioral alternative. The most notable difference between B and C is that they are normatively motivated, and the waste manager without a specific sustainability strategy is mimetically motivated; he follows the general trend. This falls in line with the previous noted differences where actors who are normatively motivated went further than the actors who are mimetically motivated. Waste manager A is new, which might explain the lack of certificates and GRI reporting. However, based on Table 70 it can be said that improvement is needed in regard to the waste manager's sustainability strategies.

8.4. Investing in efficient waste processing techniques

Waste manager D is always investing in the newest recycling techniques as they want to keep their recycling plant up to date. This is necessary as they need to compete with Chinese recyclers. Hence they are following the general trend and are mimetically motivated. Their main barrier are the regulations as REACH are becoming stricter which causes insecurity on the future of recycling. This makes it difficult to find investors.

Waste manager B is also investing in the newest technologies. Last year they have invested 6 million Euro in techniques to recycle household waste into garbage bags. They want to show that it is possible to recycle household waste and want to function as a role model. Hence they are normatively driven. No barriers are mentioned.

For waste manager A, new investments in waste processing techniques are not possible yet. The company has existed for less than one year. They are not yet producing food contact materials, but they aim to invest in this in the future. However, whether this is possible depends on their economic success. Hence they are limited by an economic barrier.

Waste manager C mentions that the development to technology is evolving gradually. They invest to keep up to date with the other actors in the market. Hence are mimetically driven. Currently their sorting machines are not able to identify plastic salad bowls and pouch ups. Yet investment in this takes time. Waste management is not a rich sector. Their expenses are covered by the Waste fund, but they do not make a lot of profit. Hence investment in technology takes time.

Table 73 Investing in efficient processing techniques

Waste manager	Investing	Not investing
A		+
B	+	
C	+	
D	+	

Table 74 Drivers for investing in efficient waste processing techniques waste managers

Producer	Coercive	Mimetic	Normative
A			
B			+
C		+	
D		+	

Table 75 Barriers for investing in efficient waste processing techniques waste managers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A				+		
B				+		
C						
D					+	

Three out of the four waste managers are investing in new efficient technologies, which is necessary to process the new products on the market as pouch ups, and to not fall behind the competition. Hence they are mainly mimetically driven as they do not want to fall behind the general trend. Waste manager A and B mentioned economic barriers for investing. The mentioned barrier by waste manager D relates to financial deficits, yet the difficult investing climate is created by regulations, and is hence a regulatory barrier.

8.5. Forecasting

The forecasting of the waste stream is necessary for processing the waste stream efficiently. Waste manager C is the only waste manager that is actively forecasting the waste stream on basis of quantitative data on consumer behavior. They adjust their predictions on a weekly basis and noticed an increase since January 2015. According to this waste manager this reflects the policies of the municipalities to reduce waste. Consumers are very enthusiastic, hence the increase in waste. The forecasting is initiated by the government, and no barriers for it are encountered. Waste manager A, B, and C are not collecting the waste itself and is purchasing it per kilo; they are recycling companies.

Table 76 forecasting waste streams

Waste manager	Forecasting	Not forecasting
A		+
B	+	
C		+
D		+

Table 77 Drivers for forecasting waste streams waste managers

Producer	Coercive	Mimetic	Normative
A			
B	+		
C			
D			

Table 78 Barriers for forecasting waste streams waste managers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A						
B						
C						
D						

This question shows that different types of waste managers exist. In the literature, waste managers are often thought to be a homogenous group. Yet for these waste managers, different types exist; collection companies and recycling companies, not all the behavioral alternatives apply. This explains the low scores on forecasting of the waste stream. Only one of the interviewed waste managers actually collects the waste. For the forecasting no barriers are encountered, and the forecasting company is coercively driven.

8.6. Collection infrastructure and sorting

After the forecasting, the waste needs to actually be collected and sorted. Waste manager C is the only waste manager that is actively collecting and sorting waste before they transport it in mono streams to recycling companies. Here the company experiences problems with post consumer separation. For instance, when a turpentine bottle is leaking in the waste, the whole waste bulk is polluted. Therefore, he argues for source separation. For collection and sorting, there are some technical issues, as machines not being able to detect pouch ups and plastic salad bowls. Not being able to detect the right materials leads to sorting mistakes, and consequentially pollution of the mono stream. Source separation works very well, especially with the diftar-system, which many municipalities implemented. This company is working since January 2015 under the municipality which bears the responsibility of the waste collection. The collection itself is well-arranged. The sorting brings more difficulties. Another mentioned barrier is a regulatory barrier. This is an international company, and sorts the collected waste in other countries. Yet it is very difficult through regulations to export waste. However, the waste manager understands the strictness of the government as in the past some companies damaged the image of the waste managers by delivering bad quality.

As mentioned in the previous section, waste manager A is not a waste collecting company and does not collect and sort the waste itself. However, a waste collecting company is a shareholder of their company and through this shareholder they experience problems in the collection infrastructure. According to this actor, the recycling sector is not professional enough. The founders of this company

have roots in the petrochemical sector where they are used to work with hard agreements, which cannot be said for the recycling sector. As a recycler you can only send badly sorted waste away when you are an important player. Otherwise you do not know whether you receive new waste the next time. Hence there is a behavioral barrier. Recycling companies are dependent on the quality of the sorted materials they receive. However, quality is not really monitored. There are standards which the sorted materials need to meet; the green dot system. Yet, these standards are made 25 year ago, and while the technologies have improved, the standards did not. This does not provide any incentive to enhance the quality of the sorted materials. Moreover, the DKR (Deutsche Gesellschaft für Kreislaufwirtschaft und Rohstoffe mbH) is controlling these standards. This is a commercial recycler and thus has interest to keep the standards as they are. Hence waste manager A perceives there to be regulatory barriers as there is a lack of government regulations.

Waste manager B also does not collect and sort the waste itself and therefore did not comment on this question. However, he comments that the collection and sorting percentage must go up to allow the recycling sector to grow and move towards a CE. Waste manager D does not collect waste itself either, and purchases presorted waste. As far as he knows the collection strategy functions well.

Table 79 Collecting and sorting waste.

Waste manager	Collecting and sorting	Not collection and sorting
A		+
B		+
C	+	
D		+

Table 80 Drivers for Collecting and sorting waste waste managers

Producer	Coercive	Mimetic	Normative
A			
B			
C	+		
D			

Table 81 Barriers Collecting and sorting waste waste managers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A						
B		+			+	+
C	+	+			+	
D						

Only one waste manager of the interviewed ones collects and sorts waste. This company is coercively driven as they work commissioned by the municipalities, who bare the end responsibility for the collection and recycling rates. The collection infrastructure is well developed, yet the sorting needs improvement. Behavioral barriers both at the consumer and sorting side are identified, just as regulatory barriers can take the form of too many regulations and a lack of them. Moreover, the technology is not always able to identify products made of laminates. Which has consequences for the recycling practices later on in the chain; recyclers are dependents on the quality of the materials they receive.

8.7. Reuse, recycling, recovery

After the sorting of the waste, it must be processed, which can be done by reusing it, recycling the materials, or recover the energy from the product. The focus of waste manager A is on recycling. This is their core business and they see this as a way to make the economy more sustainable. They hope to process 30,000 tons of waste this year, and aim for 50,000 tons. They mention that they have a loss of 25%, which is caused by polluted streams. The consumers often throw things mobile phones away, which are not always noticed by the sorters. Hence both a behavioral and technical barrier exists.

Waste manager B produces around 10,000 tons of recyclate. From this recyclate they produce garbage bags of which 98% is made of recyclates. This producer understands CE as the prevention of using new materials, which includes reuse, but his business is focused on recycling. No barriers are mentioned.

Waste manager C mentions that society is no longer in a linear economy, yet has not reached a CE. Therefore 10% still gets incinerated for energy recovery. The respondent also mentions that they cannot reach a recycling rate of 90% if the consumer provides more than 10% residual waste, showing the importance of consumer separation and a possible behavioral barrier. As said, the company works commissioned by the municipality and is hence coercive driven. However, they also believe that working towards a CE is a legitimate goal, hence also normatively driven.

Waste manager D is purely a recycling company. Therefore, it only purchases products that can be recycled. As mentioned before they are driven by the European recycling targets. The waste manager mentions no barriers.

Table 82 Reuse, recycle, and recovery of waste managers

Producer	Reuse	Recycle	Recovery
A		+	
B		+	
C		+	+
D		+	

Table 83 Drivers for Collecting and sorting waste waste managers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C	+		+
D	+		

Table 84 Barriers Collecting and sorting waste waste managers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A		+				+
B						
C		+				
D						

Table 82 shows that most waste managers focus on recycling. This is to be expected as three of them are purely recyclers. The respondent which is not mainly a recycling company, but also collects and

sorts waste, also admits that 10% of the waste is still incinerated. The companies are either normatively or coercively driven, and encountered barriers are mainly behavioral barriers from the consumer and a technical barrier. It becomes clear that the companies all aim for the recycling of materials.

8.8. Collaboration throughout the supply chain

Like all the other actors in the supply chain, waste managers should also collaborate with other actors in the chain. Waste manager A claims to do so; they collaborate with parties of which they think they can work towards a sustainable future. These actors vary from brand owners to supporting parties. Waste manager A understands that collaboration is needed for a well-functioning CE, and therefore initiates collaboration.

The biggest barrier for waste manager A is a behavioral one. Every actor has trouble moving away from their comfort zone. This is especially hard when working with a large brand owner; they are less likely to make concessions. There is also a difference between their claim of wanting to use 100% recyclate in 2020, yet when it comes to real changes, they are setting strict demands. They are missing the attitudes of early adapters.

Waste manager B also works together with the other actors in the chain. They are collaborating with big food producing companies and retailers. According to this waste manager, the food producers and retailers are not against recycled products. They understand that the shift away from virgin materials takes time, and technology needs to improve. There are other actors according to him that are against this transition including the plastic producers. He believes their attitude is problematic as they are effective at lobbying. Hence a behavioral barrier is indicated. In addition, he mentions the need for stricter regulations. More regulations demand that certain products are made of recycled materials which would give the recycling sector a boost. This lack of regulations is hence a regulatory barrier.

Waste manager C is collaborating with other actors, from municipalities to big brand owners. They do this as they are aware of the fact that it is necessary for a CE. This waste manager has good experiences; the brand owners are willing to listen, especially when they are sensitive to consumer boycotts. However, at the same time they notice that not all their signals come across, for instance the problems they experience with the pouch ups. They notice a behavioral barrier; not all actors actively change their production methods, some only change by coercive force or when there is a general trend they have to follow.

Waste manager D is the only interviewed waste manager who is not collaborating with other actors in the chain. The waste manager does understand that it is very important to work with other actors, but mentions that there is too little attention for in the rest of the chain. He would like to talk to the producing companies before the product enters the market. Unfortunately, a behavioral barrier is in place.

Table 85 Collaboration in the chain waste managers

Producer	Collaborating	Not collaborating
A	+	
B	+	
C	+	
D		+

Table 86 Drivers for collaboration in the chain products waste managers

Producer	Coercive	Mimetic	Normative
A			+
B			+
C			+
D			

Table 87 Barriers for collaborating in the chain products waste managers

Producer	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
A		+				
B		+			+	
C	+	+				
D		+				

Waste managers seem to have a bigger drive than the other actors to collaborate with other actors; three out of the four respondents do this, and the one that is not collaborating yet would like to do it, but encounters behavioral barriers. The encountered barriers by the waste managers are in line with the observed barriers by the other actors and are mainly behavioral barriers. This shows that a behavioral change of the other actors in the chain needs to occur. Another observation is that the company who is mainly coercively driven for recycling, is the only waste manager which is not actively collaborating with other actors. This is in conformity with observed trends in with the other actors.

8.9. Conclusion

Based on the section 8.1 to 8.8, a summary can be provided in Table 88 to 91. The main points of improvement are the sustainability strategy, investing, and cooperation in the chain, while normative, and economic barriers seem most influential.

Table 88 Overview behavioral alternatives waste managers

Producer	Sustainability strategy	Investing	Forecasting
A	+		
B	+	+	
C	+	+	+
D		+	

Table 89 Overview behavioral alternatives waste managers continued

Producer	Collection and sorting	Recycling	collaboration
A		+	+
B		+	+
C	+	+	+
D		+	

Table 90 Overview amount of drivers waste managers

Coercive	Mimetic	Normative
3	3	18

Table 91 Overview amount of barriers waste managers

Behavioral	Emotional	Informational	Regulatory	Economic	Technical
14	2	10	17	5	7

9. Consumers

Consumers are one of the most important actors in the chain as the products which require packaging are produced for them, and they make the first step of recycling: waste separation. Fortunately for the literature study, already existing data on this topic is available through research of European Commission, environmental NGOs, the Dutch government, consultancies, and academic articles. This section will start with an overview what is already known about sustainable consumer behavior. The policy studies will serve to establish to which degree the consumers are complying with the required behavioral changes for a CE (3.3.4). Yet, as this kind of research is not academic, and therefore no theory or theoretical lens is included, also an overview of academic research on this topic is included. These different scientific approaches will be linked to the theoretical lens applied in this research (3.4.2) and explore whether overlap can be found with the theoretical lens of this research. Hence, are worldview theories, attitudinal theories, TBP and the rational person model explanatory for consumer behavior? After this, the policy studies are linked to the theoretical lens of this research by assessing what it is they are measuring and in which theory they fit in.

9.1. Policy studies

9.1.1. Consumers opinions in regard to sustainability, waste separation and recycling

In section 3.3.4 the required behavior for a successful CE were identified as reusing packaging, demand greener products from the market and actually sorting their waste for recycling. For this section European sources such as the Euro Barometers are used in combination with studies solely based on the complete Dutch population as well as studies on specific Dutch municipalities. The following municipalities are investigated on their recycling and waste separation behavior; Amersfoort, Soest, Lisse, Breda en Velsen.

Starting with European based research on the perceptions of European consumers on the environment. In 2004 and 2014 an Euro Barometer on the attitudes of European citizens towards the environment was conducted. The survey investigated Europeans perception of the environment, the importance the environment in politics, and environmental problems (European Commission, 2005, 2014b). the 2014 survey had 27998 respondents and in 2004, interviews were conducted.

In the Amersfoort study, 2460 respondents participated in the survey, however, the respondents existed mainly of higher educated people. Therefore, this research is not necessarily representative for the Netherlands as a whole (Van de Burg & Visser, 2014). In Soest, 482 respondents participated in the survey, and an overrepresentation of a certain group was not mentioned (GFK, 2014). Hence it can be assumed that it is more representative than the Amersfoort research. In the Lisse research on waste separation, 599 citizens participated (Mira onderzoek & Marintel BV, 2015). Yet the researchers also mention a selection bias as engaged people are more likely to respond. The research on waste separation in Velsen had 1475 respondents and does not mention a selection bias (Van Grootheest & Den Ouden, 2014). The limitations mentioned by the authors should be kept in mind when drawing conclusions.

9.1.2. Green products

Green products in terms of CE fit in with the 9 R's, and the higher they are on the waste hierarchy, the more resource efficient and the better. When talking about green products, the consumers' opinion on the environment should be known, as this can be considered as a precondition for demanding green products; if one does not care about environmental issues, they will not ask for them.

Table 92 EU and Dutch attitudes towards environmental problems (European Commission, 2014b)

Region	Air pollution	Water Pollution	Increased waste	Depletion of natural resources	Our consumption patters
<i>EU</i>	56%	50%	43%	36%	24%
<i>The Netherlands</i>	54%	54%	32%	52%	14%

Table 93 Perceived influence of environmental problems on the daily life of Dutch citizens

Environmental problems do impact daily life	Environmental problems do not impact daily life
66%	31%

Table 92 shows that for the consumer, CE does not yet play a prominent role. (European Commission, 2014b). For the Netherlands specifically, the four main concerns followed the European trend with slightly less concern for air pollution, the growing amount of waste, and our consumption patterns. Hence in the Netherlands, consumers worry about the consequences of their consumption patterns in terms of climate change, depletion of resources and increased waste. However, they view their contribution to these problems low as they do not view their consumption patterns very worrisome. Moreover, if they do not care about the problems consumption brings along with it, it is unlikely that they would pressure companies to adopt green products. Nevertheless, as Table 93 shows, the majority of the Dutch respondents thinks that environmental problems influence their daily life. Hence some action could be expected from the consumer, but probably not in regard to consumption.

Table 94 Dutch citizens pro environmental behavior (European Commission, 2014b)

Individuals can make a difference	Pressuring companies to buy local products	Refusing to buy products with excessive packaging	Buying environmental friendly labeled products	Willing to pay more for environmental friendly labeled products	Willing to buy products from recycled materials
96%	18%	24%	22%	77%	95%

In regards to Table 94, the Dutch respondents believe that they can individually make a difference, yet when looking at the practical actions only a minority of the Dutch respondents “pressures” companies by buying local products, refuses to buy products with excessive packaging, and buy environmental friendly labeled products. Dutch consumers might not be pressuring the industry directly, but are willing to purchase products made from recycled materials and environmentally friendly products. This illustrates the general action value gap.

Table 95 Reasons to purchase products from recycled materials for Dutch citizens (European Commission, 2011).

Quality	Environmental impact of the product	Price
47%	30%	18%

Table 96 Reasons for Dutch citizens not to buy recycled products (European Commission, 2011).

Health and safety concerns	Quality	No clear consumer info on the product	Less appealing look of the product
18%	41%	46%	17%

Table 97 Concerns during purchase (European Commission, 2014a)

Environmental friendliness of the product	Recyclability	Made of recycled materials
40%	35%	23%

When buying these environmentally friendly products, the quality seems to be the most important reason followed by the products environmental impact. The price was the third reason. The main reasons not to buy recycled products are the quality and health concerns (European Commission, 2011). The Euro Barometer 388 on the attitudes of Europeans on resource efficiency questioned this about durable products as washing machines and fridges, and not food packaging yet it does say something about environmental concerns during the purchase (European Commission, 2014a). Table 97 shows that a group of consumers cares, but not yet the majority.

Table 98 Attitudes to own waste generation (Dutch)

Does not feel responsible for generating waste	Does not care about waste generation	Does not know how to reduce waste generation
47%	13%	22%

Table 99 Favored options to reduce packaging waste (Dutch)

Avoiding products with excessive packaging	Drinking tap water to avoid waste
35%	73%

Moreover, almost half of the respondents does not feel responsible for generating waste, others do either not care about their waste production or do not know how to reduce it (Table 98). This reluctance of feeling responsible or simply not caring makes it unlikely that consumers will pressure the food/packaging industry for better CE practices. However, if they try to avoid waste, Table 99 shows that two third of the respondents mentioned that they drink tap water to avoid packaging waste (European Commission, 2014a).

Table 100 Preferred actions to protect the environment (Dutch) (European Commission 14a)

economic incentives on pro-environmental behavior	Stricter enforcement of regulations	Taxing environmental damaging behavior	More action of the producing industry	Reduction of single use plastics	Stop production of non-recyclable plastics	More information on recyclability of the product
54%	33%	29%	95%	94%	93%	91%

Table 101 Preferred actions to protect the environment continued (Dutch) (European Commission 14a)

More government action to reduce plastic waste	Landfill ban	Prohibit micro plastics in cosmetics
89%	82%	79%

Table 102 Preferred alternatives (Dutch) (European Commission 14a)

Promotion alternatives	plastic bag	Raising awareness	Encouraging recycling
44%		36%	30

While a large share of the consumers does not feel responsible themselves or not care, the majority also thinks that the industry is not doing enough to protect the environment. (European Commission 14a) Table 100 and Table 101 show that the favored solutions are not undertaking action themselves, but governmental policies and more action by the producing industry (European Commission, 2014a). When asked about practical solutions, the Dutch respondents again focus on governmental intervention (Table 102). Hence they seem to be putting faith in the government to solve the problem and are less likely to pressure the industries themselves.

Based on this data it can be concluded that while the Dutch do care about environmental problems, increasing waste and their own consumption contributing to these problems, the problems are not perceived as a pressing or significant issue. The majority of the Netherlands expects the industry and the government to take action. While believing individuals can make a difference, adjusting purchases to environmental concerns is not yet fully adopted in the Netherlands. They seem to have a wait and see attitude towards the solutions to environmental problems. Hence it is not likely that a consumer lobby and demand for green products will soon originate.

9.1.3. The reuse of packaging

One of the behavioral alternatives as identified in section 3.3.4 is that consumers reuse their plastic packaging. However, few studies on this specific behavior have been conducted. If the reuse of plastic packaging is studied, it tends to focus on the reuse of the packaging after it is collected at the consumer side (Inspectie Leefomgeving en Transport, 2015; VROM-Inspectie, 2010). Hence, most studies focus on the degree to which the food producers reuse the packaging, and not the consumer. It should also be kept in mind that not all packaging can be reused by the consumer as many are designed for single use, for instance, the plastic wrapping cheese or other foils. Yet stronger plastics as PET bottles can be reused by the consumer. Unfortunately, research on consumer plastic packaging recycling could not be found for the Netherlands. Hence, it is strongly advised to conduct further research on this specific topic in terms of both academic and policy studies.

9.1.4. Waste separation for recycling

The of the Dutch population thinks that Europe should be more resource efficient, and almost half thinks think that households produce too much waste (European Commission, 2011). Recycling waste at home and industrial waste is perceived as something that would have a large impact on our resource efficiency (European Commission, 2014a).

Table 103 Dutch opinions on resource efficiency and waste (European Commission, 2011)

EU should be more resource efficient	Households produce too much waste	Own household produces too much waste
83%	47%	58%

The slight majority of the Dutch consumer seems to agree that their household produces too much waste. However, are they also separating their plastic waste for recycling? This was researched in four different Dutch municipalities: Amersfoort, Soest, Lisse, and Velsen.

Table 104 Consumer waste separation Amersfoort (Van de Burg & Visser, 2014)

Always (With container)	Always (without container)	Usually (With container)	Usually (without container)	Never
92%	52%	8%	9%	12%

This shows that the option to separate should be easily available to enhance waste separation as there is a large difference between the separation with and without a container.

Table 105 Reasons to not separate Amersfoort (Van de Burg & Visser, 2014)

No space for separation bin	Not hygienic	Too much effort
45%	33%	29%

Table 106 Attitude towards waste separation Amersfoort (Van de Burg en Visser, 2014)

Waste separation is important, willing to put in more effort	Separation is important, but should not cost too much effort	Doing enough already
48%	25%	8%

Table 107 preferred interventions to increase waste separation Amersfoort (Van de Burg & Visser, 2014)

Extra waste container for plastics	Waste is already well separated
33%	42%

Table 104 and 105 both show that convenience plays a big role in the behavior of households and the degree to which they separate. A large difference is shown between households that do and do not have a separation container, moreover, the biggest reason to not separate is not having the required space of an extra bin. Table 106 shows that slightly less than half of the respondents said they find waste separation important and are willing to put in more effort, while 25% claimed that they do find it important, yet are only willing when it does not cost them too much effort. This shows again that waste separation should be made as easy as possible for the citizens. This is also reflected in Table 107 which shows that two fifth of the respondents believes they do enough already.

Table 108 Waste separation Soest (GFK,2014)

Always	Often	Never
63%	16%	12%

Table 109 Reasons not to separate waste Soest (GFK)

Lack of space	Too much effort
48%	21%

Table 110 preferred interventions Soest (GFK,2014)

Economic incentives	Making separating easier	More information on the importance of separating
43%	43%	30%

Also in this research, the main reasons to not separate are the lack of space, and the effort it costs. The main options to stimulate waste separation would be an economic incentive, and making it easier. In Soest, a similar pattern can thus be found. Convenience and effort are shown to play an important role in Table 109 and 110. Differently than in Amersfoort, 30% wants more information on the importance of waste separation.

Table 111 Waste separation Lisse (Mira onderzoek & Martinel BV, 2015)

Always	Often, if not too much effort	Never
49%	44%	7%

Table 112 Attitudes waste separation Lisse (Mira onderzoek & Martinel BV, 2015)

Waste should be separated better	More separating facilities are needed	Doing enough already
71%	51%	37%

Again in Lisse similar patterns in the role of convenience are found (Table 111 & Table 112)

Table 113 Waste Separation Velsen (Van Grootheest & Den Ouden, 2014)

Always	Often	Never
17%	54%	3%

Table 114 Attitudes waste separation Velsen (Van Grootheest & Den Ouden, 2014)

Very important	Important	Not important
34%	37%	8%

Table 115 Reasons for not separating the waste Velsen (Van Grootheest & Den Ouden, 2014)

Not enough space	Collection point is too far away	Too much effort
25%	38%	24%

In Velsen, waste separation is deemed less important than in the other municipalities, however, again the role of convenience becomes clear (Table 114 & Table 115).

This section shows that Dutch citizens do care about waste generation and that they between 43%-63% claims to always separate their plastic waste. Even 93% of if they do own a separate container. However, there is still a relatively large proportion of the respondents that do not always separate their plastic waste. The main reasons not to separate waste are the same; the amount of extra effort that it costs, lack of space and hygiene. Hence, reasons not to separate are mainly practical problems. This is also reflected in the preferred solutions; easily accessible separation facilities that reduce the extra effort that separation brings along. Interestingly, the reports mainly focus on the barriers, and less on drivers.

9.1.5. Returning packaging waste.

Most reports focus mainly on the separation instead of the actual collection. In the reports on the municipalities, collection is only briefly mentioned. In the Amersfoort research a difference was made between respondents who own a separation bin, people who do not and people who have a collection container, which usually consists of people living in apartments (Van de Burg & Visser, 2014). While the research shows that people have a collection container and not a separation bin separate less, it does not say anything about the collection/return rate. Although as separation is the first step it would follow logically that the return rate would also be lower in this group.

Table 116 Attitudes towards alternatives Amersfoort (Van de Burg & Visser, 2014)

Extra container for plastic waste	Changing plastic container for residual waste container
41%	7%

41% of the respondents think that receiving an extra container for plastic waste would be a good idea as it would prove as an extra incentive to separate waste and hence likely the return rate. However, when asked if they were willing to change the plastic container for the residual waste only 7% thought of it as a positive change. The main reasons to view this as negative were hygiene concerns and too much effort to bring the residual waste away. Again convenience seems to be a determining role.

Table 117 Visits to waste return point per year Lisse (Mira onderzoek & Martinel BV, 2015)

26-52 times per year	1-25 times a year	Not at all
33%	53%	14%

The research in Lisse does mention the actual collection through the form of a waste return point, which are central places to discard recyclable waste intended for recycling. As Table 117 shows, the waste return point is not visited on a regular basis by most respondents (Mira onderzoek & Marintel BV, 2015). Moreover, 52% of those surveyed do not believe that the waste return point site helps to enhance the recycling rate. Table 117 shows that 33% return their waste to the waste return point on a regular basis, between once every one to two weeks. While this is not the majority, it might not say too much about actual returning rates of plastic waste as there are other ways of returning plastic packaging. In the Netherlands the returnable deposit system and the plastic heroes concept, which is an initiative of plastic producers and importers to collect plastic packaging waste (Ministerie van Infrastructuur en Milieu, 2012), also function as collection points. Hence, this percentage only covers a fraction of the actual return rate of plastic packaging.

Table 118 Separation and collection Soest (GFK, 2014)

Always separate before collection	Often separate before collection	Never separate before collection
53%	41%	1%

Table 119 Way of separating and collecting waste Soest (GFK, 2014)

Separating with mini container	Separating with large collection container
75%	19%

The Soest research combines the separation and collection, and sees it as successive connected actions (GFK, 2014). A difference is made between consumers who have a mini container and a large

container to present their waste for collection. Most people have a mini container as can be seen in Table 119.

Table 120 Presenting plastic waste for collection after separation Velsen (Van Grootheest & Den Ouden, 2014)

Always	Often	Never
37%	12%	24%

Table 121 frequency of bringing waste to collection point Velsen (Van Grootheest & Den Ouden, 2014)

Weekly	A few times per year
0%	55%

The Velsen research also combines waste separation and the presenting for collection. Hence these researches seem to assume that once the waste is separated, consumers will also present them for collection or indeed bring them to a collection point. Yet as main reason to not separate their plastics and present them for collection is that the collection container is too far away (36%). This shows that convenience seems to be playing an important role in the success of a waste collection system.

9.1.6. Conclusion

The above presented data gives an overview of the degree to which Dutch households are purchasing green products, sorting, returning, and recycling their waste. A brief overview will be given.

Table 122 Average percentage of the municipalities scores on the behavioral alternatives based on Table 94, Table 104, Table 107, Table 111, Table 113, Table 117, and Table 120

Willing Purchasing products	to green separation for recycling	Always waste separation for recycling	Collection	Reuse
58.5%		55.3%	41%	No data

Table 123 average scores of the main barriers

Main barriers	Percentage
Lack of space (3 times mentioned as one of the most important reasons)	39.3%
Too much effort (3 times mentioned as one of the most important reasons)	24.7%
Hygiene (once mentioned as one of the most important reasons)	33%

It becomes clear that the main reasons for complying to the behavioral alternatives is convenience. Consumers are willing to do so if it does not cost them too much extra effort. However, a limitation of the data must be mentioned. The data is mostly based on self-reporting of the consumers, which has several drawbacks as reporting errors and socially desirable answers (Huffman, Van Der Werff, Henning, & Watrous-Rodriguez, 2014). While the data gives an overview of what households say they are doing, it does not necessarily reflect the actual situation as it shows the interpretations of their own behavior. Moreover, these studies only investigate what is the current situation, and do not offer an explanation. Therefore academic sources are consulted in the next section.

9.2. Academic research

In this section it will be assessed whether there is overlap with the theoretical lens as applied in this research and the already conducted studies on consumer behavior and CE. Again the literature will be divided according to the required behavioral alternatives: green purchasing, reuse, separation, recycle and the returning of the packaging. However, after an extensive literature research and review, little data can be found in academic literature on Dutch consumer behavior on this topic. Therefore, literature on other countries are used. This literature is not used as an information source on consumer behavior but only to gain insight in the various used approaches. If information on Dutch consumers and the Dutch CE system is available it will be briefly described, after which the international approaches are discussed.

9.2.1. Green products

Starting with the purchase of green products. Green purchasing has not been studied in detail in the Dutch context, but it has been done in other countries through several approaches. One of the most adopted approaches studying the green purchase behavior of consumers is the attitude approach.

Table 124 Key characteristics research of Magnier and Schoormans (2015)

Author	Country	Respondents	Theory applied
(Magnier & Schoormans, 2015)	Study 1: France. Study 2: The Netherlands	1:185 individuals 2:1700 households	Attitudes, visual and verbal appearance

Table 125 Dependent and independent variables Magnier and Schoormans (2015)

Independent variables	Dependent variables
Environmental concern (EC)	Purchase intention
Visual sustainability claim	
Verbal sustainability claim	
Attractiveness of packaging	
Conventional looking	
Ecological looking	

Table 126 Independent variables and beta values (Magnier and Schoormans, 2015)

Independent variables	Beta
1. verbal claim x HEC	0.10
1. visual x verbal x LEC	0.31
1. verbal x conventional x LEC	-0.47
1. Attractiveness of packaging	0.39
1.Verbal x conventional x HEC	0.42
2.Attractiveness packaging	0.41
2.Verbal x visual x LEC	0.22
2.Verbal x conventional x LEC	-0.27

Magnier & Schoormans (2015) for instance investigate how environmental awareness shapes consumers attitudes on packaging which in turn influences purchasing behavior. Furthermore, the authors pay attention to the influence of verbal and visual messages of the sustainability of the packaging. The authors claim that consumers with a positive attitude towards the environment are more likely to purchase sustainable packaging. Interestingly, the authors find that when consumers

have low environmental concern and less positive attitudes towards the environment, the consumer will view a green message on the packaging negative as green washing (pretending to be more green than you actually are). Hence the packaging message and appearance is more influential. For consumers with a high environmental concern, the message and visual presentation did not significantly influence the purchase intention. Hence, consumers' reaction on green messages on packaging depends on the consumer's attitudes towards the environment or in other words ones' environmental concern.

Table 127 Key characteristics research of Tilikidou and Delistavrou (2014)

Author	Country	Respondents	Theory applied
(Tilikidou & Delistavrou, 2014)	Greece	510	Attitudes

Table 128 Dependent and independent variables and their correlations (Tilikidou & Delistavrou, 2014)

Independent variables	Dependent variables	R
Environmental unconcern	PPB	-0.38
Sociopolitical control		0.29
Materialism		-0.20
Universalism		0.14

In another article, Tilikidou and Delistavrou (2014) study pro-environmental purchasing behavior (PPB) of consumers during the economic crisis in Greece. In order to do this, the authors used a two-stage systematic sampling technique to select 510 respondents for their questionnaire in Thessaloniki. Hence their results are not representative for the Netherlands. The independent variables are mentioned in Table 128. The authors explained materialism as life satisfaction that is determined by material goods, sociopolitical control as the degree of which the respondents feel that they have control over their own life and environmental concern. Universalism is explained as the concern for others well-being. The results follow an expected trend; when are more concerned for others well-being and the well-being of the environment, and feels in control PPB increases. While when consumers care more about materialistic issues as money and goods, PPB decreases. Environmental unconcern seems to have the strongest correlation with PPB, and universalism the weakest. However, these results are solely saying something about Thessaloniki during the economic crisis.

Table 129 Key characteristics research of Martinho et al. (2015)

Author	Country	Respondents	Theory applied
(Martinho, Pires, Portela, & Fonseca, 2015)	Portugal	215, 119 fully completed surveys	TPB

Table 130 Martinho et al. (2015) dependent and independent variables and their beta values

Independent variables	Dependent variables	Beta
Attitudes	Environmental purchase & recycling	0.125
Awareness		
Gender		
Social pressure		
Packaging characteristics		0.152
Subjective norms		

Closely related to attitudes is the Theory of planned behavior (TPB), which is also used as a theoretical perspective for green purchasing behavior. For instance, Martinho et al. (2015) study the influence of attitudes, awareness, gender, and social pressure on the purchase of environmental friendly packaging in Portugal. While the authors do look at the consumers attitudes, they explain their behavior more from a TPB perspective of which attitudes are one of the three explaining factors. Moreover they are interested in comparing two groups; respondents who place more importance on environmental friendly packaging and consumers who do less. As a result, only the packaging features and attitudes significantly predict the purchase behavior for both groups. The researchers used a snowball sampling technique which renders their study non-representative and highly contextual. Nevertheless, the results of this study show that especially attitudes are predicting the purchase of environmental friendly packaging.

Table 131 Key characteristics research of Moser (2015)

Author	Country	Respondents	Theory applied
(Moser, 2015)	Germany	12113	TPB

Table 132 Dependent and independent variables and their beta values (Moser, 2015)

Independent variable	Dependent variables	Beta
Attitudes	Green purchase behavior	
Norms		0.7
Willingness to pay		0.6

In another study, Moser (2015) explores whether environmental awareness leads to greener purchasing and does this by applying TBP. The author bases her conclusions on a representative survey of the German population. Her results show that when consumers have positive attitudes for the environment that they are likely to purchase green products. However, the relation with attitudes is not significant. At the same time, personal norms are a moderate predictor of green purchasing and the willingness to pay is a hindering factor. However, when consumers are willing to pay, it predicts the purchasing behavior moderately. It should be investigated what influences a persons' willingness to pay.

Little research on Dutch consumer behavior on green purchasing is available, especially when it comes to sustainable packaging. The studies that are available mainly view purchase behavior from either an attitudinal or TPB perspective often combined with willingness to pay. The articles provide varying results. In some articles attitudes do not significantly predict green purchases, while in other studies it is the strongest predictor. Interestingly, Magnier and Schoormans (2015) show that the appearance of the packaging plays an important role in consumer purchase behavior.

9.2.2. The reuse of packaging

Unfortunately, reuse has not received very much attention in academic research. One of the few articles found is of Babader et al. (2016). In their study, Babader et al. (2016) mention that reuse is one of the least researched R's in the waste hierarchy. Nevertheless, they are interested in changing consumer behavior towards reuse in a short period of time. They are adopting a system dynamics approach, which shows the connections between the social dimensions in reuse behavior. These social dimensions in turn are borrowed from TPB, cognitive behavior theory which focusses on the difficulty of behavioral changes as individuals mainly have negative beliefs regarding changes, which in turn makes the change difficult. Hence the theory acknowledges cognitive obstacles towards behavior change and thus also the need for cognitive changes. They combine these theories to develop a social behavior aspect model. The study is exploratory and only 5 respondents participated in the questionnaire. Hence the research is not representative at all. Nevertheless, their research

showed that more information can improve people's willingness to reuse. They also mention that social norms can lead to more reuse of packaging is one is aware of the attitudes of his/her community. However, they also show that there should also be the option to reuse plastic packaging and hence the packaging product should be reusable. While this study does not adopt a TPB approach per se, by incorporating it in its model it shows that the theory is still influential. However, as this is done via a systems dynamic approach, no statistics are used which makes it hard to make a comparison in the later analysis.

9.2.3. Waste separation and recycling

Most articles on Dutch waste management focus on recycling, but again not on consumer behavior. The studie of Dijkgraaf & Gradus (2014) do focus on the effectiveness of Dutch recycling policies but yet again from a system perspective, leaving consumer behavior outside the scope of their research. Bing, Groot, Bloemhof-Ruwaard, & van der Vorst (2013) apply a reversed logistics lens on the recycling of household plastics in The Netherlands. The ultimate goal is to provide evidence to either opt for source separation or post-separation. The authors also use secondary sources as the Central Bureau of Statistics as input for their scenarios. Unfortunately, no theoretical lens for consumer behavior is used as the focus is again on the various costs of the two different waste separation and collection systems. Yet in other countries it has been done, which will be reviewed now.

Table 133 Key characteristics research of Huffman et al. (2014)

Author	Country	Respondents	Theory applied
(Huffman et al., 2014)	USA	108	worldviews

Table 134 Huffman et al. (2014) dependent and independent variables

Independent variable	Dependent variable
Social influence	Recycling behavior
Worldviews	
Attitudes	

Table 135 Huffman et al. (2014) different investigated conditions and their beta values

	Social influence (SI)condition	Worldview condition
Self reported behavior:	SI 0.29	Attitudes 0.30
	Attitudes x SI: -0.26	
Observed behavior	SI: -0.7	
	Attitudes x SI: 0.005	

Huffman, Van Der Werff, Henning, and Watrous-Rodriguez (2014) is the first encountered article that takes worldviews into account when trying to predict recycling behavior. However, they compare the influence of worldviews with social influence. Interestingly they combine observation of the actual recycling behavior with a survey on self-reported recycling behavior or 108 respondents. While the authors do not mention the five identified worldviews in section 3.4.2.1, they refer to worldviews as belief systems. Moreover, they seem to focus on one of the 5 aspects of worldviews anthropocentrism, the degree of human dominance over nature. The authors set three hypotheses:

1. The actual behavior and the reported behavior correlate.
2. Social influence moderates the influence of attitudes on the recycling behavior.
3. Worldviews moderate the influence of attitudes on recycling behavior.

Their data support the first hypothesis with an r of 0.22. The data does not support hypothesis 2, as there was only a significant beta found for the relation between attitudes and social influence. This

indicates that participants with weak environmental attitudes are more likely to be influenced by social norms in their answers in the self-report setting. Hence insufficient data supported hypothesis 2. Hypothesis 3 is supported. The interaction between worldviews and attitudes in the observed setting is strong. This indicates that when the respondents have strong environmental attitudes and low anthropocentrism, the individuals are more likely to engage in actual recycling behavior. This research does not show the direct influence of attitudes on recycling, but the influence of other factors on attitudes and the consequence on recycling.

Table 136 Key characteristics research of Miafodzyeva, Brandt, & Andersson (2013)

Author	Country	Respondents	Theory applied
(Miafodzyeva, Brandt, & Andersson, 2013)	Sweden	519	attitudes

Table 137 Miafodzyeva, Brandt, & Andersson (2013) Dependent and independent variables

Independent variables	Dependent variables (Recycling of)
Satisfaction hazardous waste disposal	1. News papers.
Recycling attitude	2. carton and paper
Collection hazardous waste attitude	3. plastic bottles and returnable cans
confidence	4. Metal and plastic packaging
EC	5. .hazardous waste
Identity	6. .Batteries
	7. Electronic waste
	8. Bulky waste
	9. Glass

Table 138 Miafodzyeva, Brandt, & Andersson (2013) correlation values for de independent and dependent variables

Independent Variables	1	2	3	4	5	6	7	8	9
Satisfaction hazardous waste disposal					0.14				
Recycling attitude	0.40	0.39	0.31	0.35	0.13	0.20	0.18	0.18	0.45
Collection hazardous waste attitude	0.30	0.31	0.27	0.22	0.16				0.37
Confidence		0.13		0.14					
EC	0.20	0.17	0.15						0.16
Identity		0.15	0.18	0.23		0.15			0.19

In Sweden, Miafodzyeva, Brandt, and Andersson, (2013) studied recycling behavior of household in an multicultural area, which they define as an area with different cultures. The ultimate aim of the study is to find out whether there as a recycling profile and to predict recycling behavior. To do this, the authors look at obstacles to recycling, socio-demographic characteristics, social norms, and again attitudes. 519 randomly selected respondents participated in this research. A Two sided T-test was conducted to calculate the correlation between the independent and dependent variables. Their results show that there is indeed a relation between positive attitudes on the importance of recycling and actual recycling behavior, at least when it comes to packaging recycling. The main obstacle found is a lack of space for recycling.

Other studies focusing on the relation between recycling and attitudes are Best and Mayerl, (2013), and Ebreo, Hershey, and Vining (1999) which are not discussed in more detail to avoid overlap.

Table 139 Key characteristics research of Tonglet, Phillips, & Read (2004)

Author	Country	Respondents	Theory applied
(Tonglet, Phillips, & Read, 2004)	UK	258	TBP

Table 140 Tonglet, Phillips, & Read (2004) variables and beta

Independent variable	Dependent variable	Beta
Attitudes	Recycling behavior	0.43
Subjective norms		0.04
Perceived behavior of control		0.15
Moral norms		-0.11
Past behavior		0.16
Situational factor		0.01
Outcomes		0.13
Consequences		-0.29
Concern for the community		0.16

Also TPB is used to study recycling behavior. In their study, Tonglet, Phillips, and Read (2004) study predicting factors of recycling behavior through TPB in Brixworth, the UK. To study this, households were observed to get information on their actual behavior. However in the second stage of the research, 20 randomly selected inhabitants were interviewed, and in the third stage of the research 258 interviews were held. In addition to subjective norms, the perceived behavior of control and attitudes, other factors as indicated in the table above were studied to understand the degree to which they can explain recycling behavior. Their results show that individuals with positive attitudes towards recycling are more likely to recycle, but that these attitudes are not solely determining recycling behavior. Concern for the community, past behavior and awareness of the consequences of recycling also play a role.

Table 141 Bernstad (2014) Key characteristics research of article overview

Author	Country	Respondents	Theory applied
(Bernstad, 2014)	Sweden	1632 households approximately 2800 inhabitants	Convenience

Table 142 Bernstad (2014) dependent and independent variables and the differences between the conditions

Independent variable	Dependent	result
Distribution of written information	Recycling behavior	No significant difference
Installation of recycling equipment at home		Significant with 49% increase

The role of convenience is another reoccurring theme in the approaches for studying recycling and sorting behavior. For instance, (Bernstad, 2014) looks at the influence of convenience on food waste separation. While food waste is not the scope of this research, Bernstads' (2014) study does

reference waste separation and more importantly how it is theoretically approached. In this study the author compared sorting behavior of respondents who received extra information on sorting and respondents in who's houses sorting equipment was installed. A total of 1632 households participated in this study. In order to measure the impact of the intervention a before and after comparison was made with a two sided T-test. The distributed written information did not lead to an increase in food waste separation, while the placement of sorting equipment did lead to increased waste sorting. The results underline that convenience is an important factor for waste separation.

The literature review conducted in this research showed that recycling is the most researched step in the waste hierarchy. This is not so strange as EU and Dutch national policies have been focusing on recycling as well (Directive 2008/98/EC). Concerning the theoretical approaches for this topic. Consumer recycling behavior is mostly approached with an attitude and TPB perspective. For recycling behavior of consumers, attitudes seem to be the strongest predictor, and show the most and strongest correlation.

9.2.4. Returning packaging waste

Groot et al. (2014) article focusses on the costs of plastic waste collection in the Netherland. They mainly compare the difference between source separation, and post-separation. And the two existing schemes; curbside collection, and drop-off location as collection scheme. They make use of an economic model and try not so much to explain consumer behavior, but the costs which the different collection systems bring with them. They also attempt to assess which system is most cost effective. Also the paper of Bing, Bloemhof-Ruwaard, & Van Der Vorst (2014) focusses on choosing a waste separation system. However, instead of using an economic model, the authors use a scenario study to assess the difference between the two systems on a strategic level. They also mention that not much research has been conducted on the strategies surrounding reverse logistics. In addition, there is little research on recycle supply chains. This is something that is also encountered in this research for the Netherlands specific.

9.3. Analysis: Policy studies and link to the academic literature

In the previous two sections (9.1 & 9.2) it is shown to what degree Dutch consumers are complying with the required behavioral changes as identified in section (3.3.4), and what the scientific approaches are to explaining consumer behavior. This section combines both the actual situation and the theoretical lenses. This is done by looking at what it is the policy studies measure. Are they measuring intentions (TPB)? Attitudes? Or are they paying attention to worldviews or the cognitive capabilities of humans? All studies base their questions on some kind of reasoning, even when it is not explicit. This section will make this reasoning explicit and link them to the theoretical lens of this research.

Starting with the Euro Barometers, the special Euro Barometer *on attitudes of European citizens on the environment* in 2005 and 2014 already gives the used approach away in its title; attitudes (European Commission, 2005, 2014b). With questions as how important, and to what extent do you agree with this statement, the questionnaire tries to elicit the respondents' attitudes towards several aspects. However, this is not the only aspect studied in this report. The questions also try to get information on the intentions of the respondents with questions phrased as are you willing to do X? Intentions and attitudes are closely related in TBP as attitudes are according to this theory, one of the requirements to come to an intention, which in turn predicts behavior. However, as only the other two influencing factors of intention, perceived behavior of control, and social norms, are missing, this study seems to be based on an attitude approach.

Euro Barometer on *European citizens attitudes on waste management and resource efficiency* is also mainly focusing on attitudes in 2011 and 2014 (European Commission, 2011, 2014a). This becomes clear from questions as phrased as how important is X for you? To what degree do you agree with X? Yet again, intentions are elicited as through questions like would you participate in X? In the answer option to the questions some made assumptions become clear as they often focus on financial and convenience factors. Overall, attitudes seem to be the guiding approach in this report, with underlying assumptions that money and convenience could be influencing factors.

The Soest research on household opinions on their regional waste management plan mainly focusses on factual information as the degree of waste separation and the amount of waste produced (GFK, 2014). Questions as how do you turn in your waste, and how do you sort your waste illustrate this. However, the study is looking for drivers and barriers in for efficient waste management, and in the answer possibilities for the respondents, assumptions become visible. Answers possibilities as separation costs too much effort or it saves space show a convenience example. Answers possibilities as because it is good for the environment or expected show attitudes and social norms. The attitude approach also comes back in questions as how would you grade the waste management system and waste tax. Hence this study seems to be based on a mix of approaches of which the attitude approach is still the dominant one.

The Amersfoort study on household waste management is mainly looks at the way the respondents separate their waste and what their attitudes are towards waste separation (Van de Burg & Visser, 2014) However, few questions on attitudes are included in the questionnaire, and they usually refer to government policies. Most factual questions are about the degree of waste separation. In the questions on possible drivers and barriers to waste separation, again some assumptions become visible. Just as in the Soest research convenience is assumed to be a barrier. All answers to the question why do you not separate your waste are based on inconvenience, except for the lack of information answer. However, the answers as possible drivers consisted mainly of extra information, and only one answer concerned convenience. This study is thus mainly conducted from a factual and attitude perspective, with the underlying assumption that convenience and awareness play an important role.

The Lisse study looks at the drivers and barriers for waste separation with a special interest in willingness to separate (Mira onderzoek & Marintel BV, 2015). Several questions are about the respondents' attitudes towards waste separation and policy instruments. However, when asked about possible solutions to increase the waste separation, again most possible were based on convenience assumptions. For instance, what would help you to separate more waste? Possible answers included more collection facilities in the area, curbside collection, underground curbside collection and an extra container for paper and plastic. Also the questions regarding the increase use of the waste return point show a convenience assumption.

The Velsen research is conducted to gain more insight in the waste separation behavior of the inhabitants, the attitudes towards waste separation and the attitudes towards government waste policies. The study starts by measuring the attitudes of the respondents by asking them to agree or disagree to a certain extent to statements. However, the questionnaire is also measuring the self-reported waste separation behavior of the respondents. Also in this questionnaire the answer possibilities of why the respondents do not or hardly not separate their waste comes down the inconveniences as too much effort and a lack of space. This shows yet again that convenience is an underlying assumption for the study. This underlying assumption also comes back in the possible answers for interventions that should lead to more waste separation. However, this is combined with more awareness as more information on waste separation from the municipality or a monitoring system via social media. Interestingly, also the respondents' attitudes on additional information on waste separation was measured. This study is thus conducted from an attitude approach with

underlying assumptions of convenience and awareness.

The study of TNS Nipo (2015) assesses whether consumers are ready for the transformation from the current plastic bottle deposit system to the plastic heroes system. Unfortunately, the questionnaire is not included in the report and only a few questions are presented. Hence not much can be said on the actual approach of the whole study, just on the questions presented in the report. The questions in the report start with measuring the attitudes of the respondents towards the deposit and plastic heroes system, and the combining of the two systems. The presented possible answers on the question why consumers think combining the two systems is a good idea, consisted again of convenience arguments. Examples include it being easier, saving costs, not having to pay a deposit anymore. Hence, there is also an economic argument for the consumer. Later on the attitudes of consumers on waste separation and recycling are measured. However, when asked why people do recycle their packaging, possible answers as everyone does it, it gives me a good feeling, and is good for the environment, shows besides attitudes, also the influence of social norms. However, again attitudes and convenience seem to be the most dominant approaches/ assumptions.

Most studies on consumer CE behavior are conducted from an attitude perspective, sometimes using borrowing from TPB when looking for consumer's intentions. Overall, the majority of the studies has the underlying assumption that convenience and awareness have a lot of influence on CE behavior. Moreover, a difference in approach of the government related studies and the non-government related study is found. The government related studies all look at attitudes, while the non-government related study uses a worldview approach. It should be emphasized that solely one non-government related study is found and used, and hence it could be sheer coincidence that these studies differ from approaches. The reasonable person model is not used in any of these studies. Hence, attitudes and convenience seem to be the dominant approaches.

9.4. Conclusion consumer literature study

This section has been divided in two parts; a part based on policy studies, and a part based on academic articles. Interestingly, the policy studies seemed to be mainly focusing on the barriers of for the behavioral alternatives, while the academic articles mainly addressed the drivers. The policy studies showed the extend to which the consumers are following the behavioral alternatives. While the Dutch care about green products and worry about the impact of their own consumption pattern they have a very wait-and-see attitude, and expect the industry and government to take action. Hence the active demand for green products, can expected to be low.

The following outcomes were found for the behavioral alternatives:

Table 121 Average percentage of the municipalities scores on the behavioral alternatives based on Table 94Table 104Table 107Table 111Table 113Table 117Table 120

Willing Purchasing products	to green	Always waste separation for recycling	Collection	Reuse
58.5%		55.3%	41%	No data

The main barriers are practical issues as no space, effort, and hygiene concerns. Reasons to recycle are the consumers believes of environmental benefits. The same barriers are found for waste returning. No data on the reuse of packaging has been found and even in the academic literature this was difficult to find. Hence not much can be said concerning this topic.

The academic studies focused more on the drivers of these behaviors as they were looking for predictor. In most studies a correlation/prediction was found between the behavioral alternative and attitudes/environmental concern. In one research willingness to pay was investigated, and provided a beta of 0.6. Showing the strong relation between the two variables. Social influence also showed a strong relation with the behavioral alternatives. Self-reported behavior showed a positive relationship with social influence, while for observed behavior it showed a negative relationship. Further important for the purchase of green products are the actual consequences of recycling, and the look of packaging.

When looking at the link between the policy studies and the academic ones, a similar pattern can be found in the search results of the scientific literature review. Most consumer research focusses on the attitudes of consumers, while sometimes borrowing elements from TPB. Some of the studies already hinted into the direction of needing extra explanations of what lies behind attitudes or social norms. As section 3.4 showed, many different theories exist explaining consumer behavior. Academic studies seem to be rather limited in their topics, almost none focusing on the reuse of returning of packaging. The Netherlands is also limitedly studied, and so are the theoretical approaches. The policy studies already assume that awareness and convenience play important roles in consumer behavior. Convenience comes back in TPB in the perceived ability of control, but also in the reasonable person model in that consumers should be in a right state of mind and situation to overcome habits out of convenience. Yet the reasonable person model, has not been recently used to study green behavior. these results show that it might be worthwhile. Hence it is advisable to look conduct more consumer studies on these topics with a broader explanatory framework.

10. Analysis

Chapter 5-9 showed to what extent the economic actors and consumers are performing the behavioral alternatives. In addition, it touched upon their main drivers and barriers for these behaviors. This section will elaborate on the found patterns in the data. Moreover, it will be showed that the actors in the chain consider the actions of others, and what they think can be improved. First the pattern between the drivers, barriers, and behavior alternatives is discussed. Following the perception of the actors among each other is discussed and the implications.

The first pattern is that the interpretation of sustainability and CE gradually shifts in its emphasis throughout the supply chain. The plastic producers view sustainability of their production mostly in terms of reduction of the amount of virgin resources used through producing lightweight materials. Food producers took recyclability more into consideration, while retailers, and waste managers placed more emphasis on recycling. Refuse in the form of bio-plastics was, aside for the different qualities of the materials, throughout the chain received positively, with an exception for the waste managers. While all the other actors in the chain see bio-plastics as a viable alternative, waste managers warn for pollution of their plastic mono streams as their sorting machines cannot detect the bio-plastics. However, bio-plastics can be processed with petro chemical plastics, yet they have to be designed for this purpose. This stresses the importance of collaboration throughout the chain, which is currently a point of improvement.

Looking at the performance of the economic actors on the behavioral alternatives, a difference between the groups can be noticed. For the plastic producers, there is one actor which seems to be a leading actor for sustainability and the producer even collaborated with other actors in the chain. When looking at its drivers, it seems to be mainly normatively driven; by both consumer demand as his own believe that he is acting legitimate. The actors that seem to go less far are mainly mimetically driven; they follow the general trend.

A similar pattern can be found by the food producers. Also here the producers who do both act out of their own believes and consumer pressures go further than the actors acting based on governmental pressures or adopting the general trends. As one food producer described, "intentions and consumer pressures on their own are not sufficient enough, you need to both want it and be pressured at the same time." This company was also one of the best scoring respondents of the food producers. More than the plastic producers, the food producers seem to be vulnerable for consumer pressure. This could be explained by the fact that they are closer to the consumer; it is their product the consumer buys, and they are more likely to hold the food producer responsible for the negative consequences of the brand.

For the retailers, there is also one retailer which performs better than the other retailers. While the retailers said to perform relatively well on the behavioral alternatives, again the collaboration with other actors is a weak spot. Interestingly, while the same pattern can be found as with the previous actors, for the retailers coercive drivers seem to play a more important role for the retailers. A big barrier for the plastic producers is that they are between two big players, the international oil suppliers, and the international food producers. Which makes it hard for them to start changes on their own.

The level of performance also differed per respondent for the waste managers. Again there seemed to be two waste managers who seem to have a leading role when it comes to a CE, and again, these waste managers were more normatively driven. There is a difference that they are one-sided normative driven. Just as the plastic producers, they seem to receive less pressure from the consumers, and are more driven by their awareness of the current waste problems.

Another pattern can be noted for the drivers. Normative drivers are mainly expressed by the leaders of CE in the different actor categories. However, purely acting on consumer pressure, has led to sometimes adopting counter-productive measures as promoting jute bags instead of plastic bags, while jute bags produce higher CO₂-emissions. One of the respondents has mentioned to have done this. While this particular retailer was aware of this, they nevertheless adopted the measure. Solely acting on consumer demands can also limit the extent to which the actors are willing to go. Moreover, when the actors are two sided normatively driven, they notice possible barriers but are not stopped by them.

Once coercively driven, the actors now seemed to experience few barriers. While coercive drivers lead to relative easy adoptions of the behavioral alternative, the actors are not going further than the legally required unless the coercive drivers are complemented with the normative drivers. Mimetic drivers also lead to the minimum adoption; the actors then would be following the general trend and can simply not fall behind the competition.

The barriers encountered differed actor. For the plastic producers a big informational barrier was found as most believed it not possible to use recycles for food packaging. One of the plastic producers showed that it is possible. Further expenses and regulations pose barriers for them. They are commercial companies, and hence need to make profit to continue existing. Especially with oil prices being very low, making virgin plastics more attractive. This is the reason why they often opt for light weights; it is cheaper, and involves less environmental pollution. This can be said for all the industry actors in the chain, which also explains why economic barriers seem to be limiting for all actor groups. However, it should also be noted that when the drivers were strong enough; either they were convinced it was the necessary action, pressured by consumers, or the government, the economic barriers were interpreted as long term investments.

The regulatory barriers seemed to have most effect on the waste managers, plastic producers and food producers. These are the actors in the chain that actively produce packaging, process it or pack their own products. Retailers, who often use a purchaser for their packaging, and thus logically encounter less regulations, seem to experience less regulatory barriers. Technology on the other hand is something all actors agree on as a limitation as to how far one can go. Behavioral barriers were observed for all actor groups. Some behavioral alternatives were not performed without clear reasoning aside from denying responsibility. Moreover, the actors themselves identified many behavioral barriers, especially at the consumer side. Consumers were not separating well enough, did not pressure companies enough, and could not see the difference between the different kinds of plastic. When looking at data on consumer behavior, there is indeed room for improvement as approximately 55% of the consumers separates their waste regularly. In addition, the data showed that consumers are not likely to pressure the industry, they rely for a large part on the government.

So far the main focus has been on what the different actors are doing themselves and why. However, as became clear from the previous paragraph, the actors are also pointing at each other. Hence it is interestingly to see what others should do according to them. Figure 9 presents an overview.

1. Plastic producers	2. Food Producers	3. Retailers	4. Consumers	5. Waste managers	6. NGO	7. Government
<ul style="list-style-type: none"> -take more responsibility (4). -More actively present alternatives (2,3,4,6). -Use more recycles (2,3,5). -Collaboration before designing products (5,6). -No laminates(5,7). -No black plastics(5). -More collaboration with purchasers(6). -Focus on development and improvement(2,3). 	<ul style="list-style-type: none"> - Demanding sustainable packaging(1,3,8). - Come out of comfortzone(3,5). - Communicate better about their sustainable practices(3). -Look beyond profit(6). -Take more responsibility(4). - More emphasis on sustainable image(1). 	<ul style="list-style-type: none"> - Pressure food producers(1,2,5). - More green purchasing products(1,2). -More actively practicing CSR.(2) -More asking about certificates(2). - Sorting campaigns(5). -Use less plastics for transportation(6). 	<ul style="list-style-type: none"> - Most powerful actor(3). -Show more demand for sustainable packaging(3,6). -More willingness to pay for sustainable packaging(2,3). - Better waste sorting(1,2,8). -More active demands on social media(3). -More knowledge on what is sustainable(6). -Don't become cynical. 	<ul style="list-style-type: none"> -More innovation(1,3,8). -More transparent: show that sustainability is more important than profit(2,3,8). -More actively showing the benefits of a CE and their possibilities(2). -More collaboration with producers(3). - More investment in sorting techniques(3,8). 	<ul style="list-style-type: none"> - Create more consumer awareness(1,2,3,8). -Be more constructive(2,5). -Understand market driven reasoning(3). -Start societal discussion. -Pushing role(3). -Naming and Shaming(3). 	<ul style="list-style-type: none"> - More subsidies for recyclers(5). - Lower taxes on recycle based packaging(5). -Obligate a percentage recycles(5,6). - Prohibit plastics of coming into nature(6). -More pressure on retail(6). -Stimulate renewable based plastics(1,2,5). -Take more action(3). -Simplify for consumers(1,2).

Figure 9 What should the actors do according to each other.

The government and NGO's are also included in this figure. As they are not part of the supply chain, their behavior was not extensively researched. Yet they do influence the chain and are therefore interviewed and incorporated in this analysis. Important to note is that only environmental NGO's are considered.

Figure 9 shows several points. First, of all, some things mentioned in the figure overlap with the behavioral alternatives. For example, green purchasing. The retailers and consumers themselves already claim to do this. This can mean two things. Either these actors are purchasing green enough, or it is not communicated well enough. It is most likely a combination of the two, as during the interviews the actors themselves mentioned that they would like to do more, and Figure 9 shows that better communication and collaboration is preferred. Interestingly, the collaboration between the actors is the least performed behavioral alternative.

A second trend is that interference of NGO's is generally perceived as a necessary influence. According to the economic actors, NGOs need to create a larger support base for green packaging at the consumer side. Moreover, naming and shaming techniques are mentioned as possible strong drivers. This is in line with the previous noted pattern, that social influence (normative drivers) seem to be the most motivating aspects. However, NGO's are at the same time criticized for being unconstructive and not understanding of the market approach of the economic actors. There are few NGO's that focus on CE specifically. According to one of the NGOs they often take on a communicative role, and aim to accelerate processes that are already popular in society. CE is not popular yet in society; the need to close material cycles is not an easy message to bring across the general public. Ironically, this actually shows the need for NGOs to take up their communicative role. However, other NGOs focusing on the reduction of plastics are making the plastic problem more known, yet they do not mention a CE specifically. More NGO focus on CE is thus preferable.

A third trend is that the different actors tend to point at each other for starting the transition towards a CE. There are three actors which are appointed to start the changes; the government, the plastic producers, and the consumers. However, these actors do not agree. The first argument is that if the plastic producers produce recyclable plastics and work with recycle, and thus only offer sustainable plastics, the rest of the chain has no choice but to follow. While this seems like logical reasoning, chapter 5 showed that the plastic producers need more coercive and normative pressures, to start changing. Their main business model still depends on virgin materials, and as they need to create profit, they will not change by themselves.

Following the second often mentioned argument, the government should start the transition to a CE. While there are several regulations setting targets, the government itself claims to provide a facilitating role in this process and points to the market trends of more conscious consumers and the responses by the industry on the conscious consumer. This illustrates the third argument; the consumer is the most powerful actor in the chain, and once they demand sustainable packaging, the

industry has no choice but to respond. While this is in line with the results of this research, that normative drivers are important, it can also work as an excuse of the industry to not undertake action preventively. The consumers in turn are expecting more action of the government and industry themselves. Hence while there is a circular argumentation in who should do what, the economy is not being made more circular; this diverting of responsibility proves to be slowing down the transition towards a CE. This illustrates again the need for collaboration and better communication.

11. Discussion and Conclusion

11.1. Answering the research questions

This research originated from the knowledge gap identified in section 1.2, describing the scientific relevance of this research. According to (Ghisellini et al., 2016) little is known on the influence of awareness of the industry actors on CE, which is investigated through the normative drivers. In addition, many historical approaches to a CE developed, which have not been combined before. Waste reduction has also usually been studied from the output side, while now the focus is on redesigning the whole chain (Liu, Li, Zuo, Zhang, & Wang, 2009). This resulted in the following objective; to contribute to the understanding the roles of drivers and barriers for a circular economy in the Dutch packaging sector and explore which driver and barrier is most influential by extending and applying the institutional model of Zhu and Geng (2013). This objective is reached through an explorative embedded case study in the Dutch plastic food packaging chain. The research is of qualitative nature existing of a literature study and interviews focused on the performance of the actors on the behavioral barriers and the drivers and barriers they experience with them. This was done to answer the following research question:

To what extent are the main stakeholders in the Dutch plastic food packaging supply chain exhibiting the behavioral alternatives contributing to a circular economy, and which drivers are influential in overcoming the barriers towards a circular economy from an institutional theory perspective?

From this a set of seven sub questions derived, which are answered now:

1. *According to the sociological institutional theory, what are the drivers towards behavioral alternatives (for the main stakeholders in the Dutch plastic food packaging supply chain) as discussed in the literature?*

This sub-question is answered in section 3.4.1 discussing the sociological institutional theory, and section 3.5 which presents the conceptual framework of this research. Following sociological institutional theory, there are three kinds of drivers; coercive drivers, mimetic drivers, and normative drivers. The coercive drivers are identified when the actors were motivated by policies or regulations by the Dutch government or the European Commission. Mimetic drivers are identified when the actors mimicked each other's business practices to not fall behind the competition; hence they are following the general trend. Normative drivers are identified when the actors acted on the pressures of their customers, or when they were aware on what they believed is the legitimate action.

2. *What are the relevant national and European legislations for plastic packaging recycling for the Dutch plastic food packaging supply chain?*

This question is answered in chapter 4 on the regulatory and policy context. In that section Figure 8 showed all the relevant directives, regulations and policies.

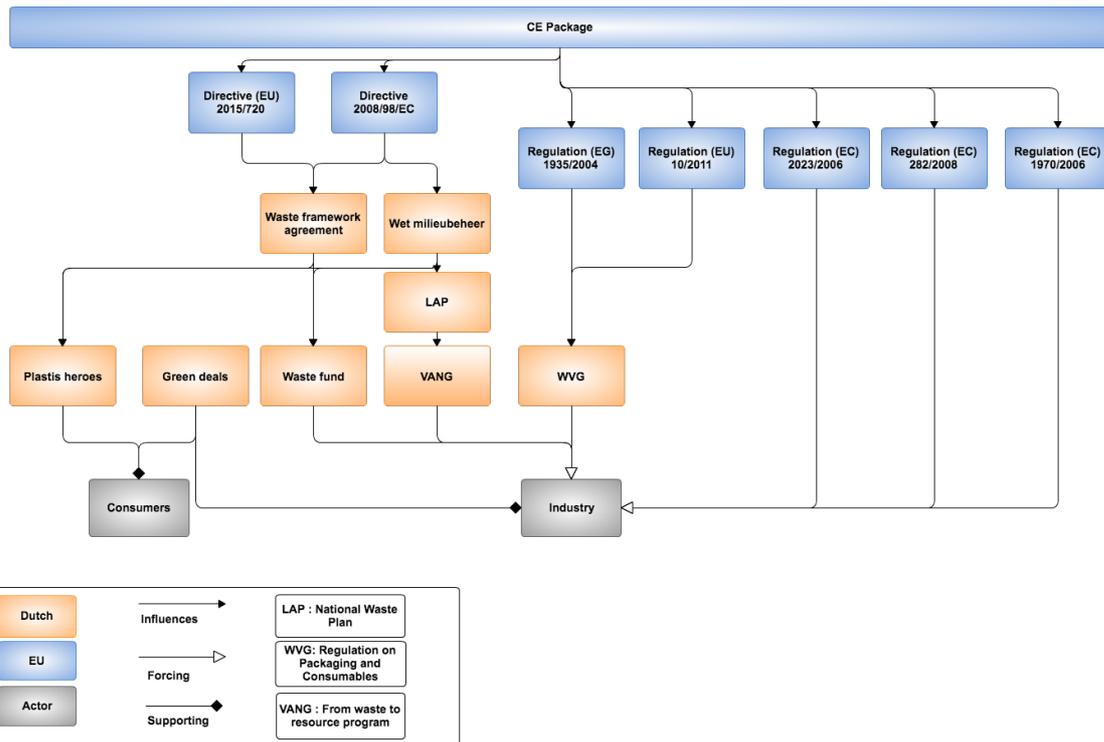


Figure 8 repeated Overview connections between the relevant Directives, Regulations and policies and their impact to the industry and consumers

3. To what extent are the main stakeholders in the Dutch plastic food packaging supply chain exhibiting the behavioral alternatives?

In none of the actor categories did respondents fully participated in all behavioral alternatives. The various degrees to which the plastic producers participated is graphically presented in Table 143.

Table 143 Overview of conformity to the behavioral alternatives plastic producers

Producer	Sustainable strategy	Mapping the materials	Design durability/recycling	Taking back materials	Cooperation in the chain
A	+		+/-		
B	+		+/-	+	+
C	+		+/-		
D	+		+/-		

While all the interviewed plastic producers have a sustainability strategy, they seem to participating less well on the other behavioral alternatives, with the exception of producer B. Points of improvement are performing LCAs, include the design for durability, taking back materials, and collaboration in the chain.

Table 144 Overview of the participation of food producers in the behavioral alternatives

Producer	Sustainability strategy	Green purchasing	EPR	Green packaging
A	+	+	+	+
B	+	+	+	+
C	+	+	+	+
D	+	+	?	+

Table 145 Overview of the participation of food producers in the behavioral alternatives (Continued)

Producer	Durability	Limit excessive packaging	LCA	Collaboration
A		+	+	+
B		+	+	+
C	+	+		
D	+	+		

The food producers seem to performing better on the behavioral alternatives, and here two producers take the lead. As Producer A and B do not producer fresh products, the design for durability criteria is not applicable to them. The main aspect to improve for the food producers is the collaboration in the chain, and the LCAs.

Table 146 Overview scores behavioral alternatives retailers

Retailer	Sustainability strategy	Green purchase	Collection point	Gate keeper	Collaboration
A		+	+	+	+
B	+	+	+	+	+
C	+	+	+	+	
D	+	+	+	+	

The retailers seem to perform slightly less well than the food producers, but better than the plastic producers. Again, there is one pusher in this group of actors. The biggest point of improvement is again the collaboration with the other actors.

Table 122 Average percentage of the municipalities scores on the behavioral alternatives based on Table 94, Table 104, Table 107, Table 111, Table 113, Table 117, and Table 120

Willing Purchasing products	to green	Always waste separation for recycling	Collection	Reuse
58.5%		55.3%	41%	No data

The consumer literature study provided the average percentages as shown in Table 122. Based on the four municipalities it seems that consumers in the Netherlands still have room to improve a considerable amount. More than half of the consumers are willing to purchase green products and separate their waste. Around two fifth of the consumers actually presents their waste for collection. Unfortunately, on the reuse of packaging there is no data found. Hence nothing can be said about the reuse of packaging.

Table 147 Overview performance behavioral alternatives waste managers

Producer	Sustainability strategy	Investing	Forecasting
A	+		
B	+	+	
C	+	+	+
D		+	

Table 148 Overview performance of behavioral alternatives waste managers continued

	Producer Collection sorting	and Recycling	Collaboration
A		+	+
B		+	+
C	+	+	+
D		+	

The waste managers also perform the behavioral alternatives to a various extend. It should be noted that 3 out of the four waste managers purely focus on recycling and hence not collect their waste themselves. Most waste managers are collaborating with others in the chain. Overall, they seem to perform fairly well, but can still improve. Mainly the collaboration, investing and the development of a sustainability strategy needs to be improved.

4. What are the main barriers towards exhibiting the behavioral alternatives according to the main stakeholders in the Dutch plastic food packaging supply chain?

Table 149 Overview total amount of barriers coded

	Informational	Behavioral	Emotional	Economic	Regulatory	Technical
Total	20	26	4	39	32	28

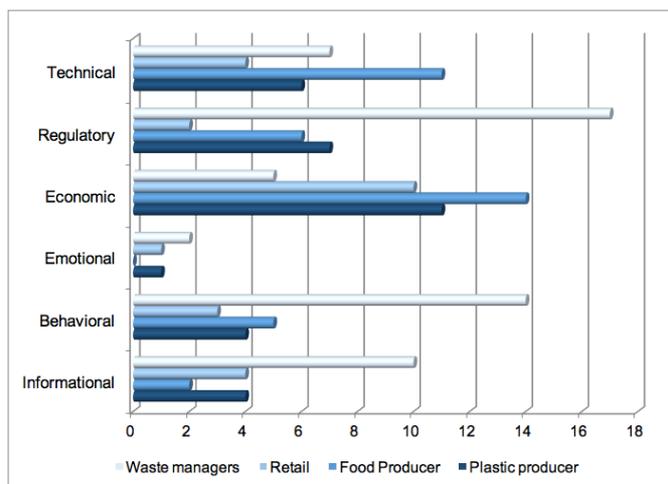


Figure 10 Overview amount of drivers coded specified per actor group

Figure 10 provides an overview of the barriers as mentioned by the respondents. The barriers mentioned per actor differ. For the plastic producers, the economic barriers are most important. This stems from low oil prices, which make virgin materials more attractive, and their need to make profit. Regulatory barriers as REACH hinder their use of recyclate as this regulation obligates them to specify all the materials in their plastics, which is difficult to do. Other hindering regulations are the food contact rules as specified in (EC) No 1935/2004, (EU) No 10/2011, and the Dutch WVG. While they understand the need for these rules, and prioritize food safety, they also acknowledge that this hinders the use of recyclate as it costs a lot of energy to clean the packaging in such a way that it meets the food contact regulations.

The food producers also point to economic barriers. Again as a commercial company they need to make profit. Yet this economic barrier is also combined with a lack of value on the consumer side. The consumer does not always value the green initiative to make it cost effective. They also point to

the technical limitations, and regulatory barriers as the food contact approval must occur in each country again.

The retailers mentioned the least amount of barriers. Yet the economic barriers stand out. These economic barriers can take the form of green bio-plastics are recycled plastics being too expensive. Recycle bins that take up commercial space, and having a priority to provide good and affordable products.

Waste managers again experience different barriers. Regulatory barriers are again a big obstacle. Yet for the waste managers this indicates sometimes a lack of regulation. They for example argue for an obligatory percentage of the packaging being made out of recycle. Another example is a too general regulation as the tax on packaging. Currently the packaging tax does not differentiate between virgin plastics and recycled plastics. Lowering the tax on recycled packaging would give an economic incentive for the use of recycled plastics. Another mention regulatory barrier is the definition of waste being too general. Once labeled as waste it is difficult to “transform” the same material into a resource.

Behavioral and informational barriers also play a big role for the waste managers. These behavioral barriers are mostly the barriers they notice by the other actors as brand owners who do not come easily out of their comfort zones, the plastic lobby, consumers not sorting well enough, and the lack of professionalism in the waste management sector. The informational barriers exist mainly of the bad image the waste management sector has.

For the consumers the main barriers are that waste separation, and recycling costs them too much effort, and that they do not find it hygienic enough. This can be translated into a behavioral barrier, which is in line with the comments of other actors in the chain. They experience behavioral barriers from consumers.

While the barriers per actor differ, a simple count leads to Economic, and regulatory barriers being the most mentioned ones. Followed by technical, behavioral, and informational, with emotional barriers on the last place as shown in Table 149.

5. *To what extent are awareness and pressure by their surroundings stimulating the main stakeholders in the Dutch plastic food packaging chain to participate in the behavioral alternatives according to the main stakeholders themselves? (Normative)*

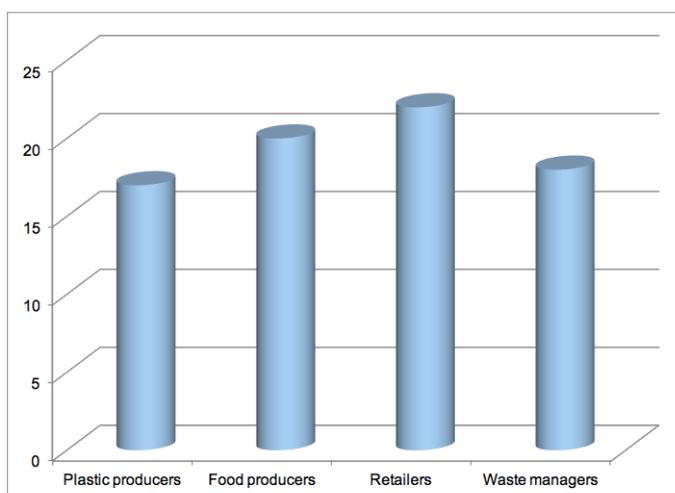


Figure 11 Overview amount of normative drivers

Overall, the normative drivers are mentioned most by the respondents. For all the economic actor groups, while differing on individual basis, the normative drivers seem to be the biggest driver for participating in the behavioral alternatives. As became clear during the results and analysis, the two components of normative pressure combined, awareness, and consumer/customer pressure, led to respondents seeing the behavioral alternatives as new business opportunities. Important to note is that only when both sides of the normative drivers are met, the companies viewed CE this way. Solely consumer pressure led in some cases to the bare minimum of action, or in some cases to counter productive action. Only awareness of the necessity of a CE is often countered by economic barriers. The combination with being aware of the need to move to a CE, whether the need comes from sustaining ones' business or the being aware of the depletion of resources and ones' own responsibility in that process, and consumer pressure resulted in behavior that went beyond the governmental or consumer required action. As can be seen in Figure 11 the economic actors that are more in contact with the consumers are also more normatively motivated. However, the retailers were more consumer pressure normative driven, while for the food producers their own responsibility in the depletion of resources played a bigger role, combined with consumer pressure. This could explain why the food producers seem to have a higher degree of participation in the behavioral alternatives. The same holds for the waste manager which are participating in the behavioral alternatives relatively well. They also were both aware of the waste problem, and vulnerable to their image, which could explain their performance. Therefore, it seems that the combination of awareness of the problem, combined with consumer/customer pressure is an important motivator for the behavioral alternatives.

6. *To what extent can imitation and competition, between the actors in a stakeholder group, enhance the behavioral alternatives according to the main stakeholders in the Dutch plastic food packaging chain themselves? (Mimetic)*

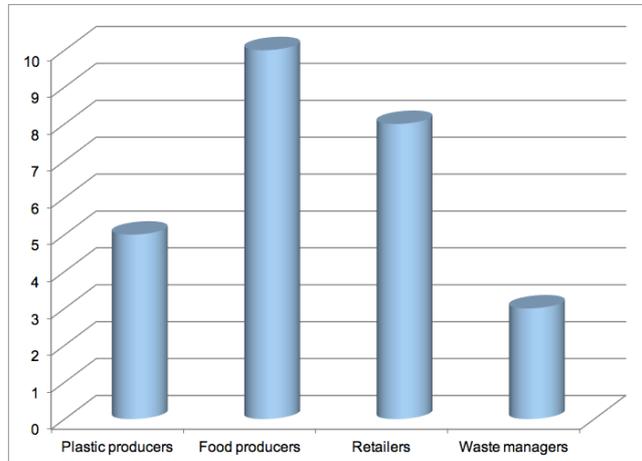


Figure 12 Overview amount of mimetic drivers

Mimetic drivers are the second most mentioned drivers. Aside for the fact that they are mentioned less by the actors, they also have less influence on the behavioral alternatives than the normative drivers. The respondents who mentioned being mimetically influenced, followed the general trends of sustainable behavior. Once they saw that certain behaviors for a CE were adopted by several companies, they did not want to fall behind the competition, and adopted this behavior too. As they are mimicking general accepted behavior in order to not fall behind, this is mainly a driver for lagging companies, and not the early adapters. Hence mainly mimetically driven companies are not expected to initiate big changes. Moreover, mimetic drivers influence the economic actors in a later stage than the stage than the normative drivers or coercive drivers.

7. To what extent are EU and national legislation supportive for CE according to the main stakeholders themselves? (Coercive)

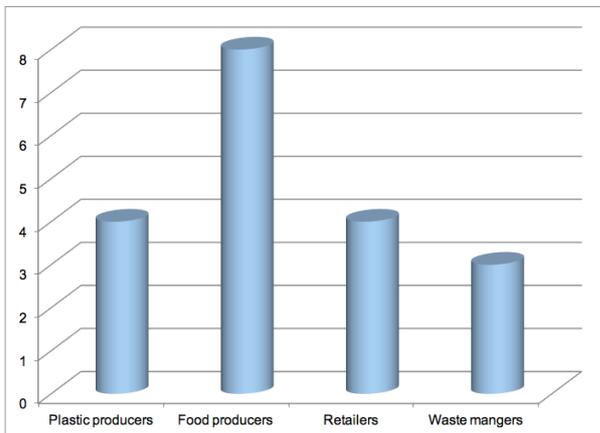


Figure 13 Overview amount of coercive drivers

Coercive drivers are the least mentioned drivers. This does not necessarily mean that they also have the least influence. Unlike the mimetic and normative drivers, the coercive ones are binding. Hence, while they are less mentioned, they do mandate the economic actors' behavior, and unlike the mimetic drivers, they can initiate change. However, while the coercive drivers obligate change, they do this only to a certain degree. If companies are purely coercively mandated, they will implement the changes, but will not go further than that. If both coercively and normatively influenced, the further they will go in regard to sustainable behavior. Nevertheless, coercive drivers are important to motivate laggards early on in the process instead of waiting until the mimetic drivers start working. Moreover, once behaviors are coercively motivated, the economic actors seem to experience less barriers. Hence, coercive drivers help to overcome barriers. Examples of supportive legislations and policies are the ones that set specific targets as WFD, The packaging Directive, the CE package, "Wet Milieubeheer", the LAPs, the VANG-program, and the agreement on packaging waste.

As mentioned in the answer to research question 4 there are also unsupportive regulations, and a lack of regulations. Yet overall, regulations and policies have a positive effect on the performance of the actors on the behavioral changes. Even more action by the government is preferred by both the consumer and the industry. Yet this action can take both the form in more, or less regulations.

The answers on the sub-questions have in detail answered the main research question. To bring it all together, the main research question will be answered briefly. The stakeholders in the Dutch food packaging supply chain exhibit the behavioral alternatives contributing to a CE to various degrees. In each group there are leaders and laggards. Overall, improvement is needed. Normative and coercive drivers are most influential to initiate the behavioral alternatives actors driven this way experience less barriers. Hence these drivers are more likely to overcome the encountered barriers.

11.2. Recommendations

Having presented the results on the sub questions, some advice can be offered for a faster transition towards a CE. Sub-question 3 focusses on which behavioral alternative the actors must improve to facilitate the transition towards a CE. Yet for this to happen, the barriers have to be overcome. The answers to sub-questions 5, 6, and 7 showed that actors that are normatively and coercively motivated, encounter fewer barriers and are less hindered by them. This gives an indication of how the barriers can be overcome. Moreover as was shown in the analysis (Chapter 10), three alternatives for directions were presented by the various actors: (1) More action by the industry sector. (2) More action by the government. (3) More action by the consumer. The problem is that each of these groups

is pointing responsibility at the others resulting in a vicious circle of argumentation and shifting responsibility.

These three mentioned alternatives overlap with the two drivers that seem to be able to overcome barriers. More government action indicates more coercive pressure. While respondents still notice certain barriers as costs, it does not stop them from undertaking action, as they are mandated to do so. The industry has been shown to be vulnerable for consumer pressure, hence normative drivers are needed. However, the consumers are not likely to act according to the literature study. They do not view their own consumption patterns as problematic. Consumers need to be aware of their contribution to the problem before they feel responsible. This is a role for NGOs, which has also been mentioned by the respondents and was shown in the historic overview of Dutch waste policies. Instead of waiting for one actor to take the lead, it can be argued that the three different actor groups; The government, the producing industry, and civil society; NGOs and consumers, need to act and start the transition together. This leads to an interactive mode of governance (Driessen, Dieperink, Laerhoven, Runhaar, & Vermeulen, 2012). In this governance mode, the government, the producing industry, and civil society are equals and working together to solve the problem. The power base of this governance mode is legitimacy, which fits in with the normative drivers; changing as it is perceived legitimate behavior. Moreover, the mode of interaction would be social learning, and negotiation. Something that is very much missing; collaboration within the supply chain. Moreover, this interactive governance mode would fit in with the current policy styles in the Netherlands. The green deals show that several actors understand the need for collaboration.

This collaboration between the three parties would show the initiatives the different actors are already taking, and would take away the misunderstanding and hence the informational barriers. This interaction can notify the government of the regulatory barriers and potentially address them. Moreover, it shows them where new legislation might be needed. Moreover, if the civil society and government pressure the industry at the same time, introducing both coercive and normative pressures, the industry is more likely to go further than the government mandated as was shown during the interviews. Hence an interactive mode of governance is advised to move towards a CE in the Dutch packaging chain. A start of this interactive governance mode has already begun with the packaging agreement. While this is a first start to bring the various actors in the chain together, the civil society part has been left out. NGOs should be included to start the societal debate on closed loops, and consumers should also be included to voice their concerns. This would allow to combine the coercive with the normative pressures, and thereby hopefully overcome the barriers towards a CE.

Another identified trend per economic actor category is that in each group there are leaders when it comes to CE, followers and laggards. It is worthwhile to take into consideration if based on the action of these leaders best practices can be developed.

Plastic producers are mostly mimetically driven, which often results in a following or lagging, but not being a leading company. The leading company for the plastic producers is motivated mainly by governmental and customer pressure. This is in line with the findings of the interviews: the plastic producers are relatively small actors between the large oil producers, and food producers; they have relatively little power in comparison to those big actors. Hence for this actor, group external pressure is needed to adapt more behavioral alternatives.

In the food producer section there were two leaders and two followers interviewed. The biggest difference between the two is that the leaders have adopted a long term perspective and see CE as an investment in the long term success and survival of their company. These companies also understand that they need the rest of the chain to achieve a CE, and are actively pressuring their suppliers and purchasers. This in turn helps the plastic producers to adopt the behavioral alternatives.

The leader in the retail category has a different business model than the other three retailers. CE fits in with the biological foundation of this retailer. The other progressive retailer aims for the behavioral alternatives from the consumer demand perspective and as they believe it is the right thing to do.

The waste managers do not differ very much once it becomes clear that only one is not only a recycler. Hence it is more worthwhile to look at the barriers. One of the most important barrier is a perception barrier. The other actors confirm this as they have little insight on what the waste managers can and are doing. More transparency is needed. The waste managers who are more transparent through collaboration also seem to perform better.

Based on this some best practices can be formulated:

- Both the government and the food producing industry should pressure the plastic producers more to help them transition towards a CE.
- Food producers should look further than short term profits, and focus on the long term.
- Retailers should change their business model into a more biological based business model or adopt faster to the growing markets for green products.
- Hence, advocates for a CE must present it as a solid business case. Show why it is profitable on the long term to invest in it now.
- Waste managers should communicate better on the possibilities of waste management and their current practices.

These best practices fit in with the integrative governance mode; the combined pressures for the plastic producers, the redesigning of business models and more transparency to enhance collaboration. These best practices have to be seen as a first step to easier allow for the behavioral alternatives and collaboration throughout the chain.

11.3. Reflection on limitations and implications for future research

As with all studies, there are limitations that require reflection. According to Bernard (2011), reliability and validity are two of the fundamental concepts of social research. Reliability refers to whether the same results are acquired when using different methods, and validity refers to the reliability of the methods, i.e. whether it is actually measuring what is supposed to be measured.

First, the reliability of this research. As it is a qualitative research, the reliability is harder to establish than with a quantitative research in which multiple measures can easily be taken to assess the reliability of the results. When conducting 30-45 minutes during interviews, it is not feasible to take multiple measurements. However, reliability of a research can be enhanced, by documenting the methods step by step to allow a reconstruction of the research. This has been done in the method section (Chapter 2). Moreover, in Appendix A, the interview guides are included. Still there are several aspects that could limit the reliability of this research. With the results mainly being based on semi-structured interviews some implications occur. The social desirability effect: respondents might have given socially desired answers when reporting their performance on the behavioral alternatives (Bernard, 2011). This has been noted several times at the result and analysis sections. As a check all the respondents were asked how they thought the other actors where behaving towards a CE. In some cases this provided less positive answers than the respondents themselves were giving. Another limit in research reliability is the lack of accuracy of the respondents answer. Their answers might be influenced by their latest experiences. However, in an aim to counter this effect, the respondents were first asked in an open question what drives or hinders their behavior, after which all barriers and drivers were questioned. This resulted often in extra answers. A last aspect that should be kept in mind is the expectations of the researcher itself can influence the results. While this it continuously has been warranted for, one cannot escape his own perspective completely. Moreover,

as the interviews were semi structured, the questions might not have been posed exactly the same way, which might have led to different answers.

Validity can be divided into internal and external validity (Bernard, 2011). Internal validity refers to measuring what one aims to measure. External validity refers to the generalizability of the results. First the internal validity is discussed, as one cannot have external validity without internal validity. The nature of this research is explorative and gathers in-depth information. In-depth case studies the internal validity tends to be higher, and the results are easier applicable on the studied in case. Moreover, during the interviews the understanding of the researcher was checked to review the whether the interpretation was correct in order to account for an observer bias of the researcher, the data is analyzed in a systematic way according to the conceptual framework. However, one can never be fully objective, and an observation bias will always be present.

An embedded case study approach lowers the external validity of a research as there is a small N (1). Moreover, the purpose sampling technique was used to select the respondents. Due to the sampling technique and a total of 4 respondents per actor category, the answers are highly contextual and can therefore not be generalized. In an attempt to enhance the external validity, triangulation of sources is used; semi-structured interviews, desk research, and a literature study. Nevertheless, due to the sample method, and the explorative in-depth nature of this research, the results are not generalizable. Moreover, as Abrutyn and Turner (2011) mentioned, the sociological institutional theory reduces the influence to three types, while the reality is far more complex. Hence there might be other influencing factors for the behavioral alternatives. Despite these limitations, considering the explorative nature of this research, the research provides valuable insights in the drivers and barriers for the various actors of the supply chain. Moreover, the results especially provide valuable insights for the interviewed actors. Furthermore, this research is a good starting point to built on for future research.

However, the mentioned limitations lead to several implications for future research. To enhance the reliability of the research, future studies could account for socially desired answering by observing the behavioral alternatives themselves. This would allow the researchers themselves to judge the extent to which the actors participate in the behavioral alternatives. Moreover, it could be interesting to bring the various actors in the chain together. This could provide a more accurate picture of their collaboration, and this would give them a change to brainstorm on solutions, which would provide more applicable results for policy suggestions. Future research could enhance the external validity by studying a larger N and using a randomized sampling technique. More practical advice is to conduct consumer research on this topic instead of using secondary literature. When doing this, it is strongly advice to study the reuse and returning of packaging, as currently there is little data available on this topic. Due to the limited time available for this research, the government and NGOs were not analyzed to the same depth as the economic actors. As they do influence the supply chain, future research should also study their behavioral alternatives and the extend to which they meet them. Finally, it would be interesting to add categories to the drivers. For instance, differentiation between awareness of the legitimate action, and social pressure in the normative driver. Changing from one to two drivers would add to the level of detail in future analysis.

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Appendix A - Topic list interviews

Topic list plastic producers

General

- What is the role of the organization?
- What is your position in the organization?
- Are there in general barriers to work towards a CE?
- Are there in general drivers to work towards a CE?
- Is there a market for circular products?
- Is it profitable to use circular products?

Behavioral alternatives

- To what extent has the organization developed a sustainability strategy? (cradle-to cradle, eco-innovation/eco-reputation)
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are the material streams mapped?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is the plastic designed so that it can be easily recycled?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is the plastic designed for durability?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are light weight plastics used?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are the plastics taken back?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is there collaboration between the various actors of the food packaging supply chain?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?

Topic list food producers

General

- What is the role of the organization?
- What is your position in the organization?
- Are there in general barriers to work towards a CE?
- Are there in general drivers to work towards a CE?
- Is there a market for circular products?
- Is it profitable to use circular products?
-

Behavioral alternatives

- To what extent has the organization developed a sustainability strategy? (cradle-to cradle, eco-innovation/eco-reputation)
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is there green purchasing for packaging materials?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is excessive packaging limited?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is green packaging investigated?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is the shelf life of products prolonged?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is there EPR?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improved?
- To what extent are the material streams mapped?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is there collaboration within the food packaging supply chain?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?

Closing questions

What can the other actors in the chain do to facilitate the transition towards a CE?

- Plastic producers?
- Retailers?
- Consumers?
- Waste managers?

What can the secondary actors do to facilitate the transition towards a CE?

- The government?
- NGOs?

[Topic list retailers](#)

General

- What is the role of the organization?
- What is your position in the organization?
- Are there in general barriers to work towards a CE?
- Are there in general drivers to work towards a CE?
- Is there a market for circular products?
- Is it profitable to use circular products?

Behavioral alternatives

- To what extent has the organization developed a sustainability strategy? (redesigning the value chain, eco-innovation/eco-reputation)
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are supermarkets a collection point for plastic packaging?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are retailers functioning as gate keepers?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are the food packaging purchased green?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is there collaboration within the food packaging supply chain?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?

Closing questions

What can the other actors in the chain do to facilitate the transition towards a CE?

- Plastic producers?

- Food producers?
- Consumers?
- Waste managers?

What can de secondary actors do to facilitate the transition towards a CE?

- The government?
- NGOs?

Topiclist Waste managers

General

- What is the role of the organization?
- What is your position in the organization?
- Are there in general barriers to work towards a CE?
- Are there in general drivers to work towards a CE?
- Is there a market for circular products?
- Is it profitable to use circular products?

Behavioral alternatives

- To what extent has the organization developed a sustainability strategy? (cradle-to cradle, eco-innovation/eco-reputation)
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is the waste stream anticipated?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is there invested in efficient waste processing technologies?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is there a collection infrastructure developed?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are the materials sorted?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are materials reused before being recycled?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are materials being recycled?

- What has been the most important driver?
- What has been the most important barrier?
- In what way could this improve?
- To what extent is there collaboration within the food packaging supply chain?
 - What has been the most important driver?
 - What has been the most important barrier?
 - In what way could this improve?

Closing questions

What can the other actors in the chain do to facilitate the transition towards a CE?

- Plastic producers?
- Food producers?
- Retailers?
- Consumers?

What can the secondary actors do to facilitate the transition towards a CE?

- The government?
- NGOs?

[Topic list The Government](#)

General

- What is the role of the organization?
- What is your position in the organization?
- Are there in general barriers to work towards a CE?
- Are there in general drivers to work towards a CE?
- Is there a market for circular products?
- Is it profitable to use circular products?

Behavioral alternatives

- To what extent does the government have an active role in the transition towards a CE?
 - What has been the most important driver?
 - What has been the most important barrier?
 - In what way could this improve?
- To what extent does the government have a steering role in the transition towards a CE?
 - What has been the most important driver?
 - What has been the most important barrier?
 - In what way could this improve?
- To what extent is the transition being monitored?
 - What has been the most important driver?
 - What has been the most important barrier?
 - In what way could this improve?

- To what extent is there invested in a waste collection/processing infrastructure?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent is the collaboration between the various actors stimulated?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?

Closing questions

What can the other actors in the chain do to facilitate the transition towards a CE?

- Plastic producers?
- Food producers?
- Retailers?
- Consumers?
- Waste managers?

What can de secondary actors do to facilitate the transition towards a CE?

- NGOs?

Topic list NGOs

General

- What is the role of the organization?
- What is your position in the organization?
- Are there in general barriers to work towards a CE?
- Are there in general drivers to work towards a CE?
- Is there a market for circular products?
- Is it profitable to use circular products?

Behavioral alternatives

- To what extent are NGOs stimulation recycling and recovery programs?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are NGOs collection data on the transition process and are they publishing them?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are NGOs raising consumer awareness on CE?
 - o What has been the most important driver?
 - o What has been the most important barrier?
 - o In what way could this improve?
- To what extent are NGOs stimulation waste separation?
 - o What has been the most important driver?
 - o What has been the most important barrier?

- In what way could this improve?
- To what extent are NGOs influencing the government to take on a more active role in the transition towards CE?
 - What has been the most important driver?
 - What has been the most important barrier?
 - In what way could this improve?
- To what extent are NGOs facilitating collaboration between the actors in the plastic food packaging supply chain?
 - What has been the most important driver?
 - What has been the most important barrier?
 - In what way could this improve?

Closing questions

What can the other actors in the chain do to facilitate the transition towards a CE?

- Plastic producers?
- Retailers?
- Consumers?
- Waste managers?

What can the secondary actors do to facilitate the transition towards a CE?

- The government?
- NGOs?

Appendix B – List of interviewees

Name	Position	Organization
Caroli Buitenhuis	Biobased Packaging Expert	Biobased packaging
Jeroen Dagevos	Head of programs	Plastic soup foundation
Willem van Dijk	Purchaser	Hordijk
Frederic Dreux	Packaging Capability Leader Rigid Plastics	Unilever
Wilfred van Elzakker	Commercial Director	Agrimarkt
Marcel van Enkevort	Account and Application Development manager	QCP polymers
Ton Emans	Director group recycling	Cedo
Janneke Figeo	Product developer	Vion food group
Arjanne Hoogstad	Public affairs and communication	Coca-cola enterprises
Steven Ijzerman	Quality advisor	Udea/Eco-plaza
Henri Kanters	Operations manager	Haval
Ben Kras	CEO	Kras recycling
Kees van der Laan	Policy advisor	Rotterdam Municipality
Sander Minnee	Purchase advisor	Plus retail
Dominique van Ratingen	Program manager CE	Amsterdam Economic Board
Han Sajet	Purchaser/ packaging specialist	The greenery
Aafko Schanssema	Director	NRK verpakkingen
Gerhard Schoonvelde	Policy advisor	Utrecht municipality
Evert Smit	Innovation manager	Kivo
Jan-Hein van Spaandonk	Brand manager private label and price	Spar
Geert Steeghs	Manager governmental services	Suez
Michael van Veldhuizen	Sales manager	Opi-plastics
Jan van der Ven	Advisor collection and recycling	Nedvang
Jelmer Vierstra	Senior business developer	Natuur en milieu