Mapping Discourses for the Dutch Circular Plastics Economy

MSc Thesis report, Dirkjan Lakerveld, Utrecht, June 2020

Universiteit Utrecht

(Photo taken from National Geographic: Planet or Plastic?)

MSc Thesis Report

A study on Circular Plastics Economy discourses in the Netherlands

MSc Thesis report (45 ECTS)
Dirkjan Arie Lakerveld (6191754)
Utrecht, June 2020

Universiteit Utrecht

Keywords: Discourses, Q Methodology, Circular Economy, Plastics, Netherlands

Master Thesis (45 ECTS)
A thesis submitted for the fulfilment of the degree of Master of Science in Sustainable Development.

Faculty of Geosciences
MSc program Sustainable Development, track Earth System Governance
Copernicus Institute of Sustainable Development, Utrecht University

Graduation Committee
MSc M.A. Martin Calisto Friant (supervisor)
dr. Walter Vermeulen (supervisor)
dr. Frank van Laerhoven (second reader)

Author
Dirkjan Arie Lakerveld
Student ID 6191754
Email d.a.lakerveld@students.uu.nl
Utrecht University
Faculty of Geosciences

Executive summary

This thesis aims to map circular plastics economy discourses in the Netherlands by analysing governance mechanisms, policies, and practices of the circular economy (CE) in the Dutch plastic sector. The CE became a popular discourse in the public and private sectors since the start of the 21st century. In 2016, the Dutch government set the target to become fully circular by 2050. Especially, the plastic packaging sector gains a lot of attention as it accounts for most plastic waste generation (European Commission, 2018). However, many contested visions on the CE exist. On the one hand, it is often promoted as an economic opportunity including environmental benefits by market actors in particular, while more recently the social implications to achieve social justice and environmental sustainability are emphasised by civil society organisations. The absence of a holistic understanding of the CE results in a limited understanding of whether and how the transition to a circular plastics economy contributes to sustainability. Also, it is unclear how and which actor discourses are represented in Dutch society. This thesis aims to fill in this gap by a scientific literature review and discourse analysis using the Q methodology. This included a Dutch media (newspaper) analysis between 2010 and 2020, European and Dutch policy analysis between 2000 and 2020, stakeholder analysis, 24 semi-structured interviews with professionals in the plastics value chain, a survey, and statistical factor analysis. This research builds upon previous work from Friant, Vermeulen, and Salomone (2020) and analyses how well Dutch public and private discourses fit in their circularity discourse typology framework. Their initial findings show that current imaginaries of the CE are mainly based on Technocentric Circular Economy-based perspectives, and emphasise that other discourses of the CE are often underrepresented. This research reveals four Dutch societal discourses of which three have strong linkages with Technocentric Circular Economy propositions (Friant, et al., 2020), and one discourse which has linkages with a Transformational Circular Society proposition. Therefore, these outcomes affirm the findings of Friant, et al. (2020) in Dutch context. To support the transition to a circular plastics economy, recommendations are given on policy actions considered important by all identified perspectives. These include financial mechanisms to make recycled plastics more competitive with virgin fossil-based plastics, which also discourage incineration and establish a fund to finance R&D and innovations, as well as banning export plastic waste to outside the European Union. Most policy recommendations align with CPB Netherlands Bureau for Economic Policy Analysis (2019), and also on the European level from research of Hartley, et al. (2020). With this respect, the findings and recommendations are relevant on the national as well as the international level. Overall, this thesis adds a theoretical and practical understanding of discourses involved in the transition to a Dutch circular plastic economy.

Preface

It was during my bachelor's half-year internship in Curaçao and one-year world trip in Oceania and South-East Asia, when I first became aware of the impact of plastics on the environment and quality of life of people. From diving 30 meters deep in the Caribbean and Asian seas, up to climbing volcanos of 4000 meters high, I was shocked about the environmental pollution of plastics as a result of poor waste management. Here, the need for more sustainable approaches became clear to me and the desire to do something about it, in particular in the circular economy. Ever since, I was continuously looking to improve my skills, knowledge, and expertise in this field, therefore, I enrolled in the MSc Sustainable Development program at the University of Utrecht.

This master program provided me with a solid understanding of what Sustainable Development is including its controversies. During my study, I was very happy to receive the opportunity to do a tailor-made course which was aimed to study the circularity, governance, policies and practices of rubber tyres in the Netherlands. This project was in cooperation with three PhD students (including Martin) with Walter Vermeulen as supervisor of the research. In this project, I became familiar with the Dutch legislative framework and learned how the Dutch waste management system was organised for rubber tyres. After the successful completion of the tailor-made course, I wanted to do something similar for my master thesis but then focused on plastics. Walter and Martin provided me with this opportunity. This report is the final result for the completion of my MSc program Sustainable Development track Earth System Governance. The results will provide you with insights into common and contested societal perspectives, and policy actions considered important for the achievement of a circular plastics economy in the Netherlands. At the end of the report, specific acknowledgements are given to the people and organisations who made this research possible.

Enjoy reading!

Dirkjan Lakerveld
Utrecht, June 2020

Table of contents

List of Figures

List of Tables

1. Introduction

1.1. Societal Background: The Need for Sustainable Production & Consumption

In recent decades, the accumulation of plastics waste, especially from plastic packaging which accounts for 59% of plastic waste generation (European Commission, 2018), and their degradation in the environment continuously increased (Lehner, et al., 2019). Therefore, much attention is given to the plastic industry by the United Nations Environmental Program (UNEP) and many countries. Overall, *synthetic polymers* (hereafter: plastics) have provided undeniable benefits to the world economy as it is a cheap lightweight material with high durability and relatively easy to make. However, dealing with plastics sustainably and responsibly remains a huge challenge (MacArthur, et al., 2016; Brooks, et al., 2018). Current prospects show that if waste management and consumption trends continue, "*the ocean could contain more plastic than fish by 2050*" and "*the plastic industry could account for 20% of the world's total oil consumption*" (UNEP, 2019, p. 2). These prospects illustrate that the plastic industry is far from achieving sustainability. Firstly, the pollution of plastics could lead to more biodiversity loss. Secondly, more CO_2 emissions emitted in the atmosphere caused by the production and consumption of virgin plastics contribute to climate change effects.

To address these challenges, various initiatives have formed such as the 'Global Commitment' which unites governments, businesses, and other organisations around the globe in a common vision for a Circular Economy (CE) for plastics. In 2016, the Dutch government set the target to become 100% circular by 2050 (Dutch Parliament, 2016). However, it seems that the Dutch recycling system for plastics is still not working properly. For instance, plastics still end up on a landfill (Afvalfonds, 2018; CE Delft, 2019) or in the environment (MacArthur, et al., 2016; Brooks, et al., 2018; UNEP, 2019; Forrest, et al., 2019), and plastics are incinerated instead of recycled (CE Delft, 2019). This hinders the aim to become fully circular by 2050.

At the same time, the development and introduction of virgin plastics are occurring at a higher pace (due to an increasing demand for plastics) than the development and deployment of related after-use systems and infrastructure (MacArthur, et al., 2016). Also, the price of virgin plastics derived from petroleum raw materials is too low to make the recycling of plastics economically viable (Forrest, et al., 2019). Therefore, better environmental, social and economic actions are required to transit from a linear towards a circular plastics economy that is economically viable (MacArthur, et al., 2016; Tencati, et al., 2016; Vince and Hardesty, 2018).

1.2. Scientific Background: The Emergence of the Circular Economy

Overall, the CE focuses on three key points. Firstly, it focuses on changing consumer behaviour and stakeholder adaption to circular solutions, and policy and laws that must shape the transition. Secondly, it focuses on rethinking business models and supply chains (Lüdeke-Freund, 2019). Essentially, the CE replaces traditional perspectives – take, make, use and dispose of – known as the Linear Economy (LE) with a CE that restores the values of used resources (de Sousa Jabbour, et al., 2018). Thirdly, it focuses on systematic challenges related to legal, political, cultural and economic regimes, social justice and environmental sustainability.

Since the start of the 21st century, the CE concept became a popular discourse in the public and private sectors (Friant, et al., 2020; Ghisellini, et al., 2016; Sauvé, et al., 2016). However, the CE is rather a refurbished concept than a new one as it is based on older sustainability models, such as Industrial Ecology, Cleaner Production, Closed Loop Supply-Chain Management, and Eco-design (Reike, et al., 2018). The emergence of the CE occurred gradually in different time steps. Firstly, in the 1970s – 1990s, the CE1.0 emerged and focused on dealing with waste itself. Subsequently, the CE2.0 emerged in the 1990s – 2010s and focused on "*connecting inputs and outputs for Eco-Efficiency*" (Reike, et al., 2018, p. 249) to achieve a greater resource efficiency and effectiveness. Eventually, the CE.3.0 emerged since the 2010s and focuses more on the underlying societal structures and values (Friant, et

al., 2020) to achieve social justice and environmental sustainability. These differences make that the CE is still an "essentially contested concept" in the public and academic debate (Korhonen, et al., 2018). Currently, the CE debate is mainly focused on the practical and technical levels regarding energy and materials (Hobson and Lynch, 2016; Korhonen, et al., 2018), while the social and political structures and implications of the CE are often ill-defined (Hobson and Lynch, 2016; Merli, et al., 2018).

1.3. Problem Definition

Plastics have provided undeniable benefits to the world economy. Current prospects show that the demand for plastics will tremendously increase in the coming years (Geyer, et al., 2017). This means that the plastic waste generation will increase as well. At the same time, research shows that the negative environmental and social impacts of plastics are outweighing the economic benefits (UNEP, 2019; Forrest, et al., 2019). Therefore, the transition from a LE towards a CE is championed and desired by the European Union, China, Japan, and Canada as the new economic approach to achieve a sustainable future (Korhonen, et al., 2018; Hahladakis and Iacovidou, 2019). However, as the social and political structures and implications of the CE are often underrepresented (Hobson and Lynch, 2016; Merli, et al., 2018), it is unclear whether and how the transition towards a CE contributes to sustainability.

The transition towards a CE is dependent on actor discourses on governance, policies, and practices (Fairclough and Fairclough, 2013; Fratini, et al., 2019). This phenomenon is also observed by Friant, et al. (2020). Their results show that different visions on the CE are often promoted by a specific group of actors. In the Netherlands, there is a lack of understanding of how different stakeholder discourses in society are represented and what their sustainability implications are concerning the governance mechanisms, policies and practices.

1.4. Research Aim

The research aims to map the main public and private stakeholder's discourses on the governance mechanisms, policies, and practices in the transition towards a circular plastics economy in the Netherlands. The objective is achieved by conducting a scientific literature review and discourse analysis with use of the Q-methodology. This included a European and Dutch policy analysis between 2000 and 2020, media (newspaper) analysis between 2010 and 2020, stakeholder analysis, 24 semi-structured expert interviews, a survey and statistical factor analysis.

1.5. Research Questions

The research aim is translated into the following main research question:

How are diverse societal stakeholder's discourses represented on governance mechanisms, policies, and practices in the transition towards a circular plastics economy in the Netherlands?

The main research question is addressed by the following sub-questions:

1. What are the existing governance mechanisms, policies, and practices for the Dutch plastic sector?
2. Who are the main public and private stakeholders in the Dutch plastic sector?
3. What are the different CE discourses by public and private stakeholders in the Dutch plastic sector and which ones are dominant?
4. What are the sustainability implications of the different CE discourses?

1.6. Relevance of the Research

This study focuses on the plastic sector in the Netherlands, and in particular on plastic packaging. The relevance of the research is justified by three reasons. Firstly, the Dutch government set the target to become fully circular by 2050. Secondly, the Netherlands achieved high recycling rates of plastic packaging in the past. For instance, the Netherlands recycled 52% of its plastic packaging waste in 2018,

while the EU norm is 22,5% (Afvalfonds Verpakkingen monitoring report, 2018). Thirdly, since the Global North has been exporting plastic waste to the Global South for many years (Brooks, et al., 2018), the accumulation of plastics and their degradation in the environment continuously increased (Lehner, et al., 2019). This is partly due to low capacities to process and manage all the plastic waste in the Global South (Brooks, et al., 2018). Therefore, in 2019, the UN implemented new legislation (the Norwegian Amendment) to make international plastic waste trade more regulated and more transparent. This Amendment stimulates Global North countries to improve their waste management infrastructure.

1.7. Research Contribution, Output, and Applicability

The research mainly contributes to the achievement of the United Nations Sustainable Development Goal 12: Responsible production and consumption for the Netherlands. The intended research outputs include: (1) the existing governance mechanisms, policies, and practices in the Dutch plastic sector; (2) the public and private stakeholders in the Dutch plastic sector; and (3) different societal CE discourses and their sustainability implications of the circular plastics economy. Since this research represents different societal perspectives, this improved the applicability of the research output in societal practices to a great extent. In doing so, the findings could be used to facilitate future academic research, and could contribute to a better understanding of the transition towards a circular society.

1.8. Thesis Outline

This chapter was the introduction to the research topic. The outline of this thesis report is presented in Figure 1.

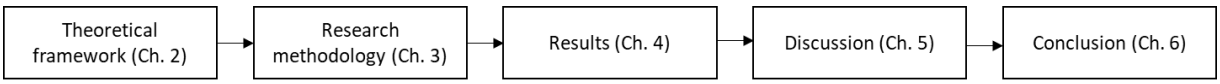


Figure 1 Thesis reading guide.

- Chapter 2 describes the theoretical context.
- Chapter 3 explains the research methodology and the process of data gathering.
- Chapter 4 provides the results derived from the data gathered.
- Chapter 5 discusses the findings.
- Chapter 6 presents the conclusion of this master thesis.

2. Theoretical Framework

2.1. Climate Change and Sustainable Development

In 2013, the Intergovernmental Panel on Climate Change (IPCC) released the Fifth Assessment report on global warming. This report stresses that urgent actions must be taken by all countries to mitigate climate change and to preserve natural resources. The IPCC emphasises that human activity has a dominant influence on the observed global rise of temperature and environmental degradation. The consequences are that the oceans warmed up, sea levels have risen due to melted ice in the arctic regions, and extreme weather events have become more common. Climate change is therefore considered as a serious threat to humanity (Collins, et al., 2013).

Sustainable development is widely addressed by many countries for societal development since the publication of the Brundtland report "*Our Common Future*" by the World Commission on Environment and Development (WCED) in 1987. Ever since, many definitions have been given to sustainable development. The original definition is as follows: "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*" (UNWCED, 1987). Critics on sustainable development argue that sustainable development "*is vague, attracts hypocrites and fosters delusions*" (Robinson, 2004, p. 369), because it tries to reconcile two irreconcilable aspects such as economic development and environmental sustainability (Robinson, 2004). This controversy reinforces diverse and contested discourses.

2.2. Plastics jeopardising Humanity & Ecosystems

The continuously increasing 'Great Pacific Garbage Patch', which already consists of 1.6 million square kilometres floating plastic garbage in the Pacific Ocean (of which in total five exist) illustrates the scale of the global plastic pollution in the oceans. The size of the Great Pacific Garbage Patch is equal to approximately three times the size of France. Therefore, the pollution of plastics in the environment is considered as "*the new millennium tragedy of the commons*" (Vince and Hardesty, 2018, p. 1) due to the difficulty to govern international legislation, economics and market-based instruments and community solutions (Vince and Hardesty, 2018).

Since plastics are mainly derived from fossil raw materials, such as oil and gas (Lehner, et al., 2019), they do not biodegrade (UNEP, 2019, p. vi). The degradation process can therefore take centuries (UNEP, 2019). During this process, plastics degrade from *macroplastics* which are notably visible (Bråte, et al., 2017), into *microplastics* which are smaller than 0.5 mm in size (Bråte, et al., 2017), and eventually in *nanoplastics* which range in size from 1 nm up to 1000 nm (Gigault, et al. 2019). The impact of plastics on the environment include habitat damage through the adherence to floating litter, entanglement, and ingestion of plastics by biota (Bråte, et al., 2017). Biota often die once they have ingested or are entangled by the plastics (Derraik, 2002; Teuten, et al. 2007; Andrady, 2011; Cole, et al., 2013; Li, et al., 2015; Bråte, et al., 2016). Currently, it is very difficult to determine the existence and presence of micro and nanoplastics in the environment (Bouwmeester, et al., 2015; Bråte, et al., 2017).

Besides the threats to ecosystems, recent studies also show that plastics are found in human foods, such as honey, beer, salt, and sugar (Liebezeit and Liebezeit, 2013; Liebezeit and Liebezeit, 2014; Yang, et al., 2015). Plastics can be harmful to human health (Lehner, et al., 2019) by damaging and inflammation the human lungs, skin, and brain cells (Forrest, et al., 2019). Many diseases, such as cancer (Ohlson and Hardell, 2000; Brophy, et al. 2012; DeMatteo, et al., 2013), obesity (Nadal, 2012; Manikkam, et al., 2013), diabetes (Lang, et al., 2008; Shanker and Teppala, 2011), endocrine system disorders (Andra and Makris, 2012; Brophy, et al. 2012), thyroid dysfunction (Ahmed, 2016), and reproductive impairment (Kabir, et al., 2015), are linked to leaching of harmful substances by nanoplastics in the human body (Forrest, et al., 2019).

2.3. Circular Economy Discourses

Circular Economy discourses differ in whether actors have a holistic or segmented approach to social, economic, environmental and governance considerations on the CE, and "*whether discourses are optimist or sceptical about the capacity of technology and innovation to overcome the major ecological challenges of the Anthropocene before an irreversible ecological collapse occurs*" (Friant, et al., 2020, p. 21). Essentially, a discourse is a shared way of how the world is understood and perceived. It consists of bits of information put together by people to create a coherent story of reality. In other words, "*discourses construct meanings and relationships, helping define common sense and legitimate knowledge. Each discourse rests on assumptions, judgments, and contentions that provide the basic terms for analysis, debates, agreements, and disagreements"* (Dryzek, 2013, p. 9-10). Discourses can coordinate the actions of large groups of people and organisations. However, the way a discourse is perceived might not be accepted by others. Discourses are often associated with politics and power (Hajer and Versteeg, 2005), some are more dominant, while others are suppressed. Therefore, discourses are considered important since they condition the way humanity defines, interprets, and addresses environmental affairs (Dryzek, 2013). Fairclough and Fairclough (2013) constructed a framework to structure practical reasoning in political discourses (Figure 2). In this study, this framework is used to analyse (inter)national governmental policies and to structure stakeholder discourses.

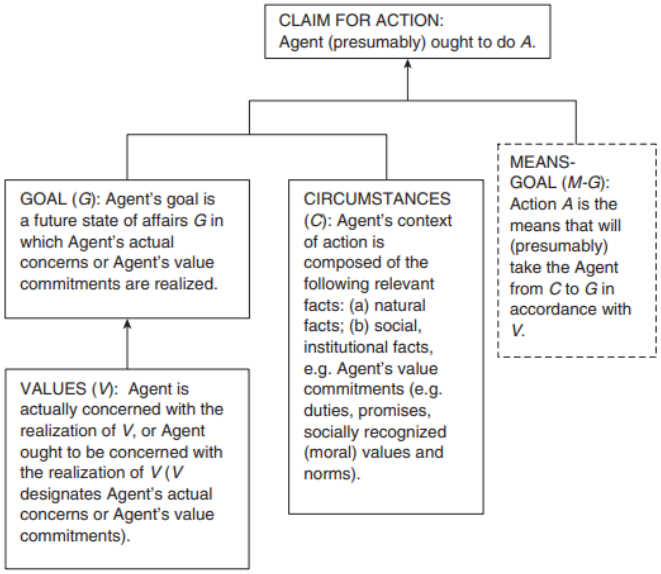


Figure 2 Structure of practical reasoning framework (Fairclough and Fairclough, 2013, p. 48).

As Meadows (1999, p. 21) describes it is crucial "*to keep oneself unattached in the arena of paradigms, to stay flexible, to realize that no paradigm is "true", that everyone, including the one that sweetly shapes your own worldview, is a tremendously limited understanding of an immerse and amazing universe that is far beyond human comprehension*". This means that it is key to build synergies between different discourses. Thus eventually, a more plural understanding of what a CE is, could minimise the risk that the CE turns into a hegemonic vision. In doing so, the CE becomes less susceptible to 'greenwashing' (Friant, et al., 2020).

Friant, et al. (2020) developed four CE discourses for circularity thinking. In this research, this framework is used to map actor discourses (Figure 3). Firstly, the ***Reformist Circular Society*** discourse proposes a deep reform of the current societal system "*toward circularity and believe that social and economic innovation can lead to a sufficient level of eco-economic decoupling to prevent a widespread ecological collapse*" (Friant, et al., 2020, p. 22). This discourse does not see a fundamental contradiction between sustainability and capitalism, and beliefs that social-cultural change and new ways of public participation are necessary to achieve sustainability. Examples of circular concept are Doughnut Economics (Raworth, 2017), the Sharing Economy (Frenken, 2017), and the Social Circular Economy

(Economy, 2017) as explained by Friant, et al. (2020). Secondly, the ***Transformational Circular Society*** discourse proposes "*an entirely transformed social system where individuals gain a renewed and harmonious connection with the Earth and their communities*" (Friant, et al., 2020, p. 22). Especially local production through collaborative economic initiatives are emphasised: "*using agroecological techniques and open-source innovations and technologies that do not harm the biosphere nor deplete its limited resources*" (Friant, et al., 2020, p. 22). Examples of circular concepts are Degrowth (Latouche, 2009), Eco-socialism (Löwy, 2011), Voluntary Simplicity (Trainer and Alexander, 2019) as explained by Friant, et al. (2020). Thirdly, the ***Technocentric Circular Economy*** discourse proposes "*an era of 'green growth' and technological advancements, which allow for increasing levels of prosperity while reducing humanity's ecological footprint. These discourses thus expect that circular innovations can lead to an absolute eco-economic decoupling to prevent ecological collapse*" (Friant, et al., 2020, p. 22). Examples of concepts are the Circular Economy (Pearce and Turner, 1989), Eco-design (Ryan et al., 1992), Cleaner Production (Baas, 1995), Closed-loop Supply Chain (Guide et al., 2003), and Energy Recovery (Boyle, 1977) as explained by Friant, et al. (2020). Lastly, the ***Fortress Circular Economy*** discourse has "*a vision of a future where scares resources, overpopulation and biophysical limits require strong cohesive measures. These discourses thus seek to impose sufficiency, population controls and resource efficiency from the top down to rationally confront global scarcity and limits, yet they do not deal with questions of wealth distribution and social justice*" (Friant, et al., 2020, p. 22). Examples of concepts are the Tragedy of the Commons (Hardin, 1968), The Population Bomb (Ehrlich, 1968), and Overshoot (Catton, 1982) as explained by Friant, et al. (2020).

		Approach to social, economic, environmental and political considerations	
		Holistic	**Segmented**
Technological innovation and ecological collapse	**Optimist**	**Reformist Circular Society** • *Assumptions:* reformed form of capitalism is compatible with sustainability and socio-technical innovations can enable eco-economic decoupling to prevent ecological collapse. • *Goal:* economic prosperity and human well-being within the biophysical boundaries of the earth. • *Means:* technological breakthroughs, social innovations and new business models that improve ecological health, resource security, and material prosperity for all.	**Techncentric Circular Economy** • *Assumptions:* capitalism is compatible with sustainability and technological innovation can enable eco-economic decoupling to prevent ecological collapse. • *Goal:* sustainable human progress and prosperity without negative environmental externalities. • *Means:* economic innovations, new business models and unprecedented breakthroughs in CE technologies for the closing of resource loops with optimum economic value creation.
	Sceptical	**Transformational Circular Society** • *Assumptions:* capitalism is incompatible with sustainability and socio-technical innovation cannot bring absolute eco-economic decoupling to prevent ecological collapse. • *Goal:* a world of conviviality and frugal abundance for all, while fairly distributing the biophysical resources of the earth. • *Means:* complete reconfiguration of the current socio-political system and a shift away from productivist and anthropocentric worldviews to drastically reduce humanity's ecological footprint and ensure that everyone can live meaningfully, and in harmony with the earth.	**Fortress Circular Economy** • *Assumptions:* there is no alternative to capitalism and socio-technical innovation cannot bring absolute eco-economic decoupling to prevent ecological collapse. • *Goal:* maintain geostrategic resource security and earth system stability in global conditions where widespread resource scarcity and human overpopulation cannot provide for all. • *Means:* innovative technologies and business models combined with rationalized resource use, imposed frugality and strict migration and population controls.

Figure 3 Circularity discourse typologies (Friant, et al., 2020, p. 21).

2.3.1. Discourses forming Governance, Policies and Practices

The way humanity thinks about the environment changes over time (Dryzek, 2013). For instance, since the 1890s the idea arose that human activity could cause climate change effects. However, a global agreement on this issue was not found until the establishment of the United Nations Framework Convention on Climate Change in 1992. The reason why this shift in governance happened is because "*the way the issue is dealt with depends largely (though not completely) on the balance of competing discourses*" (Dryzek, 2013, p. 8). In other words, "*diverging perspectives or discourses shape actions,*

institutions and power relations and fulfil a key role in processes of change" (Ampe, et al., 2019, p. 2). With this respect, the power of discourses is not only to include certain ideas, but it is also able to exclude ideas from the debate. In doing so, it influences what is thought within a societal group. Therefore, discourses influence sustainability transition pathways (Ampe, et al., 2019), and environmental governance and policy development (Smith and Kern, 2009).

Sustainability transitions, the process of change from one system to another, refers to a period of non-linear disruptive change in a societal system (Loorbach, et al., 2017). It refers to an iterative process of structural change, with changes in fundamental patterns, elements, and interrelations (Feola, 2015). Transformations are often used to describe ecological changes. They can occur as a result of ecological changes where the environment ended-up in a degraded state, an ecological crisis with unexpected or unanticipated outcomes, or shifts in social values and resources (Olsson, et al., 2006). Sustainability transition management is a form of multi-level governance. It interferes with all levels, i.e. the strategic (e.g. problem-structuring, envisioning, long-term goals), tactical (e.g. agenda-building, networking, negotiation), and operational level (e.g. experiments, projects, innovation, implementation) (Kemp et al., 2007). These three levels interact with each other and are all considered equally important when governing sustainability in transitions.

"*Governance, in essence, is about solving collective action dilemmas*" (Driessen, et al., 2012, p. 145) and is determined by the relations and interactions between state, market and civil society actors. Governance includes three features: *actor* (e.g. ambitions, stakeholders, different policy levels, and basis of power), *institutional* (e.g. model of representation, rules of exchange and interaction, and mechanisms of social interaction) and *content* (e.g. types of goals, policy instruments, types of knowledge, and the integration of these features). The interaction between those features lead to certain measures, decisions and implementations in a certain context, e.g. in a country, aimed to prevent, reduce and mitigate harmful effects on the environment (Driessen, et al., 2012). Therefore, good environmental governance is key to prevent environmental degradation, depletion of resources, biodiversity loss, and climate change. Driessen, et al., (2012) distinguish five modes for environmental governance as presented in Table 1.

Table 1 The modes of environmental governance (Driessen, et al., 2012).

Governance mode	Explanation
Centralised	Central government takes the lead, the market and civil society are the recipients of the government's incentives.
Decentralised	Regional and local governments take the lead, the market and civil society are the recipients of the government's incentives.
Public-private	Cooperation is mainly between government and market actors.
Interactive	Governments, market actors, and civil society are collaborating on equal terms.
Self-Governance	Environmental goals are aimed to be achieved by private efforts and investments.

In the 1990s, the concept of 'Extended Producer Responsibility (EPR)' was introduced by the Swedish academic Thomas Lindhqvist. He defined EPR as "*a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially to the take-back, recycling and final disposal of the product*" (Lindhqvist, 2000, p. 37). In essence, EPR gears towards cleaner production and involves a shift in (administratively, financially, and physically) responsibility from government to producers for the whole lifespan of the products they make. The EPR approach can be considered as a public-private mode of governance, and builds on both, the 'polluter's pay principle' (Watkins, et al., 2017) and the achievement of mandatory and voluntary objectives and agreements between the market and state. Since the introduction of the OECD EPR Guidance Manual in 2001, the adoption of EPR policies grew exponentially (Kaffine and Reilly, 2013) and became a leading and dominant policy approach in the European Union as well as in the Netherlands. The OECD manual points out four goals of EPR policies: "*1) source reduction; 2) waste prevention; 3) design of more environmentally compatible products; and 4) closure of materials use loops to promote sustainable development*" (Kaffine and Reilly, 2013, p. 8).

2.3.2. Operationalisation of Circular Economy Discourses

Plastic packaging is important for safely distributing products, and especially for preventing food waste (Coelho, et al., 2020). The amount of packaging is growing, in particular in the retail sector, and plastic waste generation is expected to grow tremendously in the future (Geyer, et al., 2017). Plastic packaging is often applied to bottles, films, bags and containers, also referred to as "single-use plastics" (UNEP, 2019). Most fossil-based plastic packaging is made from thermoplastic, such as polystyrene, polyethylene terephthalate (PET), polyvinyl chloride (PVC), polypropylene (PP), and polyethylene (PE) which distinguishes low-density polyethylene (LDPE) and high-density polyethylene (HDPE). Most of them can also be made from bio-based materials such as bio-PET, bio-PP, bio-PE or polylactic acid (PLA). Generally, thermoplastics can be easily recycled, remoulded or reshaped, because the curing process is reversible and no chemical bonding takes place. However, due to the different chemical bonds and properties, every plastic material requires another treatment option (Ragaert, et al., 2017).

In the literature, the CE concept is operationalised into a 10R's imperative framework (Reike, et al., 2018). This framework represents the treatment operations for certain products and materials. The R's are ranked from the longest loop (R9: Re-mine) to the shortest loop (R0: Refuse). Generally, Refuse (R0) is the most sustainable. However, the other shorter loops are not necessarily more sustainable than a longer loop. This is partly dependent on the purpose of a certain product and the substances that it contains. Besides, not all R's apply effectively to plastic packaging. For instance, R3, R4 and R5 (Table 2) do not apply to plastic packaging (but can effectively apply to household products such as coffee machines). Additionally, it could also be that it is technically not feasible to recycle (R7) plastics effectively because technologies do not exist (yet) (Ragaert, et al., 2017).

In this research, the hierarchically ranked 10R-imperative framework (Reike, et al., 2018) is used to clarify the treatment options for plastic packaging. Therefore, references are often made to the '10R's' (Table 2). Furthermore, the R's could help reveal stakeholder discourses since they could have different perspectives on the implementation of the CE. For example, a *Technocentric Circular Economy* would be associated with R4-R9 (Friant, et al., 2020), a *Reformist Circular Economy* with R3-R7 (Friant, et al., 2020), a *Transformational Circular Society* with R0-R6, and a *Fortress Circular Economy* with R0-R9 (Friant, et al., 2020). However, one of the main criticisms on the R-hierarchy is that it does not take into account export and leakage to other countries (Reike, et al., 2018), social considerations. and principles of eco-design. Therefore, these should be taken into account as well.

Table 2 10R-imperatives framework applied to treatment operations for plastics (Reike, et al., 2018, edited).

R's	Treatment Operations
R0	**Refuse:** For producers, refuse to use plastic materials or designs. For consumers, buy or use less plastics. For governments, policies which ban certain plastics or other government planning policies.
R1	**Reduce:** Via preventing plastic usage, either by using less plastic material in plastic packaging, make more efficient use of virgin materials, and deploying other materials with lower environmental impact.
R2	**Resell/Reuse:** Increasing the percentage of reusable plastic materials.
R3	**Repair:** Extend the lifetime of a plastic product by 'bringing back into working order'. This does not apply to plastic packaging.
R4	**Refurbish:** The plastic product remains intact, while components are replaced. This results in an overall upgrade of the product (e.g. use newer or more advanced plastics in products), 'up to the state of art'. This does not apply to plastic packaging.
R5	**Remanufacture:** Full structure of the plastic product is disassembled, checked, cleaned, and when necessary replaced or repaired in an industrial process (e.g. plastics in electronic waste), 'up to the original state'. This does not apply to plastic packaging.
R6	**Repurpose:** Reusing discarded plastics for another function, plastic material gets a new life (e.g. plastic sheeting into handbags), or it is processed in another low-tech way (without chemically nor mechanically recycling).
R7	**Recycling:** 'any recovery for any purpose' by downcycling, recycling, or upcycling of plastic waste of post-consumer products/waste streams. This includes shredding, melting and other **chemical/mechanical** processes to capture (nearly) pure materials (which degrade over time).
R8	**Energy recovery:** Recover energy via incineration.
R9	**Re-mine:** Retrieval of plastics by landfill mining.

Concerning recycling (R7), plastics can be mechanically and chemically recycled. In the mechanical process, plastics are converted into secondary raw material without changing the chemical structure of the plastic (Ragaert, et al., 2017). This is possible for most thermoplastics (e.g. PET, PP, and PE). It has environmental benefits such as the replacement of virgin materials which reduces the environmental impact by the extraction of virgin materials. At the same time, it has economic benefits by generating revenues from selling the recyclate. The main challenges of mechanical recycling techniques are related to sorting and reprocessing (Ragaert, et al., 2017). A brief overview of current mechanical recycling techniques, advantages, and challenges is given in Table 3.

Table 3 Mechanical recycling techniques, advantages, and challenges (Ragaert, et al., 2017, p. 54, edited)

	Technique	Advantages	Challenges
Sorting	Flotation (sink-float)	Well-known technology; Cost-effective; Particle size.	Efficiency determined by density differences plastics; Mainly limited to binary mixtures.
	Melt filtration	Useful to remove non-melting contaminants; Additional melt pressure.	Potential pressure fluctuations in production.
	Fourier Transform Infrared Spectroscopy	Post-drying not required; Well-known.	Black plastic is undetectable; Plastic should be dry.
	Tribo-electric (electrostatic) separation	Efficient for various plastics; Small particle sizes allowed.	Pre-treatment.
	Froth flotation	Efficiency.	Precursor step required; in development for recycled plastics.
	Magnetic density separation	Improved density-based technique; Multiple polymer fractions in a single step.	Density overlaps remain.
	X-ray detection	Accuracy; Useful for PVC.	Cost-effectiveness.
Reprocessing	(not specified)	High-value recycling; Well-known technology; Straightforward.	Thermal-mechanical degradation; Challenging for complex mixtures; Miscibility of polymer blends.

In the chemical recycling process, plastics are converted into valuable chemicals for the chemical industry (Ragaert, et al., 2017). First, polymers (large molecules) are broken down into oligomers and eventually in monomers (small molecules) through techniques such as gasification, pyrolysis, chemical depolymerisation, hydrogenation, and catalytic cracking and depolymerisation (Ragaert, et al., 2017). Then, the monomers can be used as building blocks for virgin polymers (Ragaert, et al., 2017). A brief overview of current chemical recycling techniques, advantages, and challenges is given in Table 4.

Table 4 Chemical recycling techniques, advantages, and challenges (Ragaert, et al., 2017, p. 54, edited)

Technique	Advantages	Challenges
Chemolysis	Generates pure value-added products; Operational for PET.	Requires high volumes to be cost-effective; Mainly limited to condensation polymers.
Pyrolysis	Suitable for highly heterogeneous mixtures of plastics; Simple technology.	Complexity of reactions; Requires high volumes to be cost-effective; Low tolerance for PVC; Stable waste supply.
Fluid Catalytic Cracking	Narrow product outcome; Less stringent reaction conditions leads to favourable economics.	Deactivation of catalyst; Absence of suitable reactor technology; Presence of inorganics.

Hydrogen technologies	Hydrocracking	Quality of produced naphtha; Suitable for mixtures of plastics.	High cost of hydrogen; High investment and operational costs.
	IH^2 process	Promising technology for the production of liquid fuels out of biomass; Different elements already commercialized.	Further research required.
Catalytic Depolymerization		Also suitable for oxygen and halogenated compounds.	Chemistry still unknown; Lack of technical information.
Gasification		Syngas is a valuable intermediate; Cost of air; Well-known technology.	Amount of noxious NO_x; Specific drawbacks of air.

2.4. Conceptual Framework

Overall, the CE requires to rethink business models and supply chains (Lüdeke-Freund, 2019). It requires a shift in governance in the economic model, but also influences societal and environmental values and resources. Thus, the transition from a LE (current situation) to a CE (desired situation) is a process of change from one system to another (Loorbach, et al., 2017), a so-called 'sustainability transition', in which a period of non-linear disruptive societal changes could occur. Therefore, the study object of this research is the sustainability transition from a LE to a CE. This is being studied in this research by the representation of discourses on governance mechanisms, policies and practices in the transition towards a circular plastics economy in the Netherlands.

Different discourses perceive the environment differently and communicate different social values, assumptions and beliefs. Both, form a perception of reality. Reality is perceived and communicated differently by every individual. As discourses determine how the world is understood and perceived, different CE discourses thus propose different sustainability transition pathways (Dryzek, 2013). Transitions could occur as a consequence of ecological changes and/or a shift in societal values and resources (Loorbach, et al., 2017). Recent years, both the degraded state of the environment and social beliefs constructed a certain reality that urgent environmental, social, and economic governance and actions are needed to tackle plastic related issues. In this case, the circular plastics economy is championed and desired by the Dutch government. Therefore, discourses determine how the circular plastics economy is understood and how it will be implemented in the future. During the transition, the way people think could change over time (Dryzek, 2013). As humans behave differently (e.g. more sustainable) and learn, this could simultaneously reinforce other discourses which could form other social values, beliefs, or another perception of the environmental state. This, in turn, reinforces another perception of reality, governance, actions and so on. This process is visualised in the conceptual model in Figure 4.

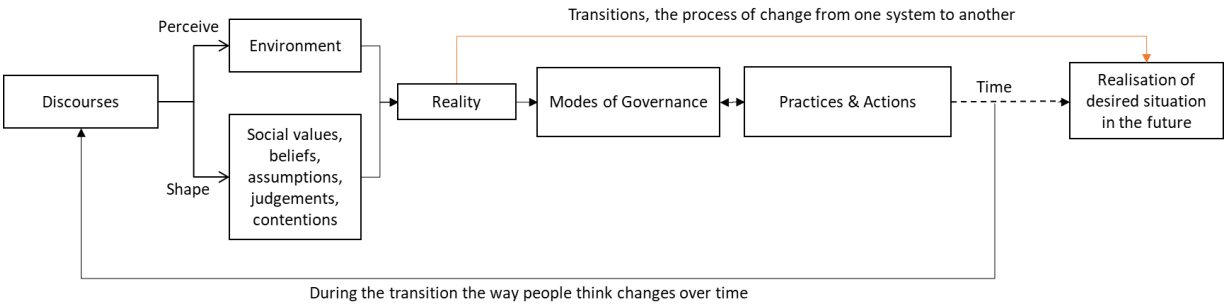


Figure 4 Conceptual model.

3. Methodology

This research uses a single case study approach to provide in-depth recommendations on the transition towards a circular plastics economy in the Netherlands. The case selection was justified by three reasons: first, the target of the Dutch government to become 100% circular by 2050; second, the Netherlands achieved a high recycling rate of plastic packaging (e.g. 52% in 2018, whereas the EU norm is 22,5%) (Afvalfonds Verpakkingen monitoring report 2018); and third, Global North countries have to improve their waste management infrastructure. This study is qualitatively and quantitative driven and employed with a multi-method approach.

3.1. Research Framework

Figure 5 presents the research framework of the research. The research commenced by first, a literature review to establish the conceptual model. Then, discourse analysis is conducted with the use of the Q-methodology consisting of six stages to arrive at societal discourses. The analysis included a European and Dutch policy analysis between 2000 and 2020, media (newspaper) analysis between 2010 and 2020, stakeholder analysis, 24 semi-structured expert interviews, a survey and statistical factor analysis. The stages in the research framework are explained in more detail in the following sections.

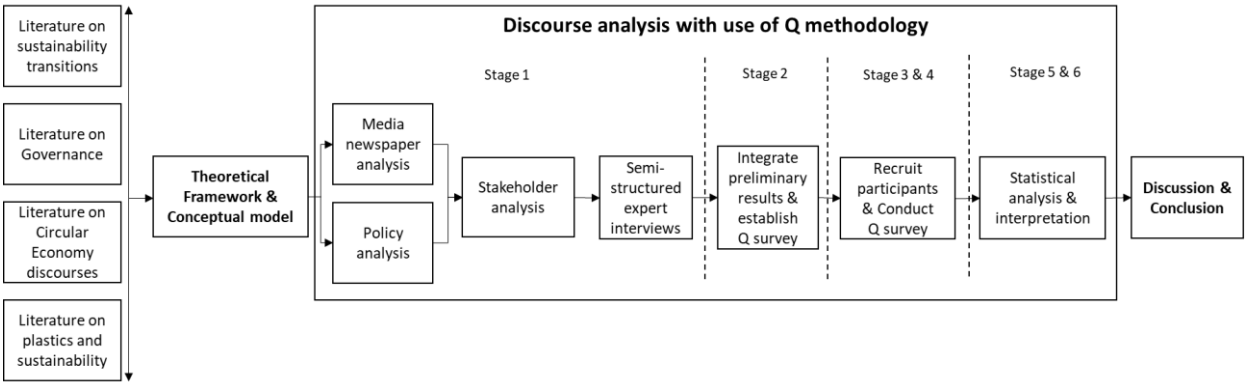


Figure 5 Research framework.

3.2. Scientific Literature Review

The research commenced with a scientific literature review to establish the conceptual foundation of this research. The literature review aimed to provide an understanding of sustainability transitions, discourses forming governance, policies and practices, sustainability of plastics, and the CE. The results concluded in the conceptual model as presented in Figure 4. Scientific literature was obtained with the help of the academic search engines Google Scholar and Scopus. Relevant academic literature was also found by consulting the references in the relevant academic articles.

3.3. Discourse Analysis

Q methodology (introduced by William Stephenson in 1935) is an interdisciplinary holistic mixed (quantitative and qualitative) research method. The purpose of a Q study is to identify different perspectives, instead of their prevalence in a large population. In other words, the Q study is about identifying the representation of different viewpoints about a certain study object (Brown, 1980; Watts and Stenner, 2005; Watts ad Stenner, 2012). For this reason, the Q method is also considered as a 'small sample' research method (Brown, 1980). It is a commonly used method specifically designed to study the finite range of different perspectives (or discourses) within a sociodemographic group on a certain societal topic. In essence, Q-based discourse analysis identifies how different societal groups align with certain ensembles of ideas and beliefs (Stevenson, 2019). The method can also be applied to elicit alternatives or solutions to certain problems, especially "*at the stage of policy design, when measures have not yet been implemented and researchers aim to understand various options*" (Zabala et al., 2018,

p. 1990). For instance, Stevenson (2019) recently applied the Q method, and he derived three underpinning discourses including several key points of the wider debate concerning the 'green political economy'. Besides, the Q methodology can be applied to identify the most and least important policy actions since "*diverging perspectives or discourses shape actions, institutions and power relations and fulfil a key role in processes of change*" (Ampe, et al., 2019, p. 2). In this area of the research, the Q methodology is a suitable approach to apply in this research, since it can be used "*to explore whether and why a policy mechanism is or will be accepted*" (Zabala, et al., 2018, p. 1192). Besides, it can be used to reveal other key points for achieving the Dutch circular plastics economy.

Generally, the Q method data analysis works reductive. The research starts with a large number of statements which in the end is reduced to a few viewpoints. The wide variety of collective perspectives of stakeholders on a certain topic form the so-called 'concourse' of the study object. Essentially, the 'concourse' means: the universe of different viewpoints (Brown, 1980). From these collective viewpoints of different stakeholders, statements can be derived which form the so-called 'Q-set' (Exel and Graaf, 2005). A 'Q set' consisting of 40 and 80 statements is considered as satisfactory in a Q-study (Curt, 1994; Stainton Rogers, et al., 1995). Respondents (the P-set) are asked to rank the set of statements based on individual consent and preference. This process is called 'Q-sorting'. The 'Q-sort' technique is the most important part of the Q-methodology (Brown, 1980). Here, people provide their point of view, and in doing so they reveal their subjectivity about a topic including their profiles. During the Q-sorting process, participants have to give a relative weighing of all statements on a quasi-normal distribution (Brown, 1993). The Q-sorting process is followed by a pattern- and 'by person' factor-analysis to reveal groups of participants who sorted the set of statements similarly. This represents a shared view, a so-called 'factor' in the literature (Brown, 1993). Thus, each factor reflects a different point of view. A brief description is given on the general steps needed to collect the data, and how to conduct Q analysis. The method consists of six stages (Barry and Proops, 1999). These are also taken in this research.

3.3.1.1. Stage 1: Definition of the Concourse

In this step, it is key to identify all 'discourses' in the population and gather all relevant opinions, ideas, beliefs, and assumptions surrounding the study object, in this case: the transition towards a circular plastics economy in the Netherlands. It is very important to collect as many different discourses of the topic as possible. In this part of the research, policy analysis, media newspaper analysis, stakeholder analysis and 24 semi-structured expert interviews were conducted to obtain a series of opinions and statements concerning the transition towards a circular plastics economy in the Netherlands.

3.3.1.1.1. Policy Analysis

Data collection: As the spectrum of policies regarding the transition to a Dutch circular plastics economy is very broad, this study mainly focused on policies and monitoring reports from the European Union, the Dutch government, and Afvalfonds Verpakkingen (Waste Management Fund which represents all producers and importers of packaging in the Netherlands). Table 5 provides an overview of the empirical data sources used in this research.

Table 5 Empirical data sources for policy analysis.

Year	Document location	Dutch document name	English document name
2003	Rijkswaterstaat	Landelijk Afvalbeheerplan 1	National Waste Management Plan 1
2004	Rijkswaterstaat	Landelijk Afvalbeheerplan 1	National Waste Management Plan 1
2007	Rijkswaterstaat	Landelijk Afvalbeheerplan 1	National Waste Management Plan 1
2007	Dutch Parliament	Besluit Beheer Verpakkingen en papier en karton	Packaging and Paper and Cardboard Management Decree
2007	Dutch Parliament	Raamovereenkomst Verpakkingen en zwerfafval	Framework Agreement on Packaging and litter

2013	Dutch Parliament	Programma: Van afval naar grondstof	Program: From waste to raw material
2014	Dutch Parliament	Raamovereenkomst Verpakkingen	Framework Agreement on Packaging
2014	Afvalfonds Verpakkingen	Monitoringsrapportage 2014	Monitoring report 2014
2014	Rijkswaterstaat	Landelijk Afvalbeheerplan 2	National Waste Management Plan 2
2014	Dutch Parliament	Besluit Beheer Verpakkingen	Packaging Management Decree
2015	European Commission		Directive 2015/720/EU on reducing consumption plastic bags
2015	Afvalfonds Verpakkingen	Monitoringsrapportage 2015	Monitoring report 2015
2016	Dutch Parliament	Rijksbrede programma Nederland Circulair in 2050	A circular economy in the Netherlands by 2050
2016	Afvalfonds Verpakkingen	Monitoringsrapportage 2016	Monitoring report 2016
2017	Dutch Parliament	Grondstoffenakkoord	National agreement on the circular economy
2017	Dutch parliament	Transitie agenda Kunststoffen	Transition agenda circular economy for plastics
2017	Afvalfonds Verpakkingen	Monitoringsrapportage 2017	Monitoring report 2017
2018	European Commission		A European Union Strategy for plastics in a Circular Economy 2018
2018	European Commission		Directive 2018/851 on waste
2018	European Commission		Directive 2018/852 on packaging and packaging waste
2018	Afvalfonds Verpakkingen	Monitoringsrapportage 2018	Monitoring report 2018
2019	European Commission		Directive 2019/904 on the reduction of the impact of certain plastic products on the environment
2019	Dutch Parliament	Plastic Pact NL	Plastic Pact NL
2019	Rijkswaterstaat	Landelijk Afvalbeheerplan`3	National Waste Management Plan 3

Data analysis: Policies were analysed qualitatively through content analysis to better understand the legislative framework and transition pathway. Policies were analysed by studying (1) the policy history, and (2) activities done in the past to improve plastic management. The content of the data is structured and summarised according to the practical reasoning framework (i.e. circumstances, goals, and means) of Fairclough and Fairclough (2013, p. 48) provided in Appendix A.

3.3.1.1.2. Media Analysis

Data collection: This study made use of the LexisNexis database to gather Dutch legal and journalistic documents for the media newspaper analysis. Using “plastic*” OR “kunststof*” AND “circulaire economie” OR "kringloopeconomie" as keywords, a search of the news archive returned with a total of 1212 newspaper articles between 01-01-2010 and 17-12-2019. The sample was reduced to 183 news articles by selecting the national paid newspapers, such as Trouw, Financieele Dagblad, Nederlands Dagblad, NRC Handelsblad, Volkskrant, Telegraaf, Reformatorisch Dagblad, and Algemeen Dagblad. This sample was chosen to cover a wide spectrum of the Dutch population to identify stakeholders, and opinions and statements.

Data analysis: The analysis started by selecting relevant news articles concerning the circular plastics economy through content analysis. In case articles occasionally contained one of the keywords (see above) and did not relate to the transition to the Dutch circular plastics economy, these articles were excluded from the sample. After deletion, the final sample consisted of 42 articles (Appendix B). These

news articles were coded in Discourse Network Analyzer 2.0. and acted as data for the empirical database. The news releases were analysed on the name of the newspaper, publication year, number of publications per newspaper, references to other documents (such as legislation, policies, and reports), mentioned stakeholders, and explicit stakeholder statements. Direct statements were included to complement the main empirical body. The results took form in a list of statements derived from the newspaper articles (Appendix C).

3.3.1.1.3. Stakeholder Analysis

Stakeholder analysis is conducted with a twofold approach through (1) policy analysis, and (2) media newspaper analysis. First, the methodological approach for stakeholder analysis through policy analysis is similar to previous work from Giurca and Metz (2018). As they identified actors and main organisations in Germany's Wood-based Bioeconomy by consulting "*web pages, reports, policy documents*" (Giurca and Metz, 2018, p. 4), this study used the same approach for identifying stakeholders in the transition to a circular plastics economy in the Netherlands. As the spectrum of actors in the transition is very broad, this study mainly focused on web pages, reports, and policy documents from the European Union and Dutch government, but also from Afvalfonds Verpakkingen monitoring reports. Hereby, it was assumed that stakeholders participating in policy development are: (1) actively involved in the transition towards a circular plastics economy; and (2) have a certain interest or stake in the achievement of this transition. Furthermore, policies were analysed based on the stakeholders to which they apply to. For instance, this could be mandatory through legislation or voluntary through agreements signed by different stakeholders. Second, the methodological approach for stakeholder analysis through media analysis is similar to previous work from Lazarevic and Valve (2017). As they identified actors publicly engaging in the circular economy debate on the European level with the use of the European news services EurActiv and ENDS Europe, this study made use of the LexisNexis database to gather Dutch legal and journalistic documents to identify stakeholders. The integration of results formed a list of stakeholders as presented in Appendix D.

3.3.1.1.4. Semi-Structured Expert Interviews[1]

Data collection: Semi-structured interviews with professionals in the Dutch plastics value chain were held to explore the research questions, and to keep an open mind on what is talked about by stakeholders actively involved in the transition to a circular plastics economy in the Netherlands. Interviewees were selected based on their expertise in the transition to a circular plastics economy and derived from the results of the stakeholder analysis. Also, interviewees were recruited through the 'snowball-sampling' method at the end of each interview. Snowball-sampling is a recommended research method to identify relevant stakeholders as well (Webler, et al., 2009). The general objectives of the interviews were to identify stakeholder statements regarding the 'circumstances', 'goals', 'means', and experiences, policies, and actions in the transition and achievement of the circular plastics economy. The interview questionnaire is provided in Appendix E. Most interviews were conducted through online communication, such as Skype and Microsoft Teams. Field research was conducted in March and April 2020. In total, 74 organisations were approached for an interview of which 24 accepted the interview request (Figure 6). An overview of the interviewed people including the sector, role of the interviewee, type of organisation, and country is presented in Appendix F.

[1] In advance of each interview, the interviewees were informed about the purpose of the research, the length of the interview, the procedures, and the recording. The interviewees had to sign a consent form in which they declared that they fully understood their rights in the research. Furthermore, all respondents had the opportunity to withdraw any statements from being used. They also had the opportunity to receive the final report of the research. For privacy reasons for the interviewees, only organisation, background and position titles of the interviewed people are shown.

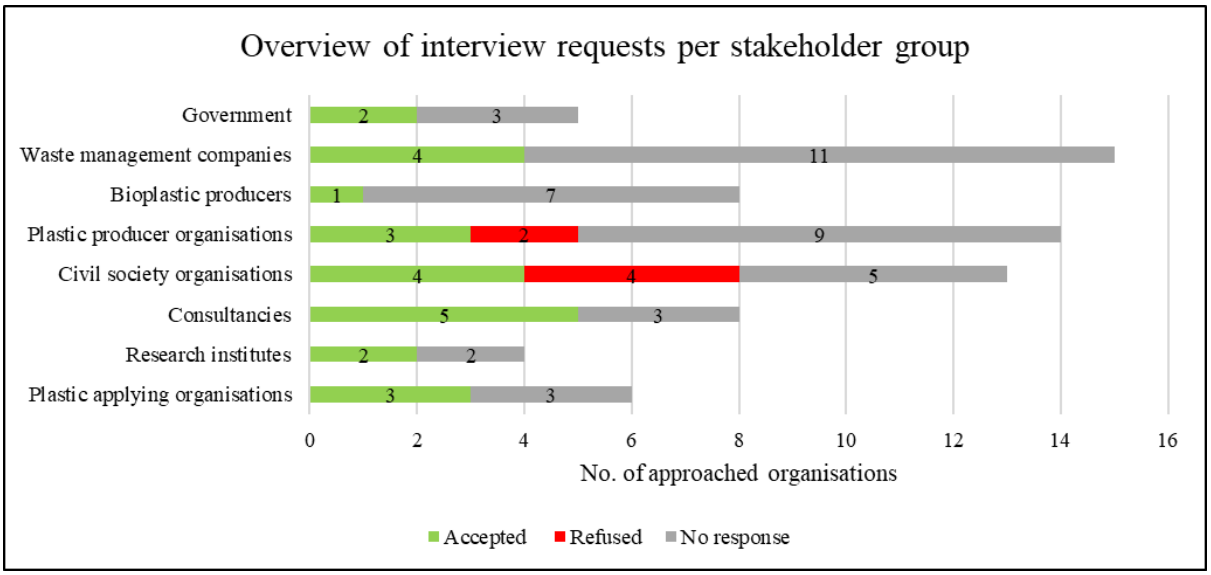


Figure 6 Overview of interview requests per stakeholder group.

Data analysis: The recorded interviews were transcribed with transcribing software online available at https://otter.ai/ to derive stakeholder statements. Subsequently, the statements were corrected and analysed.

3.3.1.2. Stage 2: Identify, Select, and Edit Q Statements (Q sample)

The Q-sample is the set of statements that is used as input for the Q-methodology research. In this step, it is key to obtain a set of statements from the concourse and to make a selection of statements which respondents need to reply to (described in step 4). Thus, it is important "*to decide upon the number of statements to present to participants*" (Barry and Proops, 1999, p. 339). However, varying opinions exist about the number of statements for a Q-sample. For instance, Denzine (1998) argues to have at least 60 statements to be statistical reliable, while McKeown, et al. (1999) considers a number between 30 and 100 statements as sufficient, and Curt (1994) and Stainton Rogers, et al. (1995) argue for a Q-sample consisting of 40-80 statements. Eventually, the Q-sample must reflect the concourse. Besides, too many statements could be too overwhelming for the participants and time-consuming, while a very small sample would be at the expense of the quality and depth of the research. For this reason, the full number of statements will be at least 30, but no more than 50.

After identifying the minimum and maximum number of statements, it is important to establish a representative sample for a wide variety of statements that represent a broad opinion (Exel and Graaf, 2005). According to Webler, et al. (2009), it is acceptable for the researcher to generate Q statements when the methodological choices are transparent and have a convincing explanation. For this reason, each Q statement is selected and defined by the researcher based on the following criteria:

1) First, statements were **selected** based on a variety of sources. This means that Q statements were selected on whether they were addressed by multiple sources. For instance, mentioned by different experts, (inter)national policies, newspapers, and organisation policy reports. A statement was included in the Q-sample, once it was mentioned by multiple sources (at least two).
2) Second, statements were **defined** on the same level of detail with, in the jargon of Q, a "*distensive zero*" (Webler, 2009, p. 17). This means that statements are neutrally formulated with a point of no opinion. Also, it is acceptable and desirable that Q definitions have "*excess meaning*" (Webler, 2009, p. 16), implying that they can be interpreted in slightly different ways.
3) Third, statements were **merged** to reduce the Q-sample to a manageable number. They were also merged in case statements had an overlap, e.g. by addressing a similar topic. In doing so, they could become a valid statement.

4) Fourth, statements were **tested** on linguistic clarity by the supervisors of this research and a few independent persons. They tested the (linguistic) clarity, interpretation and understanding of the statement.
5) At last, there is a trade-off in how the Q-sort could be **presented** to the participants. There are two ways: (1) face-to-face or (2) online. The main advantage is that an online tool is less time-consuming. Also, research of Reber, et al. (2000) show that there is no difference in validity and reliability between an online and face-to-face approach. They also found that participants find an online tool more convenient. However, the main advantage of a face-to-face approach is that it is possible to derive extra information from the participants which could improve the outcome of the research. In this research, this is also taken into account by asking additional open questions at the end of the online Q survey, and thus, the main advantage of the face-to-face approach is to some extent included in this Q survey. Eventually, a few software options were reviewed, where Qmethodsoftware.com was chosen for user-friendliness and ease of use for participants.

3.3.1.3. Stage 3: Recruit Participants (the P-set)

The P-set defines the participants of the research. The selection of the P-set is not random and is rather a structured sample of participants who have a relevant view on the researched topic (Brown, 1980). So, it is important to have people holding a relevant view on the transition towards a circular plastics economy. In this case, people are organisations involved in the transition. Large numbers of participants are not required for a Q study (Brown, 1980; Watts and Stenner, 2005). A rule-of-thumb is between 40 and 60 participants. However, effective studies can also be carried out with far fewer participants (Watts and Stenner, 2005). Eventually, it is important to arrive at diverse and plural perspectives on the transition towards a circular plastics economy. In general, a social study results in 2 - 5 perspectives (Webler, et al., 2009). Webler, et al. (2009, p. 22) argue that "*if one expects to reveal four perspectives, a good balance is to use about 45 Q statements and 15 Q participants*". However, it is recommended to include more participants, since it is impossible to know who will determine a certain perspective (Webler, et al., 2009). Eventually, 145 participants were invited, of which 28 submitted the Q survey. However, two participants submitted the survey after the final deadline. These were not included in the final analysis. Figure 7 presents the invitations and responses to the survey per stakeholder group. The full list of invited and responded organisations is provided in Appendix G.

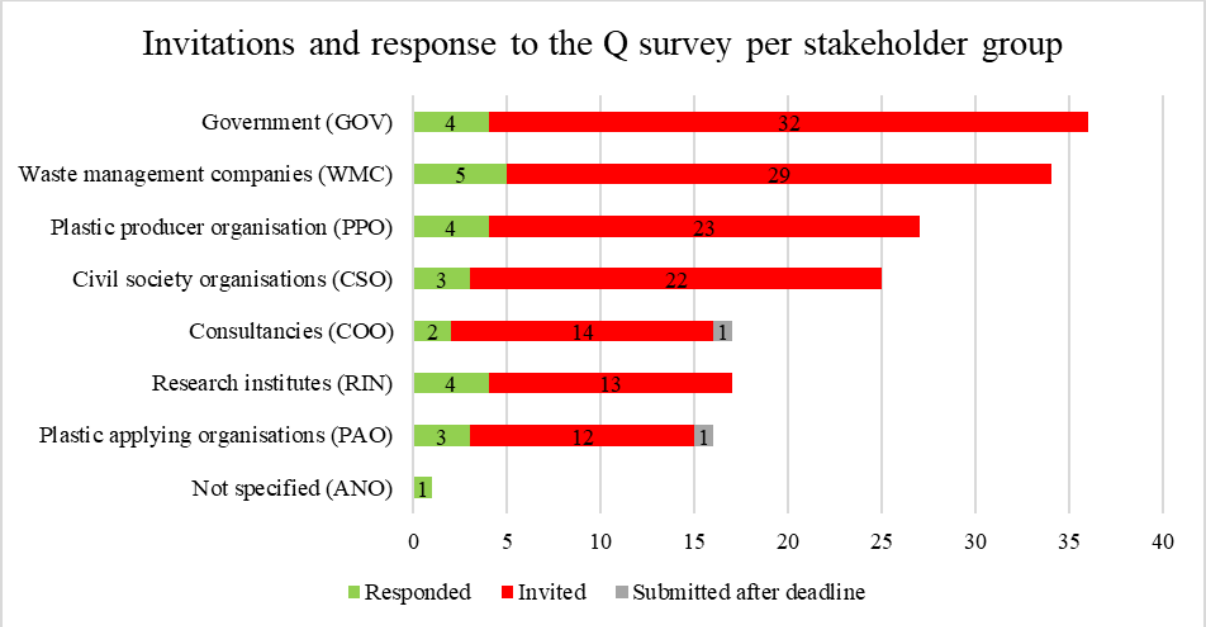


Figure 7 Invitations and response to the Q survey per stakeholder group.

3.3.1.4. Stage 4: Ranking Statements (the Q-sort)

In this part of the research, participants were invited to complete the Q-sort. This group is equivalent to the 'experimental condition' of the R methodology (Kitzinger, 1987). First, in the process participants were asked to pre-sort the statements with the leading question: "How important do you consider the following statements for the transition and achievement to a Dutch circular plastics economy?", in three groups: 'not important', 'neutral', and 'important'. In the second step, participants were asked to refine their pre-sort with the same question. Here, participants had to drag the statements from the pre-sort on an 11-point quasi-normal distribution ranging from 'least important (-5)' to 'neutral (0)' to 'most important (+5)' (Figure 8). The 11-point scale is often used in the Q method and considered adequate for 40-50 statements (Watts and Stenner, 2005; Webler, et al., 2009). Participants needed to rank all statements based on their preference, even when they considered all statements equally important. Thus, participants had to make trade-offs (and in doing so they reveal their strongest opinions). Eventually, the "*set of ranked statements constitutes the 'Q-sort' for that individual*" (Barry and Proops, 1999, p. 339). In the last step, participants were asked to answer a few short questions about their organisational background and whether participants wanted to receive the outcomes of the research. The Q-sort process and instructions are shown in Appendix H.

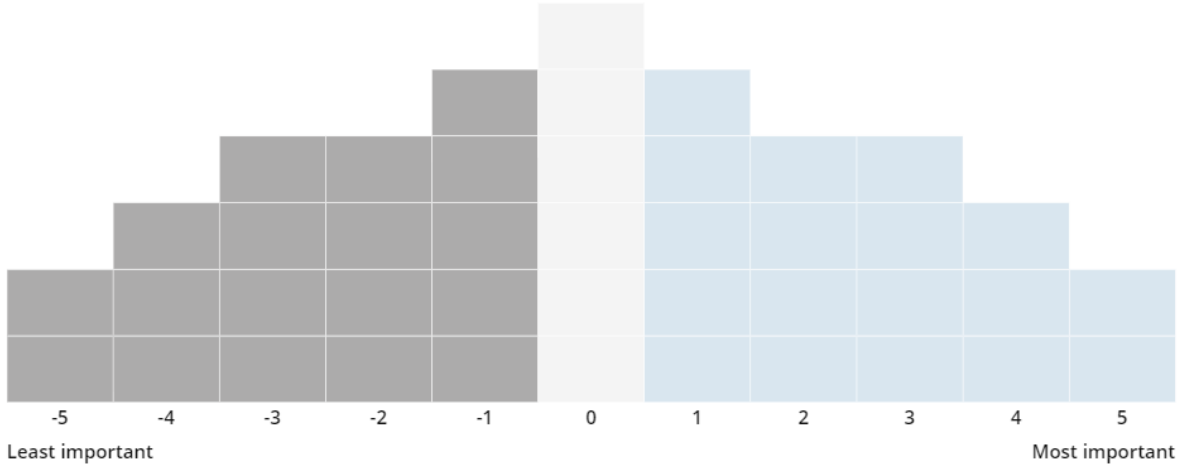


Figure 8 The ranking grid of the Q-sort process (step 2).

3.3.1.5. Stage 5: Statistical Analysis

The completed Q-sorts are the main input for the 'by person' factor analysis. The individual completed Q-sorts reflect the perspectives of the participants actively involved in the transition to a circular plastics economy in the Netherlands. Participants who sort the set of statements similarly reveal a perspective of a certain group of people (Herrington and Coogan, 2011). PQMethod software (Schmolck and Atkinson, 2002) was used to analyse the data. This (free) software is specifically developed for Q factor analysis as it facilitates data input, automatically generates the 'by person' correlation matrix, and it makes the factor extraction, rotation, and estimation quite straightforward (Watts and Stenner, 2005).

First, all completed Q-sorts were entered into the PQMethod software. The next step was to run the factor analysis. Here, the software provides two options: the 'Centroid method' or Principal Component Analysis (PCA). The difference between the two options is that the Centroid method is focused on commonality (i.e. variance due to common factors) among the completed Q-sorts and ignores the specificity (i.e. variance due to unique factor) of individual ones, while PCA considers both, communality and specificity. Since this research is focused on common perspectives, therefore, the 'Centroid method' was chosen to run the factor analysis. Overall, both options usually give similar results (Webler, et al., 2009) and offer "*a potentially infinite number of rotated solutions*" (Watts and Stenner, 2005, p. 81).

Subsequently, the 'Varimax rotation' was used to rotate the factors. Factor rotation is required since this leads to more easily interpretable factors. Here, the individual Q-sorts become associated with

one factor. This reveals the most *mathematically* informative solution and is used to reveal the range of perspectives from the Q-sorts (Watts and Stenner, 2005). Generally, the Q methodology finds common ground on two, three, or four perspectives. Five or six perspectives are rare, and they only add value if they lead to additional valuable insights. Overall, the more perspectives there are, the smaller the number of participants that load significantly on a perspective. These are called 'non-loaders' and are not desired because they do not give any consistency and meaning. When participants load on multiple perspectives, these are called the 'confounders', which should be minimised as well. However, if, eventually, a few confounders remain it means that those people have truly hybrid views. So, the 'Varimax rotation' should be run multiple times to determine the most optimal solution and to minimise the amount of non-loaders and confounders (Webler, et al., 2009). Furthermore, to determine the significance of each factor loading, they need to fulfil two conditions:

1. The Eigenvalues (EVs) and the percentage of variance explained by each factor provide a basic indication of the intercorrelations (Watts and Stenner, 2005). **Loading EVs > 1** are considered statistically significant (Watts and Stenner, 2005; Stevenson, 2019). Therefore, EVs > 1 can be considered as a potential factor to determine a certain perspective. The EV is calculated by multiplying the variance times the number of participants and then divided by 100 (Herrington and Coogan, 2011). However, caution should be taken into account here, since the number of participants could inflate the EVs. Therefore, another consideration should also be taken into account to assess the significance of a perspective;
2. **At least two factor loadings** (i.e. two participants that highly correlate) need to load significantly on a certain perspective (Watts and Stenner, 2005). Here, significant factor loadings mean that participants similarly ranked the statements, which reveals a pattern of Q statements that expresses their subjective views (Herrington and Coogan, 2011). Generally, significant loadings are marked with an asterisk '*'. Besides, the software makes use of the formula of Brown (1980) to calculate significant scores. In essence, this formula multiplies 1.96 with the standard error (which is: $1 / \sqrt{n}$) where '*n*' is equal to the number of statements. So, $1.96 * (1 / \sqrt{n}) = y$. Then, participants who load '$\pm$ y' are statistically significant at $p < 0.05$.

3.3.1.6. Stage 6: Derive Perspectives by interpreting the Results

The interpretative task involves the production of summarising factors on the significant scoring statements. The results are presented in tables, the so-called 'factor loadings' (i.e. participants who similarly completed the Q-sort), 'normalised factor loadings' (i.e. most and least important statements), 'descending array of differences between factors' (clarifies which statements were ranked most differently) and 'distinguishing statements' (clarifies significant differently ranked statements between one perspective and all others) (Webler, et al., 2009).

The Q-Sort Values' (Q-SV) most extremes, indicated by +5 (most important) and -5 (least important), are equally important. These provide the strongest opinions of the participants. All results are provided with Z-scores (Z-SCR). The Z-scores can be used to determine how far a statement deviates from the middle of the distribution (Webler, et al., 2009). The Z-scores can be used to interpret a perspective (Webler, et al., 2009). Z-scores above 1 indicate importance, and below -1 indicate less importance. Eventually, the qualitative comments of the interviewed people can be used to complement a certain narrative when that participant loaded significantly high on that perspective.

Overall, a common interpretation failure is the disregard for the neutral (0) area (Watts and Stenner, 2005). Also, in this area, much significance can occur. By disregarding these scores, the risk occurs that too few statements are included. In doing so, the holistic nature of a certain perspective is not fully captured (Watts and Stenner, 2005). This interpretation failure was kept in mind during the interpretation of the results.

4. Results

The results section is structured according to the six stages of the Q methodology as described in section 3.3. Chapters 4.1 to 4.3 define the concourse of the research (step 1 of the Q method). This section identifies as much as possible relevant opinions, ideas, beliefs, and assumptions surrounding the transition towards a circular plastics economy in the Netherlands through policy, media, and stakeholder analysis, and semi-structured expert interviews. Chapter 4.4 defines the Q-sample (step 2 of the Q method) and integrates the results of section 4.1 to 4.3. Chapter 4.5 covers the statistical analysis (including step 3, 4 and 5 of the Q method), and chapter 4.6 covers the statistical interpretation (step 6 of the Q method) and presents the perspectives on the transition to a Dutch circular plastics economy.

4.1. Policy analysis

4.1.1. 1990s – today: External Influence of European Union Directives and Policies

The European Union requires the establishment of EPR systems for the following products to all its Member Nations: Directive 2000/53/EC on the end-of-life vehicles, Directive 2006/66/EC (repealing Directive 91/157/EEC) on batteries and accumulators and waste batteries, Directive 2012/19/EU on electric and electronic equipment, and Directive 2018/852 (amending Directive 94/62/EC) on packaging and packaging waste.

The reuse and recycling rates of plastic packaging are very low in the European Union, as "*less than 25% of collected plastic waste is recycled and about 50% goes to landfill. Large quantities of plastics also end up in the oceans*" (European Commission, 2015, p. 13). Therefore, the European Union considers plastics as one of the key priority areas in the transition to a circular economy. For this reason, the Commission adopted A European Union Strategy for plastics which addresses issues like recyclability, biodegradability, the presence of hazardous substances of concern in certain plastics, and marine litter (European Commission, 2018). Several plastic specific Directives were implemented to address these issues, such as Directive 2015/720/EU on reducing consumption of lightweight plastic carrier bags, and Directive 2019/904 on the reduction of the impact of certain plastic products on the environment. Also, the European Union proposed more ambitious recycling targets for plastics in Directive 2018/851 on waste (amending Directive 2008/98/EC) and Directive 2018/852 on packaging and packaging waste (amending Directive 94/62/EC).

In short, the European Union's goals to achieve the circular plastics economy is by closing the loop by creating smart, innovative and sustainable plastic industry with fully respect to reuse, repair and recycling that brings jobs and growth to Europe, and in doing so, cutting greenhouse gas emissions and reducing its dependence on fossil fuel imports (European Commission, 2018). Furthermore, Directive 2015/720 target is to "*prevent or reduce the impact of packaging and packaging waste on the environment*" by means such as reducing plastic usage through financial incentives such as not providing plastic bags free of charge. Additionally, Directive 2018/851 aims to improve "*the efficiency of resource use and ensuring that waste is valued as a resource can contribute to reducing the Union's dependence on the import of raw materials and facilitate the transition to more sustainable material management and to a circular economy model*" by the establishment of waste prevention programmes (Article 9). Besides, Directive 2018/852 aims to increase "*the recycling of packaging waste to make them better reflect the Union's ambition to move to a circular economy*". Most recent Directive 2019/904, aims to "*promote circular approaches that give priority to sustainable and non-toxic re-usable products and re-use systems rather than to single-use products, aiming first and foremost to reduce the quantity of waste generated*" by banning certain plastic products for which alternatives exist, such as straws, plates and beverage stirrers. Appendix A provides an analysis of each Directive. The overarching means to achieve the transition are "*improving the economics and quality of plastics recycling*" (European Commission, 2018, p. 10), "*curbing plastic waste and littering*" (European Commission, 2018, p. 13), "*driving innovation and investment towards circular solutions*" (European Commission, 2018, p. 15), "*harnessing global action*" (European Commission, 2018, p. 16).

4.1.2. 1990s - 2012: Dutch Legal Framework

Also, the Netherlands requires the establishment of EPR systems. In the 1990s, landfilling of plastic waste has been prohibited by the Landfills Decree of 1994. The first legal binding National Waste Management Plan (2002 – 2012) came into force in 2003, which was reviewed in 2004 and 2007 (Appendix A). The main objectives were (1) limit growth in waste generation by decoupling waste from economic growth, (2) reduce the environmental impact of waste by optimising recovery and re-use, and (3) minimise the environmental impact of product chains from raw material extraction, production, and use and waste management (National Waste Management Plan 1 Policy Framework 2003, chapter 2, p. 43). In 2007, to further promote the prevention, separation, and recycling of packaging waste, the legal binding Packaging and Paper and Cardboard Management Decree and the Framework Agreement on Packaging and Litter were incorporated in national legislation. These policies implemented a deposit system for large PET bottles. In case the targets of the Framework Agreement on Packaging and Litter were not achieved, the Packaging and Paper and Cardboard Management Decree imposed a deposit obligation to all non-cardboard beverage packaging.

However, besides a deposit for large PET bottles, this full deposit system never came into force due to the opposition of business lobbies. For instance, in 1998-2002, a deposit system for cans was proposed by Cabinet Kok II. However, in 2006, this proposal was withdrawn by the government due to the opposition of businesses. In 2007-2010, State Secretary Van Geel proposed a deposit system for cans again. However, the government chose as alternative more strict enforcement on polluters by placing more bins near the road to reduce litter. In 2009, the lobby intensified their opposition. They had pushed researchers from Wageningen University to promote the abolishment of the deposit system for large PET bottles due to the very high costs the system supposedly had. In 2012, former State Secretary Atsma (CDA) (supported by the VVD and PVV), therefore, promoted the abolishment of the deposit system as well. However, the abolishment of the deposit system never occurred due to the resignation of Cabinet Rutte I in November 2012. In Cabinet Rutte II, State Secretary Atsma (CDA) was replaced by Wilma Mansveld (PvdA) who decided to keep the deposit system for large PET bottles. Eventually, in 2014, the Scientific Integrity Committee (CWI) found the research of Wageningen University 'insufficiently scientific practice' and found that the report for the abolishment of the deposit system should never have been used. According to the Plastic Soup Foundation (2016), "*it is not often that the working methods of a powerful corporate lobby are exposed in such detail and that it is demonstrated how vulnerable government officials and scientists are towards the lobby of business*". Until today, the deposit system for large PET bottles is still enforced under the Framework Agreement on Packaging (2014) and Packaging Management Decree (2014).

Both, Packaging and Paper and Cardboard Management Decree (2007) and the Framework Agreement on Packaging and Litter (2007), represent the implementation of EPR in the Netherlands under the European Directive 94/62/EC on packaging and packaging waste. Producers and importers founded the Afvalfonds Verpakkingen to collectively implement the obligations of the packaging industry under these policies. Afvalfonds Verpakkingen is financed by the packaging industry via a so-called 'waste management contribution fee'. This fee must be paid by producing and importing organisations when they bring and/or discard 50,000 (or more) kilos of packaging on the Dutch market, even if an organisation is located outside the Netherlands. The most important goal of the Afvalfonds Verpakkingen is to implement the Framework Agreement on Packaging and Litter which contained plastic recycling targets (from 32% to 38% in 2010, and up to 42% in 2012) and mutual agreements between government and the private sector. Activities of the Afvalfonds Verpakkingen include: (1) maintaining the waste management structure; (2) levying the waste management contribution fee from all associated members; (3) reporting on the packaging placed on the market and the achieved recycling percentages; (4) providing compensation to municipalities, waste companies and material organisations for the collection of waste; (5) stimulating activities and campaigns to prevent packaging litter; and (6) increasing environmental efficiency and cost reduction (Afvalfonds Verpakkingen, 2020). The organisational and financing structure of the Afvalfonds Verpakkingen is presented in Figure 9. Diverse

activities of the Afvalfonds Verpakkingen are outsourced to other organisations. These organisations are also financed by the waste management contribution fee (through Afvalfonds Verpakkingen).

1. Nedvang advises and supports municipalities and waste companies in (the registration of) the collection and recycling of packaging materials;
2. Nederland Schoon conducts campaigns against litter, conducts research, advises companies and sets up other activities;
3. Verpakkingsketen B.V. (VPKT) is responsible for the sorting and recycling of (plastic) packaging by making contracts with post-separators, sorters, recyclers, transporters, and storage and transfer stations;
4. Kennisinstituut Duurzaam Verpakken (KIDV) advises and inspires companies about sustainable packaging. They offer factual knowledge, current trends and practical tools.

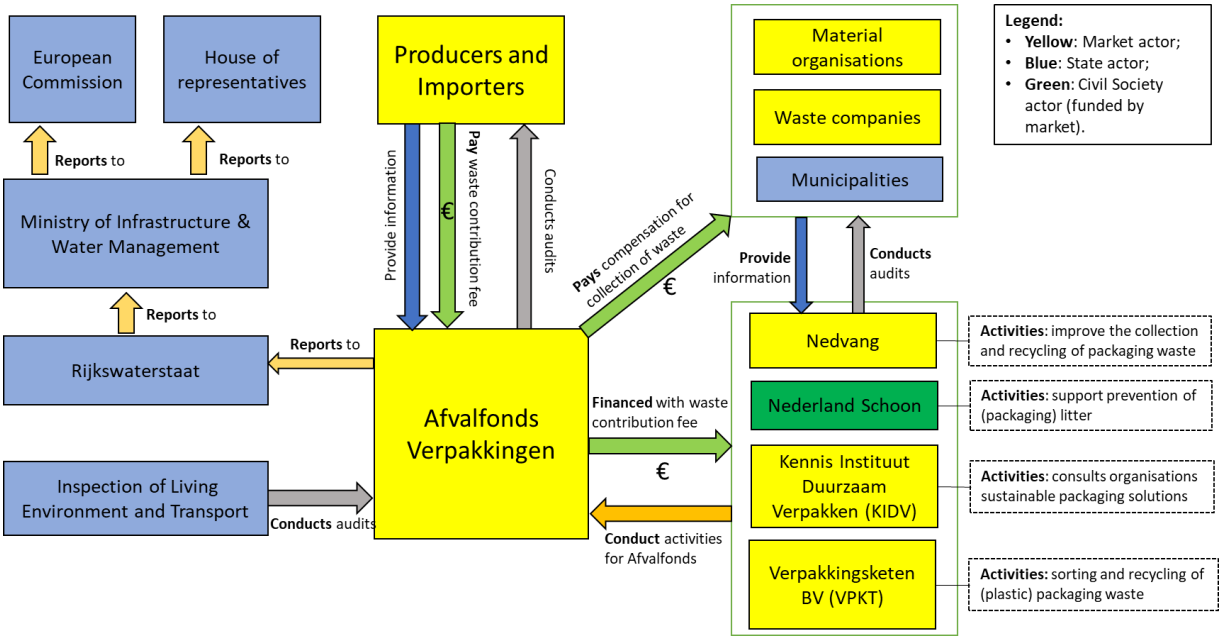


Figure 9 EPR-system of packaging in the Netherlands (source: Afvalfonds Verpakkingen, 2018, edited).

Dutch municipalities are free in organising their plastic waste collection methodology, and thus, "*there are a lot of municipalities that have not an effective system*" (interview with Senior Policy Advisor of local governments). Due to the diverse methods of collection by municipalities, "*people get totally confused because it is different in all municipalities, and they do not know where to start*" (interview with Sustainability Director of multinational consumer-product brand). For instance, in 2012, 49 municipalities in the Netherlands did not collect any plastic waste separately at all (Gradus, et al., 2017). As a consequence, the collection and separation rates between municipalities are huge. Especially, smaller municipalities perform better in collecting and separating (plastic) waste than big cities, because: (1) simply, people living in big cities have a lack of space in their homes to collect and separate (plastic) waste and must walk to special recycling bins on the street, whereas people living in suburban areas have about three or four recycling bins near their front door; and (2) it is hard to explain to non-native citizens who not speak the language to tell them what they have to do. Therefore, municipalities like Rotterdam, have very different objectives for collecting (plastic) waste than smaller municipalities (interview with Senior Policy Advisor of local governments). To improve the collection, separation, and recycling, government organisations organise events to promote the best practices and provide a benchmark database where municipalities can learn from each other (interview with Senior Policy Advisor of local governments).

However, the costs for collection, separation, sorting and recycling outweigh the revenues of the sales of recyclate (recycled plastics) (Gradus, et al., 2017). Therefore, municipalities are compensated for this deficit by the Afvalfonds Verpakkingen. However, municipalities are only

compensated when plastic packaging waste is collected 'clean', for instance, not contaminated by food waste. So first, collected plastic waste is checked on contamination following certain quality norms and standards, and then municipalities receive a fee per kilogram of collected 'clean' plastics. Since plastic waste is often too contaminated, municipalities do not receive compensation for them. Therefore, some municipalities have to finance the costs for processing these contaminated plastics (interview with Senior Policy Advisor of local governments). In this case, the costs for collection are not covered by the Afvalfonds Verpakkingen, but by the taxpayer.

4.1.3. 2013 – today: External Influence of China's Policies

In the past, China was the biggest global importer of plastic waste (Brooks et al., 2018). However, China implemented the 'Green Fence' policy in February 2013, aimed to prevent low-quality bales of plastics being shipped to China. More aggressive Chinese anti-plastic policies followed with the implementation of the 'National Sword' policy at the beginning of 2018, which targeted illegal smuggling of foreign waste (including plastics) to China. These policies made the export of plastic waste to China much more difficult. The Netherlands is one of the leading exporters of plastic waste in the world (Brooks et al., 2018). Therefore, for the Netherlands "*China's ban was a shock*" (interview with Innovation & Solution Manager of an environmental organisation).

The short-term effects of China's ban also became visible in the Netherlands. For instance, Afvalfonds Verpakkingen blamed China's ban as an important reason for not achieving the plastic recycling targets of the Framework Agreement on Packaging in 2017 (Annual monitoring report of 2017, p. 5). Furthermore, waste traders started to look for other opportunities to get rid of plastic waste. For instance, Kras Recycling (Dutch recycling company) stated that "*market prices have dropped by 80% because the massive demand from China declined. As a result, countries such as Turkey, Vietnam, Malaysia, and Indonesia became interesting to export too*" (quoted in: Stooker, 2019). So these countries became alternative destinations (Zoete, 2019). However, much plastic waste became mismanaged in these countries with severe environmental and social consequences (The Guardian, 2019). Also, illegal dumping and burning of plastic waste arose in Poland in June 2018 (Klundert, 2018). It only took a few months before these countries started to ban imports of plastic scrap as well with support of the United Nations. In 2019, new rules in the Basel Convention were set for Global North countries that export (hazardous) waste to the Global South, and aim to (1) prevent (illegal) dumping of plastic waste and (2) make the global plastic waste trade more transparent and better regulated.

The long-term effects of China's ban are favoured because the assumption is that China's ban will increase the pressure to improve the Dutch plastic recycling industry (Director of large recycling firm). Also, plastic recycling companies in the Netherlands, such as Suez, favour China's ban since "*for the longer term, the China import stop is good for the recycling market in Europe. Good for the circular economy. Quality becomes important because of the large amounts of plastic waste. For too long, high-quality plastic recycling has been forgotten in Europe* (quoted in: Financieele Dagblad, 28-12-2018, Appendix C).

4.1.4. 2013 – today: Dutch Legal Framework

In June 2013, the Dutch government implemented its first Dutch Circular Economy policy, the so-called: '*program: from waste to raw material'* (VANG). In this report, the government defined the CE as "*an economic system that takes the re-usability of products and raw materials and the conservation of natural resources as a starting point and strives to create value in every link in the system*" (Dutch Parliament, 2013, p. 3), with the overarching goal to reduce the ecological footprint of human activity with the underlying reason that human activity depletes natural resources and the habitability of the physical environment (CPB Netherlands Bureau for Economic Policy Analysis, 2019). Overall, "*the challenge is to grow by greening, by providing our prosperity with both renewable and non-renewable raw materials through optimum use of natural resources*" (program: from waste to raw materials, 2013, p. 2). The key sources for the establishment of the Dutch CE policy were World Wide Fund for Nature (2007), European Commission (2011), International Resource Panel (2011), and Brown (2011). The

most important reasons to strive for a circular plastics economy are (1) an increase of plastic usage worldwide, (2) plastic pollution of the physical environment, (3) released emissions from production, recycling and burning of plastics, (4) limited bioplastics solutions, and (5) limited options for recycling with current technologies (CPB Netherlands Bureau for Economic Policy Analysis, 2019). However, the "*depletion of resources for fossil fuel-based plastics will play a minor role in the coming decades*" (CPB Netherlands Bureau for Economic Policy Analysis, 2019, p. 45).

In 2014, an updated legal binding National Waste Management Plan 2, updated Packaging Management Decree (2014), and updated Framework Agreement on Packaging (2014) were implemented. These policies all mention Eco-design and the Cradle-to-Cradle approach to close the loop of materials. The Packaging Management Decree (2014) aims to increase the legal minimum recycling percentage of plastics from 43% in 2013, up to 48% in 2018 (with an annual increase of 1%), while Framework Agreement on Packaging (which is legally binding negotiator's agreement) aims to increase the recycling percentage of plastic packaging from 44% in 2013 up to 52% in 2017 (with an annual increase of 2%). Furthermore, the Framework Agreement on Packaging aims to stop the use of polyvinyl chloride (PVC) as packaging material. PVC is a very contested material as it could contain and release dangerous chemicals such as dioxins, phthalates, vinyl chloride, ethylene dichloride, lead, cadmium, and organotin (Pacheco-Torgal, et al., 2012).

In 2016, the Dutch government set the aim to become 100% circular by 2050 to accelerate the transition towards a circular economy for plastics. In the following years, the 'National agreement on the circular economy (2017)', 'Transition agenda of plastics (2018)', and 'Plastic Pact NL (2019)' were implemented. However, the latter policies (2016 – 2019) are not legally binding and only contain voluntary commitments, but are supported by a wide variety of market, state, and civil society actors (Appendix D). In July 2019, a third National Waste Management Plan was implemented. The most recent general Dutch waste hierarchy framework is based on the 'Ladder van Lansink' which takes prevention (R0), re-use (R2), recycling (R7), energy recovery with (R8) and without energy and landfilling as the appropriate sequence of waste processing. However, landfilling and incineration without energy recovery as a form of disposal are prohibited for all sorts of plastic waste (Table 6).

Table 6 Dutch Waste Hierarchy applied to the framework of Reike, et al. (2018) (Source: National Waste Management Plan Policy Framework 3 Chapter A.4.2., edited).

Dutch Waste Hierarchy
a. Prevention (R0)
b. Prepare for reuse (R2)
c1. Recycling of the original functional material in an equal or comparable application (R7)
c2. Recycling of the original functional material in a non-identical or comparable application* (R7)
c3. Chemical recycling (R7)
d. Other useful application, including incineration with energy recovery (R8)
e1. Incineration without energy recovery as a form of disposal (**prohibited** for plastics)
e2. Landfilling (**prohibited** for plastics)

Plastics can be fossil-based (e.g. oil and gas), biodegradable (which can be degraded by living organisms), bio-based (made from renewable biomass sources such as food waste, sugar, corn, and vegetable oil). Bio-based plastics and biodegradable plastics are often confused with each other, but they are not the same. Often plastic waste that contains biodegradable plastics causes for many troubles at recycling facilities, since it is not possible to process all plastics similarly due to the chemical bonds and properties. However, Dutch legislation does not make a clear distinction between fossil-based, bio-based and biodegradable plastics or plastic packaging specifically. The National Waste Management Plan only adds a minimum standard for three categories of plastic waste such as thermoplastics, thermoset plastics, and mixed plastics (Table 7). Plastic packaging can be made from both, thermoplastics (most common) and thermoset plastics.

(1) Thermoplastics can be easily recycled, remoulded or reshaped, because the curing process is reversible and no chemical bonding takes place. Thus, material recycling (R7) is possible once they are heated, and so valuable materials can be obtained. Examples of thermoplastics are polyethylene terephthalate (PET) (often used for bottles), polypropylene (PP) (often used for products that have to be shipped for a long-distance or multiple times), and polyethylene (PE) (often used for films, bags and containers). These can also be made from bio-based materials such as bio-PET, bio-PP, bio-PE and polylactic acid (PLA).
(2) Thermosetting plastics are very difficult or cannot be recycled, remoulded, or reshaped, because during the curing process irreversible chemical bonds are created. Therefore, there is a very low demand for recycling them. Examples thermosetting plastics are epoxy resin, silicones, polyurethane (often used to transport products safely, e.g. medical and electronic equipment), and phenolic (often used in automotive, electronics and laminates). These can also be made from bio-based materials such as polyphenols (lignin, tannin, cardanol) (Dodiuk and Goodman, 2013).
(3) Mixed plastics are a mix of all sorts of plastics. This mix is very complex, therefore, difficult to recycle since each type of plastic in the mix must be treated differently. Thus, all plastics must be sorted. However, current technologies are not able to detect all plastics, so they should be sorted by hand. However, this is time-consuming and expensive. Therefore, these plastics are often incinerated with energy recovery (R8) and/or exported for recycling to other countries where recycling outcomes cannot always be guaranteed.

Table 7 National Waste Management Plan minimum standard for plastic waste in 2019 (edited).

	Useful and separately collected	**Non-reusable and/or not separately collected / high calorific plastic waste**	**The minimum standard applies to these sort plastics:**
Minimum standard	Material recycling (R7)	Other useful application, such as energy recovery (R8)	Mixed plastics (excluding artificial grass) and thermoplastics
Minimum standard for polluted plastic, technical limitations, or plastics cannot be recycled for less than €205 per tonne	Other useful application, such as energy recovery (R8)	Other useful application, such as energy recovery (R8)	Mixed plastics (excluding artificial grass), thermoplastics, thermoset plastics and elastomers (excluding car tyres)

In 2020, new developments on the agreements in the Framework Agreement on Packaging 2020 and 2028 were announced (TLE/U201900846, Lbr. 19/086) by the Association of Dutch Municipalities (VNG). The proposed agreements are aimed to simplify, clarify, and improve the system for the collection and processing of household plastic packaging waste. They want to stimulate the packaging industry to recycle more, to take recyclability of products as a starting point, and (3) to communicate to citizens only about plastics that disturb the sorting and recycling process. However, it remains unclear through what means this should be realised. However, the new Framework Agreement on Packaging for 2020 and 2028 is already criticised by one of the interviewed stakeholders. It is criticised as "*a very bad new contract and they only allow very large players like Aterro, Omrin, and Suez to take part in the new contract. So yeah, that's at least 50,000 tonnes of packaging before you can participate*" (interview with Associate Director Sustainability of a multinational consultancy firm).

In July 2021, an amendment of the Packaging Management Decree of 2014 will come into force (Ministry of Infrastructure and Water Management, 2020). This amendment was announced in 2019 by Stientje Van Veldhoven (State Secretary for Infrastructure and Water Management) where she proposed an ultimatum for the packaging industry to decrease litter by 70% to 90%. However, these targets were

not met by the industry. This amendment will implement the Plastic Soup Surfer motion that calls for measures for small PET bottles. So, cans, juice and dairy bottles, and other beverage packaging are not included in this amendment. The new amendment will require that: (1) producers or importers, who place drinks in a plastic bottle with a volume of 3 litres or less on the Dutch market, ensure that at least 90% by weight of the total amount of bottles, caps, and lids are separately collected (per calendar year); and (2) for every bottle a deposit must be charged. For large PET bottles (> 1 litres) the deposit will remain 25 cents per bottle, while for small PET bottles (< 1 litre) the deposit will become 15 cents. According to the packaging industry, the costs to expand this deposit scheme are estimated to be €154 million and must be fully paid by the producers and importers. The costs of the amendment will apply to approximately 50 large producers and importers as well as a maximum of 200 smaller ones (Ministry of Infrastructure and Water Management, 2020). According to a spokesperson of Afvalfonds Verpakkingen that is "*a lot of money for a 3% reduction in litter. There is so much more on the street. Think of candy wraps, crisp bags, and French fries' trays*" (quoted in: Nederlandse Omroep Stichting, 2020).

4.1.5. Plastic practices in the Netherlands

In the Netherlands, there are mainly three commercial practices for dealing with plastic waste, namely recycling (R7), incineration with energy recovery (R8), or export (and import). There is a trade-off in practices between recycling (R7) and incineration with energy recovery (R8) of plastic waste. On the one hand, significant costs are involved concerning recycling, for instance, for the collection, sorting, and recycling. On the other hand, increased recycling of plastics will result in a decrease of plastic content in the waste streams destinated to incineration. This lowers the energy output per unit input. In doing so, the incineration costs become higher as a consequence of increased recycling activities (Gradus, et al., 2017). In contrary, inceration with energy recovery (R8) of too much plastic waste at once is also bad, since this increases the energy output per unit input. This means that less waste can be incinerated at once, which reduces the processing capaciry of incinerators per time.

4.1.5.1. Recycling (R7)

The main benefit of recycling is the avoidance of greenhouse gas emissions that otherwise would occur from (virgin) plastic production and incineration of plastic waste (Gradus, et al., 2017). Overall, the recycling costs largely depend on the quality of the recycled plastic material that is desired. So, producing for higher industrial purposes also require to meet higher standards, which eventually leads to higher recycling costs (Gradus, et al., 2017). Currently, there are two practices for recycling plastic waste, via mechanical recycling and chemical recycling which both have their advantages and challenges (Ragaert, et al., 2017).

In the Netherlands, **mechanical recycling** is the most applied practice for recycling for plastic packaging. However, there is insufficient recycling capacity in the country (interview with Associate Director Sustainability of a multinational consultancy firm). Therefore, it is not possible to process all plastics in the Netherlands (interview with Plastic Manager of large recycling firm; Associate Director Sustainability of a multinational consultancy firm; Business Development Manager of large recycling firm), and even in Europe which was addressed by Aterro (a large Dutch plastic recycling company) in Financieele Dagblad on 28-2-2018 (Appendix C) "*there is too little sorting and recycling infrastructure in Europe, with the result that there is more plastic in the residual waste and is incinerated*". Besides, the 'design for recycling' is very poor due to the wide variety of plastics and all extra additives given to plastic products which hinder sorting and recycling operations (interview with Director & Chemical Engineer of a consultancy firm).

Generally, once plastics are mechanically recycled, "*recycled plastics are pushed on the market, without an idea what their destination will be*" (interview with Business Development Manager of large recycling firm). Also, "*the recycling and also the demand for the recycled plastics is not so good*" (interview with Senior Policy Advisor of local governments). Therefore, "*99% of the producers choose*

for virgin plastics, because it is cheaper and trustable. The quality is safer" (interview with Senior Policy Advisor of local governments). Besides, "*in large corporations, the marketing teams often win from the sustainability teams*" (interview with Professor in plastic packaging of Dutch University). This is also emphasised by 4PET Recycling in NRC Handelsblad on 24-2-2018 (Appendix C). Furthermore, recycled plastics are often criticised for their colour, smell, quality and high price. For this reason, "*the main challenge is how we present the recycled plastic on the market*" (interview with Plastic Manager of large recycling firm). The REACH regulation is key in "*pushing the recycler forward. It's a way to improve our processes the best way, it's the way to make sure that we release safe plastic on the market. I think we need those guidelines as a recycler to do our job properly. And it's for sure, improving the status of the recycled plastic improving the image*" (interview with Technical Engineer Manager of large recycling firm).

Globally, **chemical recycling** is in its infancy. Chemical recycling (or feedstock recycling) can be seen as another solution for plastics that are difficult to recycle. However, the main disadvantage is that the process is very energy-intensive and expensive, and there will always be a chemical (toxic) residue (interview with Director & Chemical Engineer of a consultancy firm). The 'Waste to Chemicals' project is one of the few initiatives in Europe experimenting with chemical recycling of (mixed) plastics (interview with Director of large recycling firm). This project is set-up by the Port of Rotterdam and Shell, and supported by the European Union and the Dutch Ministry of Economic Affairs and Climate. Other initiatives also exist, such as the Ioniqa Technologies process which focuses on chemical recycling of PET and shows promising results.

4.1.5.2. Energy Recovery (R8)

The main disadvantage of incineration with energy recovery is that it comes with an environmental impact, such as the emissions of greenhouse gasses, and "*there will always be a residue of ashes which is highly toxic, and probably will be landfilled*" (interview with Innovation & Solution Manager of an environmental organisation). According to the Project Manager Monitoring & Senior Business Analyst of the Afvalfonds Verpakkingen: "*It is important to know that the Dutch waste energy plants (AECs) have such a technological level (R1 status) that there is no discussion about energy recovery*" (personal e-mail conversation on 18-02-2020). The R1-status implies that the Dutch waste incineration installations are considered as energy-efficient according to the Waste Framework Directive 2008/98/EC to be a sufficient energy recovery (R8) installation. The results of incineration of plastic waste with energy recovery are heat and electricity production (Gradus, et al., 2017). The main benefit of incinerating plastic waste is that it generates three times more energy compared to other materials (Morris, 1996). Also, plastic waste can replace fossil fuels in industrial processes to generate energy, for instance, in cement ovens. In doing so, overall fossil fuel consumption can be reduced. Furthermore, incineration with energy recovery is also much cheaper compared to recycling (Gradus, et al., 2017). So, for mixed and heavily contaminated plastics incineration with energy recovery may be the most suitable solution since these plastics also disturb most sorting and recycling activities (Hopewell, et al., 2009).

4.1.5.3. Import and Export of plastic waste

In the Netherlands, the import of thermoplastics is allowed as valuable materials can be obtained with material recycling (R7). For thermoset plastics and mixed plastics import is allowed for incineration with energy recovery (R8). However, the export of plastic waste is only allowed for material recycling (R7), when: (1) plastics cannot be recycled for less than €175 per tonne in 2014, and €205 per tonne in 2019; or (2) when it is labelled as 'preferred recycling'. Preferred recycling is defined based on an extensive Life-Cycle-Assessment (LCA) explained in the National Waste Management Plans Policy Framework in Appendix 9. Preferred recycling means that a certain form of "*recycling is significantly higher in quality for a given waste material than other forms of recycling of the same waste material*" (National Waste Management Plans Policy Framework 3). Once this is defined, export for other forms

of recycling are not allowed anymore. However, the government did not define 'preferred recycling' for all plastics (yet). Table 8 provides an overview of the most recent import and export conditions of plastic waste in the Netherlands.

Table 8 National Waste Management Plan of import and export conditions of plastic waste in 2019 (edited).

	Disposal	**Useful application (R7 or R8)**
Import	*Landfilling*: not allowed *Incineration without energy recovery*: not allowed	*Reuse:* allowed *Material recycling*: allowed • Allowed for thermoplastics (e.g. PET, PP, PE) only for material recycling (R7). • Allowed for thermoset plastics and mixed plastics if in line with the Dutch minimum standard: for material recycling (R7) and energy recovery (R8).
Export	*Landfilling:* not allowed *Incineration without energy recovery*: not allowed Export for other purposes than landfilling and incineration is not allowed, since useful application (R7 or R8) is possible.	*Reuse:* allowed (unless a part will be landfilled). *Material recycling*: allowed (unless a part will be landfilled) • Plastics cannot be recycled for less than €205 per tonne. • Export of thermoset plastics is allowed.

4.1.6. Recycling performance of Afvalfonds Verpakkingen

Figure 10 presents the performance of the packaging recycling and energy recovery operations of the Afvalfonds Verpakkingen between 2013 and 2018. The black numbers in the figure represent different legislative targets, where the green numbers indicate if the targets of the Framework Agreement on Packaging (2014) were achieved, red if targets were not met, and grey if not completely specified.

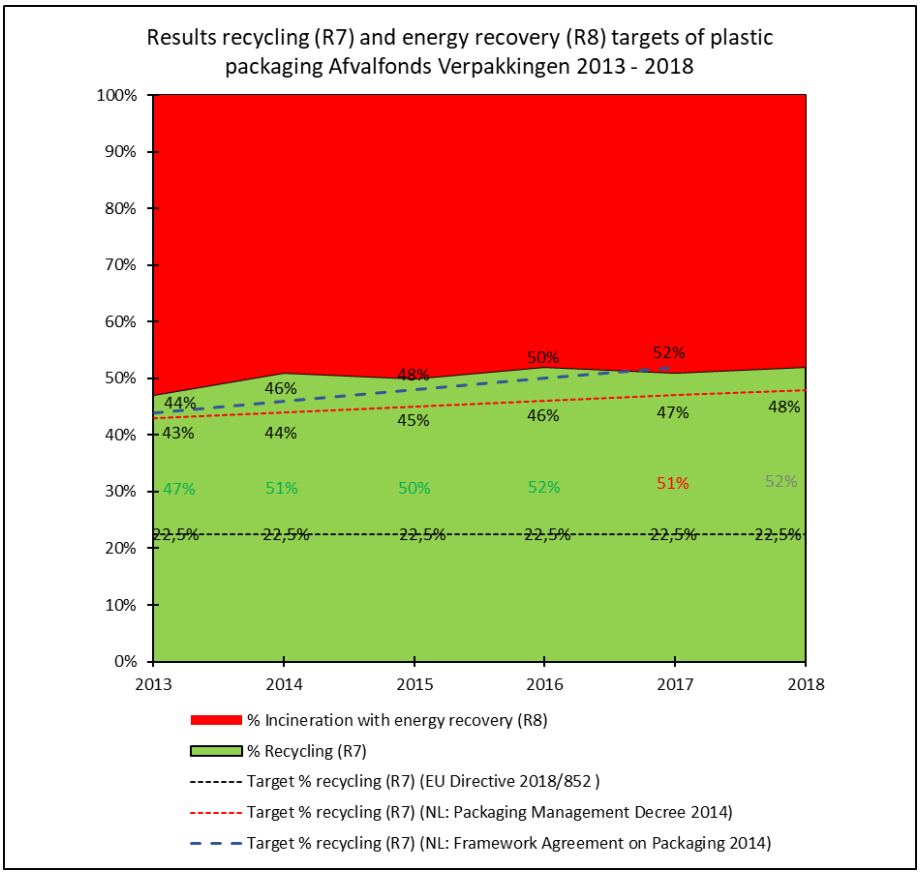


Figure 10 Results recycling (R7) targets and energy recovery (R8) of plastic packaging of Afvalfonds Verpakkingen between 2013 – 2018 (author's work, source: annual monitoring reports of Afvalfonds Verpakkingen 2013 – 2018, Appendix I).

4.1.6.1. Recycling (R7)

Looking at the recycling (R7) performance of Afvalfonds Verpakkingen between 2013 and 2018, it becomes clear that the recycling targets of Packaging Management Decree (2014) were achieved every year and scored above the European Directive 2018/852 minimum recycling target. The recycling percentage is an average of all plastics which are recycled (i.e. thermoplastics, thermosetting plastics, and mixed plastics). Overall, the recycling percentage increased from 47% (in 2013) up to 52% (in 2016 and 2018). With this respect, the policy framework is effective since the mandatory objectives of the Packaging Management Decree have been achieved and the recycling percentages improved.

However, in 2017, the recycling percentage was 51%. Therefore, the Framework Agreement on Packaging desired 52% recycling objective was not achieved. Concerning China's ban, there was a too great uncertainty among waste companies that plastic waste would not be accepted in China or neighbouring countries. As a result, waste companies were looking for other opportunities and did not hold any stock due to the uncertainty in the market. Therefore, part of the material was not recycled but incinerated in the cement industry. In doing so, the recycling of plastic packaging waste declined in 2017 (Afvalfonds Verpakkingen monitoring report 2017).

4.1.6.2. Energy Recovery (R8)

Overall, between 2013 and 2018, the energy recovery (R8) percentage improved from 53% in 2013 to 48% in 2018. The decline in the export of plastic waste resulted in that Dutch incineration companies now have more supply of plastic waste. As a consequence, incineration companies became more reluctant in accepting certain plastic waste as plastics are mostly 'high calorific'. This means that plastics contain a lot of energy which will be released once they are incinerated. Therefore, there is a limit on the amount of plastics that can be incinerated at once. The sudden increase of high calorific plastic waste, therefore, negatively impacts the processing capacity of the incinerators, since fewer volumes of waste can be incinerated at once (interview with Director of large recycling firm).

4.1.6.3. Export and Leakage

In the current Dutch policy framework, the core issues of plastics are mostly related to low-grade plastics, since "*we don't have any recycle capacity for low-grade plastics*" (interview with Associate Director Sustainability of a multinational consultancy firm), and especially mixed plastics. As a consequence, the Netherlands exports these plastics for recycling to other countries. However, "*in every step of the value chain, a part of the low-grade plastics is being leaked away, because it's not a high grade, and there is no incentive to use it because nobody wants it, so everybody's very glad when you find somebody who can do something with it*" (interview with Associate Director Sustainability of a multinational consultancy firm). Overall, the Netherlands pays at least €205 per tonne to recycle the low-grade plastics in another country (National Waste Management Plan 3). However, "*maybe in ten places in the whole of Europe, there's a processing facility for low-grade plastics and like I mentioned that is good for 1%, 2% or 3% of the potential of low-grade plastics, so in practice there's almost no recycling of low-grade plastics*" (interview with Associate Director Sustainability of a multinational consultancy firm). As a consequence, due to the low recycling capacity in Europe, "*all those low-grade plastics from the countries themselves go not to the processing facility. They go to the incinerators because that is more profits since incineration of their low-grade plastics costs them about €50 per tonne*" (interview with Associate Director Sustainability of a multinational consultancy firm).

Furthermore, it was also stressed that in practice, in the Netherlands "*we put low-grade plastics altogether. And then we put a bag of money on top of it when we push it to Germany, and then we ask Germany. Well, here you have money and you have films, are you going to recycle them? And then Germany says yes, we are going to recycle them. Thank you. We collect everything, they sign that they will recycle it. So, the Netherlands, our waste management industry says, well, they have signed for recycling our flexibles. So, and then in Germany, they take out the flexibles that are based on polypropylene and polyethylene because from this combination they can make pellets …. And for the*

rest of the flexibles, they put it in a bag again, with a bag of money on it and push it to Poland or Hungary. With the question: will you recycle this? Yes, they say, we will do this! Germany signs it and then we lose track of the packaging. Yeah, that's... and then you have resellers of this waste. And that's why it still ends up in Asia, like in Bangladesh and Indonesia. So that's… we're still part of the plastic soup drama in this case" (interview with Director of consultancy firm in biotechnology). Additionally, "*there is uncertainty about the quantities and actual recycling of plastic packaging waste that has been exported to customers outside the EU*" (Afvalfonds Verpakkingen monitoring report, 2018, p. 44).

4.2. Media Analysis

Between 2010 and 2019, a total of 42 newspaper articles concerning the circular plastics economy were found in the Dutch national newspapers (Appendix B). From these news articles, a total of 86 statements made by the market, state, and civil society actors were identified. Most problems related to the plastic pollution. Proposed solutions to solve these issues mostly addressed 're-use', 'recycling and recyclability', 'upcycling', 'waste as raw material', 'minimise waste', and 'price incentives such as taxes and deposit schemes' (Appendix C). Additionally, from Figure 11, it becomes clear that especially the national government is most mentioned in the news articles (Appendix D). Besides, from Figure 12, it becomes clear that especially research institutes made often an actual statement. Therefore, it seems that research institutes were most active in the national newspapers (Appendix D).

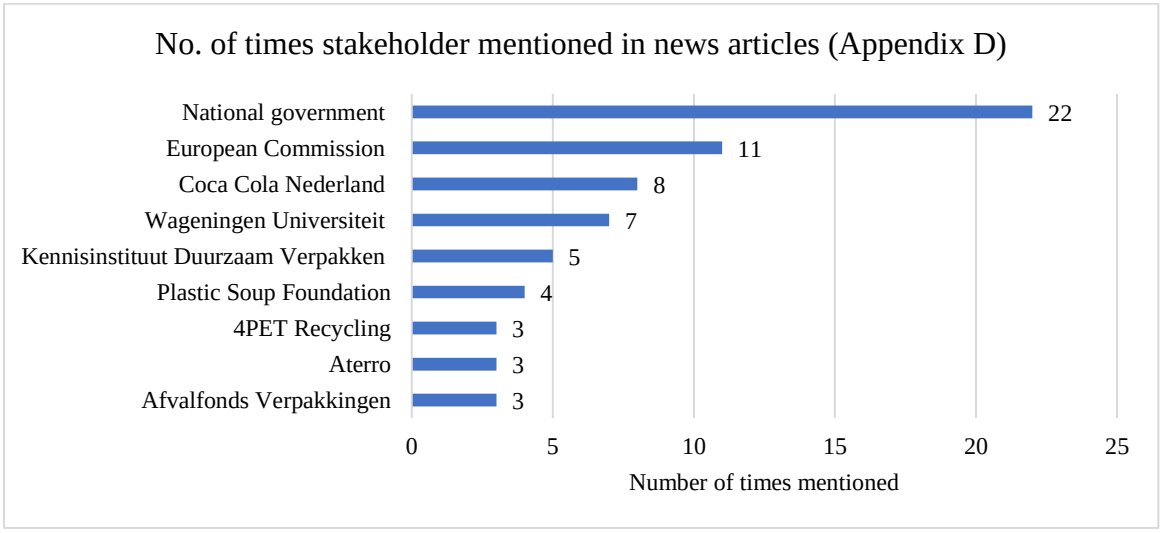


Figure 11 No. of times stakeholder mentioned in news articles (author's work, Appendix D).

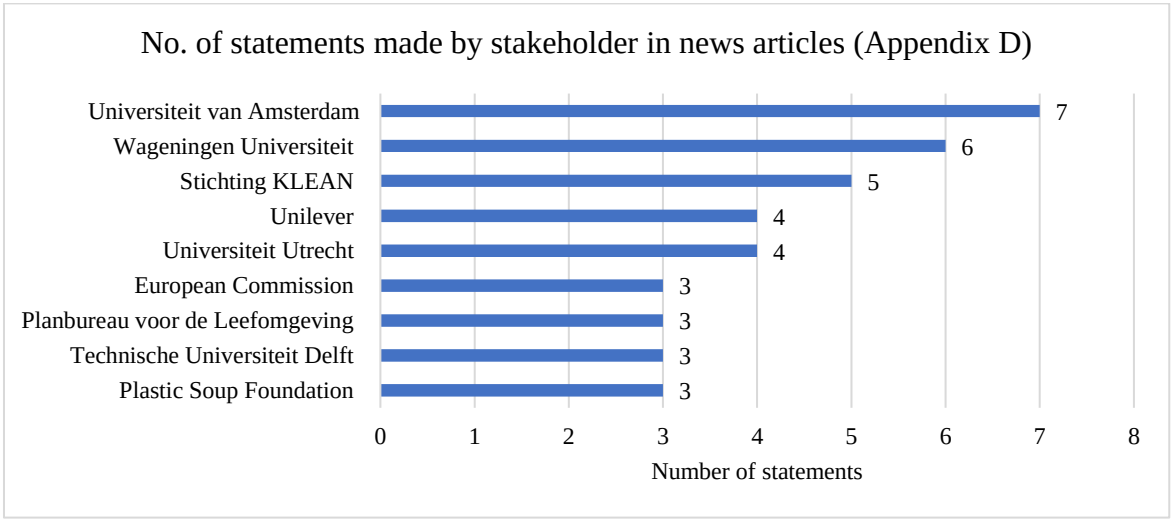


Figure 12 No. of statements made by stakeholder in news articles (author's work, Appendix D).

Furthermore, from Figure 13, it becomes clear that the publication of news articles between 2010 and 2016 is relatively low compared to 2017 and onwards. It is worth noting that, in July 2017, Chinese leaders officially announced to the World Trade Organisation (WTO) to implement the 'National Sword' policy at the start of 2018. This event could have drawn the attention of the news media and could explain the sudden increase of news articles in 2017. The cumulative counts in Figure 13 show that Trouw published most articles (16), followed by Financieele Dagblad (9), Nederlands Dagblad (6), NRC Handelsblad (6), and the Volkskrant (5). However, the Telegraaf, Reformatorisch Dagblad, and Algemeen Dagblad did not publish any news article.

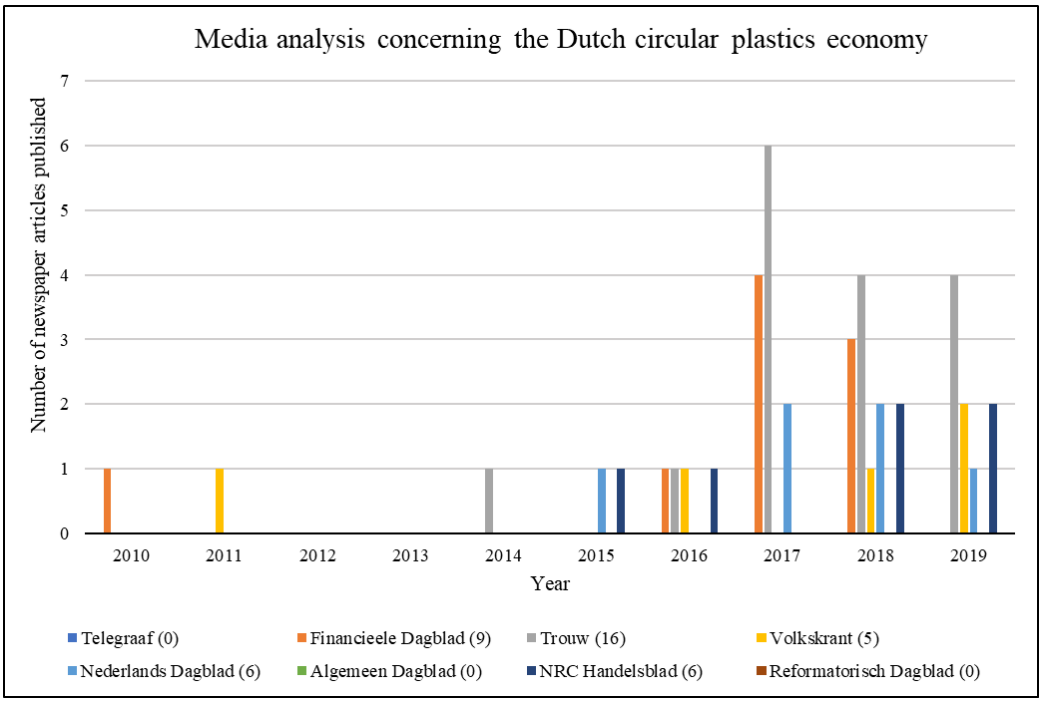


Figure 13 Media newspaper analysis concerning the Dutch circular plastics economy (author's work, source: LexisNexis, Appendix B).

4.3. Stakeholder Analysis

By integrating the policy and media analysis results, a total of 212 organisations were identified concerning the circular plastics economy in the Netherlands (Appendix D). It appeared that the national government was mentioned often in the newspapers, and research institutes were most active by providing a lot of statements. However, other stakeholder groups were also identified, such as plastic producer organisations, plastic applying organisations/brand owners, consultancies, waste management companies (recyclers and collectors), and civil society organisations. The total stakeholder categories are presented in Figure 14.

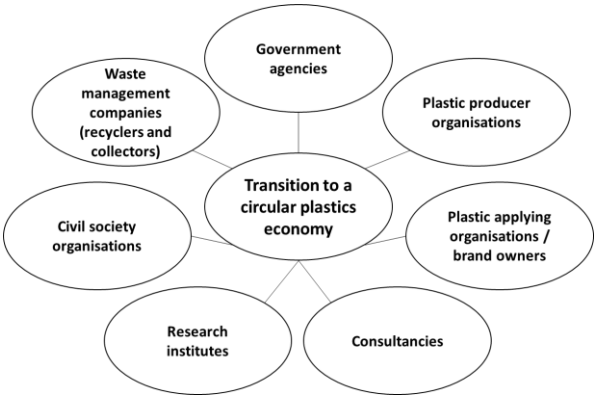


Figure 14 Stakeholders involved in the transition to a circular plastics economy (author's work).

4.4. Set of Statements (Q-sample)

This section presents the final Q-sample (step 2 of the Q method). In this step it was key "*to decide upon the number of statements to present to participants*" (Barry and Proops, 1999, p. 339). The aim was to have at least 30 statements and no more than 50. The Q sample is focused on Q action statements (or policy actions) since many goals, assumptions and means were identified through the policy analysis, media newspaper analysis, and 24 semi-structured expert interviews. Besides, the CE concept is recently implemented, therefore, it was decided to explore which policy actions are considered important for the achievement of a circular plastics economy, and which ones will be accepted in future policy design (as Zabala, et al. (2018) pointed out). The Q action statements were defined and tested on clarity by the supervisors of this research and several independent persons with and without knowledge of the research topic. Table 9 presents the final Q action statements list for the Dutch circular plastics economy. Appendix H shows the software and way of how the Q-sample was presented to the participants in the Q survey.

Table 9 Q action statements for Dutch circular plastics economy.

#	Themes	Q action statements
1.	Alternatives to plastic	The government and companies should investigate and promote sustainable alternative materials to plastic.
2.	Ban export outside the EU	The EU should ban the export of plastic waste outside Europe so plastic waste is recycled and processed within European borders.
3.	Benefits of plastics	The media should communicate the health and environmental benefits of plastics better, especially compared to alternatives, which can have a higher environmental footprint.
4.	Promote bio-based plastics	The government and companies should encourage and highly increase the use of bio-based plastics.
5.	Regulate bio-based plastics	The government should highly regulate bio-based plastic to prevent that they compete with food production and biodiversity conservation.
6.	Clean-up fund	The government and companies from the Global North should establish a fund to finance clean-up activities of plastics in the oceans and other natural ecosystems.
7.	Promote compostable plastics	The government and companies should promote the use of compostable plastics for applications where it is suitable (e.g. tea bags, coffee capsules, cups, cutlery etc.).
8.	Consumer responsibility	Consumers should be responsible for the pollution of plastics in the environment, not only companies.
9.	Ban controversial fossil plastics	The government should ban plastics made from controversial sources such as tar sands and shale gas.
10.	Deposit return system	The government should mandate the establishment of a deposit return systems for all relevant plastics (not just large PET bottles).
11.	Design for sustainability	Companies should always design for recyclability and lower overall environmental impacts throughout a product's lifecycle (including resource use and hazardous substances).
12.	Discourage incineration	The government should establish financial and legal incentives to discourage the incineration of lower grade plastics (with or without energy recovery) and promote their recycling.
13.	Education & awareness	All stakeholders should educate citizens and create more public awareness and change the culture of mass consumption to reduce overall plastic use.
14.	Enforcement and control	The government and companies should enforce stronger control policies to prevent mismanaged plastics (illegal dumping and exports to the Global South).

15.	Expand EPR to other plastics	The government should expand EPR systems to other plastics currently not covered by EPR schemes.
16.	Fair and just societal system	The government should establish a fair and just societal system to make sure that all the fees and costs of a circular economy transition for plastics do not fall on the poorest and most vulnerable people.
17.	Global solidarity	Government and companies from the Global North should provide financial assistance and technology transfers to countries in the Global South so they can better manage plastic waste, as that is where most ocean plastics come from.
18.	Health, safety and toxicity	Regulatory agencies should strengthen and improve the enforcement of health, safety, and hazardous substances standards (OHS and REACH) on plastic products, and their production process.
19.	EPR inclusiveness and participation	Afvalfonds Verpakkingen should include civil society organisations and local and national government representatives in a participatory and inclusive manner so that its decisions regarding plastics are more democratic and collaborative.
20.	Increase EPR fees	Afvalfonds Verpakkingen should increase the waste management contribution fee paid to the EPR system because the current price is too low to foster the best recovery practices.
21.	Innovation fund	The government should establish a fund focused on innovation and R&D of circular solutions (such as new sorting and recycling technologies) financed by fees on virgin materials.
22.	Marketing on recyclability	The government and companies should ensure that claims about recyclability and composability are not misleading and deceptive.
23.	Municipal autonomy	Municipalities should have more autonomy in the management of their recycling systems so that small-scale plastic recovery initiatives can be created and develop disruptive innovations.
24.	Ban non-recyclable plastics	The government should ban non-recyclable single-use plastic applications until an effective collecting, sorting, and recycling infrastructure is implemented.
25.	Open-source innovations	The government, companies, and civil society organisations should promote open source technologies for plastic collection, sorting, and recycling to expand innovations throughout society.
26.	Multi-stakeholder participation and collaboration	The government should increase civil society participation and multi-stakeholder cooperation along the entire value chain to improve plastic policies and practices including eco-design, reuse, and recyclability.
27.	Material passport	The government and companies should ensure that all plastic products and packaging have a material passport with the full list of materials and their origin (including all the different polymers and additives) so recyclers know how to process them.
28.	Restrict polymer types	The government should restrict the types of polymers and additives allowed in the market so there are only a handful of plastic streams that can be easily sorted and recycled.
29.	Product ecological footprint	The government and companies should ensure that all products contain a health, environment, and social footprint label (which includes information about the packaging), so consumers have full information to make sustainable choices.
30.	Recycled content requirements	The government should set high minimum requirements for recycled plastic content in new plastic products.
31.	Recycling bins	The government should provide more recycling bins and containers to people living in large cities, so they don't have to walk large distances to be able to recycle.
32.	Recycling targets	The government should increase plastic recycling targets.

33.	Less regulatory constraints	The government should place less regulatory constraints for bio-based, biodegradable, and recycled plastics, especially for food-uses.
34.	Renewable energy sources	Companies should strive to use less energy as well as use only renewable energy sources to produce, transport, and recycle plastics.
35.	Restrict sales in Global South	Companies should not sell non-biodegradable single-use plastic products in countries where the waste system cannot deal with plastic waste (such as in many countries in the Global South).
36.	Promote reusable packaging	The government and companies should highly increase the use of reusable packaging.
37.	Short loops	Companies should keep plastic loops short and minimise transport costs by using local products and materials as well as local sorting, recycling, and production facilities.
38.	Employment and social inclusion	The government should help people working in unsustainable sectors of the plastic industry to re-locate to the circular plastic economy and especially help the employment of people with poor job prospects.
39.	Taxes on plastic	The government should tax virgin fossil-based plastics and non-recyclable plastics and reduce the taxes on recycled plastics.
40.	Transparency on pledged commitments	Companies should publicly disclose data on their use of plastics including information on plastic recycling and bioplastics, as well as data regarding the progress on the achievement of pledged commitments such as the Plastic Pact.
41.	Unified municipal system	The government should establish a single system for waste management in all municipalities to generate efficient economies of scale for plastic recovery operations.
42.	Reduce virgin-plastic consumption	The government should place targets to reduce overall plastic consumption per capita.

4.5. Statistical Factor Analysis

This section represents step 5 of the Q methodology. For privacy reasons, organisation names are anonymous and only refer to their background (Figure 7). A total of 28 of the 145 invited participants completed and submitted the Q survey (Appendix G). However, two participants submitted the survey too late. Thus, these were not included in the final analysis. Appendix J displays the output of the PQ Method. The first result is a correlation matrix displaying the correlations between all individual Q-sorts. The second result is the unrotated factor matrix and shows seven possible perspectives. The third result is the factor scores (Q-Sort Values) per perspective and shows four significant perspectives, the fourth outcome presents the Z-scores (i.e. deviation from the middle) and shows the most and least important policy actions per perspective (i.e. < -1 and > 1), and at last, the significantly distinguishing scores (at $p < 0.05$ and $p < 0.01$) per perspective are presented.

The completed Q-sorts were 'by person' factor analysed with PQmethod software using the Centroid method. Significant loadings had to fulfil two conditions: (1) EVs > 1, and (2) at least two participants that load significantly on a certain perspective. Significance was determined by using the formula of Brown (1980) as proposed by the PQ method software. This was calculated by multiplying 1.96 with the standard error (which is: $1 / \sqrt{n}$) where '*n*' is equal to the number of statements (i.e. 42). So, $1.96 * (1 / \sqrt{42}) = 0.302$. Then, participants who load ± 0.302 are statistically significant at $p < 0.05$. Eventually, four out of seven perspectives complied with these requirements. Significant participant loadings on a perspective are appointed with an asterisk (*).

The grey boxes in Table 10 indicate to which perspectives participants belong mostly. Most participants attributed significantly to one of the perspectives. Perspective 1 consists of four people (and three confounders from perspective 3, and one negative loading), perspective 2 has four people (and one negative loading), perspective 3 consists of twelve people (and one confounder from perspective 4), and

perspective 4 consists out of four people. Thus, the results indicate that the amount of people per stakeholder group loading on a certain perspective is not equally spread.

- ***Confounders***: In total four confounders loaded significantly on two perspectives. These are participants 4, 16, 17, and 26. Those people are considered to have hybrid views. They are appointed to the perspective where they scored the highest because this gives more meaning to the perspective. During the interpretation, it will be kept in mind that they scored also high on other perspectives.
- ***Non-loaders***: are people who did not load significantly to one of the perspectives. In this case, only participant 23 did not load significantly. This participant will be excluded from the rest of the analysis. This participant holds a unique point of view, therefore, no consistency with others can be found.
- Participants 6 and 21 hold interesting positions: they loaded significantly in the opposite (-) direction on one of the perspectives. This means that they have a significant opposite view compared to the participants that belong to that perspective. In case of participant 21, he/she was not appointed to one of the perspectives at all. Although, this participant has nothing in common with persp. 1, the participant holds a strong opinion in the opposite direction on the same topics.

Table 10 Significant factor loadings at $p < 0.05$ (marked with '*').

#	Participant	Persp. 1	Persp. 2	Persp. 3	Persp. 4	Extra information
1	CSO1	0.5727*	-0.0712	0.2363	0.0543	
2	GOV1	0.0332	-0.1995	0.6170*	0.1478	
3	PAO1	0.1050	0.2982	0.3433*	0.3018	
4	WMC1	0.1736	0.2940	0.3769*	0.4877*	Confounder 4 and 3
5	PAO2	-0.2419	0.6376*	0.3003	0.0476	
6	CSO2	0.3695*	-0.3871*	0.1746	-0.0826	Negatively significant persp. 2
7	RIN1	0.2864	-0.0270	0.2912	0.3539*	
8	COO1	0.2331	0.0778	0.3672*	0.2290	
9	PPO1	-0.0441	0.6217*	0.1139	0.0582	
10	ANO1	0.0551	0.1380	0.5368*	0.0398	
11	CSO3	0.2269	0.2983	0.4939*	-0.0278	
12	WMC2	0.0932	0.5270*	-0.0418	0.1706	
13	GOV2	0.6160*	0.1815	0.0381	-0.0935	
14	PPO2	0.1698	0.7494*	0.2214	-0.0509	
15	RIN2	0.6906*	0.0152	0.1073	0.1022	
16	WMC3	0.3214*	0.0646	0.5219*	0.2174	Confounder 3 and 1
17	PAO3	0.3144*	0.0757	0.5413*	-0.1169	Confounder 3 and 1
18	COO2	0.1430	0.0181	0.4494*	0.1854	
19	WMC4	0.1855	0.2519	0.4939*	-0.0254	
20	WMC5	-0.0725	0.1275	0.5117*	0.0892	
21	RIN3	-0.3649*	0.2264	0.1497	0.2437	Negatively significant
22	RIN4	0.0183	0.2719	0.1548	0.5020*	
23	PPO3	-0.1207	-0.0203	-0.0267	0.2691	Non-loader
24	PPO4	0.0360	0.0162	0.0298	0.5696*	
25	GOV3	-0.1213	0.0472	0.5158*	0.0182	
26	GOV4	0.3294*	0.2496	0.3434*	0.2190	Confounder 3 and 1

4.6. Perspectives on Circular Plastics Economy

Table 10 represents the four perspectives with different participants who define that perspective. In essence, they share a perspective on policy actions considered most and least important for the achievement of the Dutch circular plastics economy. The perspectives were analysed and interpreted based on the normalised factor loadings (including Z-scores) and significant distinguishing policy actions (including Q-Sort Values and Z-Scores). The results were complemented with qualitative comments from the interviews on the assumptions, goals and means.

4.6.1. Perspective 1 focused on Reusability and Global Solidarity

4.6.1.1. Normalised perspective loadings on policy actions

The core of this perspective was formed by four people from non-business sectors: two from civil society organisations (CSO1 and CSO2); one from the government (GOV2), and; one from a research institute (RIN2). This perspective has support from three confounders, namely: two people from the business sector (PAO3 and WMC3) and one from the government (GOV4). From Figure 15 it becomes clear that the core belief on the most important policy action shared by participants in this group is: 'increasing the use of reusable packaging' (36). Furthermore, the view highlights the importance of 'expanding the deposit return systems to all relevant plastics' (10), 'banning of export of plastic waste to outside the EU' (2), 'taxing virgin fossil-based plastics and non-recyclable plastics, and reduce the taxes on recycled plastics' (39), 'design for sustainability' (11), 'discouraging incineration' (12), and 'setting high minimum requirements for recycled plastic content in new plastic products' (30).

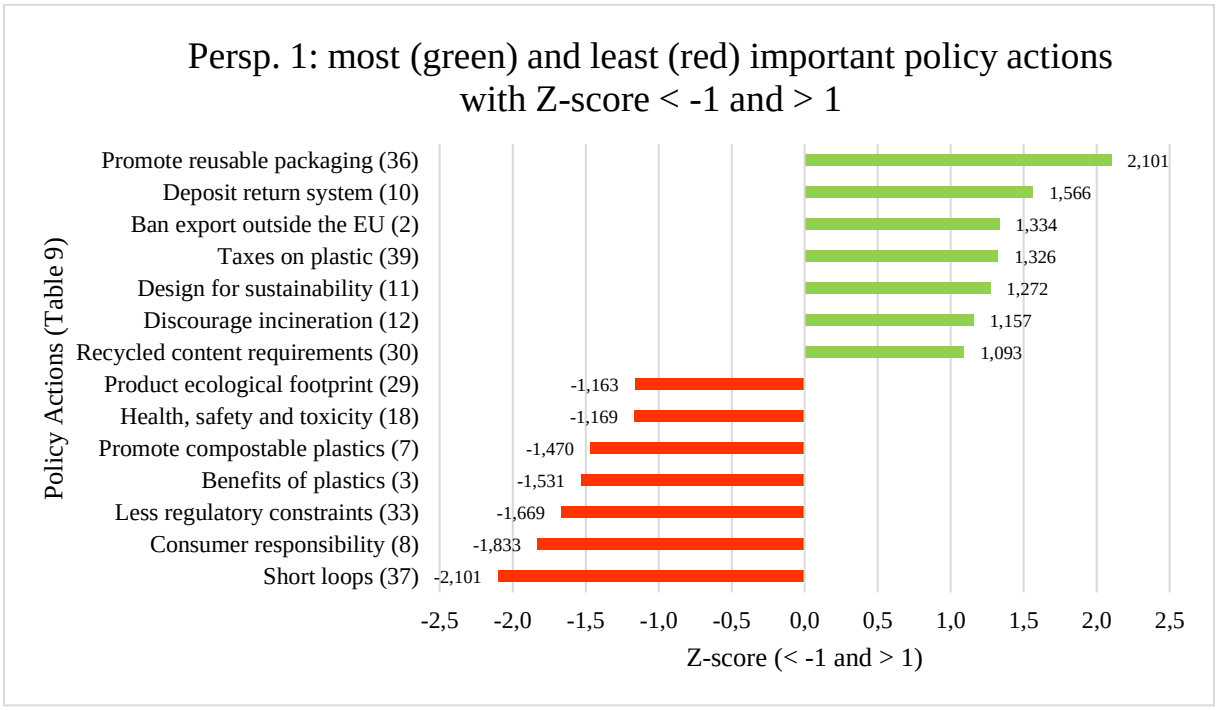


Figure 15 Most and least important policy actions of perspective 1 with Z-score < -1 and > 1.

4.6.1.2. Distinguishing policy actions

Table 11 shows the significantly distinguishing policy actions between perspective 1 and all other perspectives. Both, the Q-SV and the Z-SCR are shown. These are statistically significant at $p < 0.05$, and values indicated by an asterisk (*) have a statistical significance at $p < 0.01$. Looking at the results, this perspective is clearly distinguished by its specific focus on 'promoting reusable packaging' (36), 'expanding the deposit return system' (10), 'ban non-recyclable plastics' (24), 'global solidarity' (17), and 'reducing the overall use of plastics per capita' (42). This view considers 'regulating bio-based production' (5), and especially 'promotion of compostable plastics' (7), 'communicating the benefits of plastics better' (3), 'less regulatory constraints for bio-based, biodegradable, recycled plastics for 'food-uses' (33), 'consumer responsibility' (8), and 'short loops' (37) as less important policy actions.

Table 11 Significant distinguishing policy actions of perspective 1 at $p < 0.05$ and marked with '*' at $p < 0.01$.

		Perspective 1		**Perspective 2**		**Perspective 3**		**Perspective 4**	
No.	**Policy Actions**	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*
36	Promote reusable packaging	5	2.10*	-3	-0.97	1	0.54	-3	-0.90
10	Deposit return system	5	1.57*	-1	-0.65	1	0.48	-3	-1.19

24	Ban non-recyclable plastics	3	0.90*	-4	-1.10	0	-0.03	-2	-0.81
17	Global solidarity	3	0.85*	-1	-0.60	-3	-1.04	-2	-0.72
42	Reduce virgin plastic consumption	2	0.65*	-4	-1.58	-4	-1.36	-4	-1.38
5	Regulate bio-based plastics	-1	-0.43*	2	0.59	2	0.79	-5	-1.76
7	Promote compostable plastics	-4	-1.47	-2	-0.66	0	-0.02	5	1.95
3	Benefits of plastics	-4	-1.53*	4	1.38	3	0.95	0	-0.19
33	Less regulatory constraints	-4	-1.67	-2	-0.79	-2	-1.02	3	1.33
8	Consumer responsibility	-5	-1.83*	2	0.85	3	0.92	0	-0.10
37	Short loops	-5	-2.10	-1	-0.54	-2	-0.65	-3	-1.09

4.6.1.3. Qualitative comments of interviewed Q participants

The qualitative comments of the people who were interviewed, completed the Q survey, and loaded significantly on this perspective are used to further complement this narrative on the assumptions, goals, and means as much as possible. In this case, these were CSO1 and CSO2 (and confounder PAO3).

4.6.1.3.1. Assumptions

CSO2 explains that "*we don't think that the circular economy on plastics is the answer. I don't say we don't need to do it but we need to make it way more simple for recyclers*" (interview with Innovation & Solution Manager of an environmental organisation**)**. This partly supports the claim for 'non-recyclability' (24). Besides, "*the circular economy on plastics again is some sort of hoax almost, I think that there is too much focus on that. And of course, there are a lot of recyclers trying to do the best to recycle whatever they can, but there is also something like an aftermarket, where are big problems to get the good quality to the producers*" (interview with Innovation & Solution Manager of an environmental organisation**)**. CSO1 adds to that "*we cannot fold our economy into being circular. But we have to create conditions in which the economy organises itself circular, because that will lead to less negative externalities*" (interview with Senior Program Leader CE of an environmental organisation). This group values other solutions than recycling, and does not think a circular plastics economy is feasible at all. Also, both, CSO1 and CSO2, responded that a circular economy cannot decouple economic growth from environmental degradation.

Furthermore, "*if you look at the Netherlands, then we are relatively well organised. We are a dense country, we have been collecting waste already from the 1930s, I guess. However, if you look at other areas in the world, like Southeast Asia or Africa, the problems are immense. Of course, it has to do with economics, politics and infrastructure and sizes of countries. So, the impact is everywhere in the world completely different. And I always say that, especially the Netherlands is by far not a representative country for the rest of the world*" (interview with Innovation & Solution Manager of an environmental organisation**)**. So, "*in a lot of countries or regions, they are not even able to invest on such levels to make this feasible because the only way to recycle plastic is in really big amounts to make it a little bit economically feasible to do*" (interview with Innovation & Solution Manager of an environmental organisation**)**. This explains why 'global solidarity' (17) is important.

4.6.1.3.2. Goals

CSO2 commented to have "no goals" since their "*mission is to reduce, especially, single-use plastics. We have to reduce wherever possible. And that doesn't mean reducing in weight. And that's one of the things that a lot of retailers now do, like Albert Heijn in Holland*" (interview with Innovation & Solution Manager of an environmental organisation**)**. And "*there are, I am sure, more possibilities to work with refillable containers or refillable bottles, etc. I know it's not sexy, and I know that if you think about it now, then a lot of people say and it is not doable. But, everything is doable*" (interview with Innovation & Solution Manager of an environmental organisation**)**. This clearly illustrates why 'promoting reusable packaging' (36) is considered as a key policy action.

4.6.1.3.3. Means

CSO2 argued that "*the only way to make it clear to people what the health risks and ecological risks are, is to make it more personal. We think that's the way to make it more tangible for consumers, but also companies and governments*. *We have to change our minds that we are contaminating our world. We have to rethink our processes because we are ruining our world and our living area*" (interview with Innovation & Solution Manager of an environmental organisation**)**. This perspective beliefs that personalisation of plastic issues and other social changes are the right means to achieve sustainability. Overall, they seek systemic socio-cultural change in values and worldviews, and not only by technical solutions.

4.6.1.3.4. Views of other Perspectives

An interesting comment was made on the 'promotion of reusable packaging' (36) by RIN1 (persp. 4), which was the highest score of perspective 1. RIN1 stated that "*the amount of reusable packaging can be increased, but it requires the responsibility of the end consumer and it requires change of the retailing. But I think that will not apply to all of the fast-moving consumer goods to work with reusable packaging. Because as soon as you scale up you have to take such high-quality measures to prevent any risk, then I think the environmental performance of reusable packaging is going down very fast*" (interview with Professor in high-tech recycling from a university). This person's view stresses that 'promoting reusable packaging' (1) would probably not be the optimal solution by looking at the environmental impact of reusable packaging once applications have to be scaled-up, unless consumers take responsibility.

4.6.1.4. Linkage to Discourse Typology Framework (Friant, et al., 2020)

In short, this perspective emphasises social changes such as 'promoting reusable packaging' (36) (Figure 15), and considers policy actions of wealth distribution such as 'global solidarity' (17) important (Table 11). Altogether, looking at the most important policy actions, assumption, goals, and means, this perspective has some linkages with Transformational Circular Society propositions by calling the circular economy almost a form of a "hoax" and by emphasising that the CE is not able to absolute decouple economic growth from environmental degradation. It also focuses on "to reduce wherever possible" (R2) as most important policy action, which is typically a Transformation Circular Society practice. Overall, this perspective beliefs that the circular economy is "not the answer". Therefore, "change our minds" is key. Besides, this is the only perspective that considers reducing plastic consumption semi-important, while all other perspectives do not consider it important (Table 11). Furthermore, it also emphasises a few Reformist Circular Society propositions important as well, such as 'discourage incineration' and 'design for sustainability'. However, both could also be linked to Technocentric Circular Economy propositions.

4.6.2. Perspective 2 focused on Governance and Recycling

4.6.2.1. Normalised perspective loadings on policy actions

This perspective was formed by four people from the business sector: one person from a plastic applying organisation (PAO2); two people from plastic producing organisations (PPO1 and PPO2), and; one from a waste management company (WMC2). From Figure 16 it becomes clear that the core belief on the most important policy action shared by participants in this group is a: 'unified municipal system' (41). Furthermore, this view highlights the importance of 'discouraging incineration' (12), 'design for sustainability' (11), 'communicating the benefits of plastics' (3), 'marketing on recyclability' (22), 'expanding EPR to other plastics' (15), 'establishment of an innovation fund' (21) and 'enforcement and control' (14).

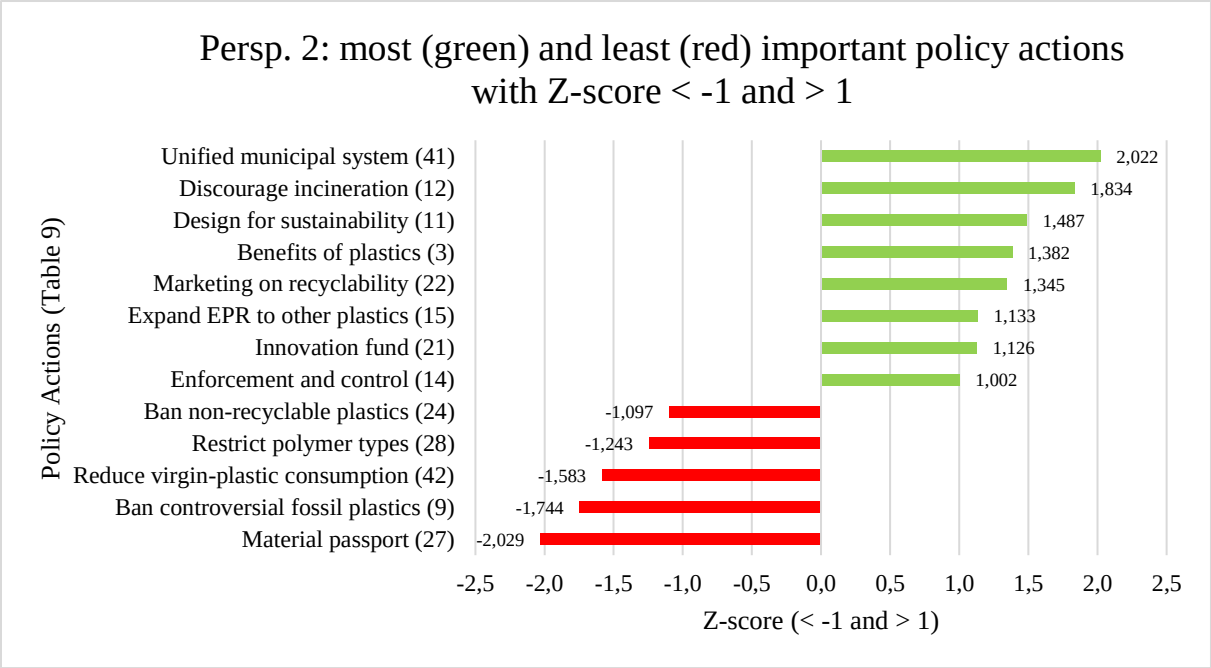


Figure 16 Most and least important policy actions of perspective 2 with Z-score < -1 and > 1.

4.6.2.2. Distinguishing policy actions

Table 12 shows the significantly distinguishing policy actions between perspective 2 and all other perspectives. Both, the Q-SV and the Z-SCR are shown. These are statistically significant at $p < 0.05$, and values indicated by an asterisk (*) have a statistical significance at $p < 0.01$. Looking at the results, this perspective is clearly distinguished by its specific focus on a 'unified municipal system' (41), 'open-source innovations' (25), 'social return' (38), and compared to others relatively low focus on 'taxes on plastic' (39). Furthermore, this perspective considers 'restrict sales in Global South' (35), 'promoting compostable plastics' (7), 'recycled content requirements' (30) less important, especially 'ban controversial production' (9) and a 'material passport' (27).

Table 12 Significant distinguishing policy actions of perspective 2 at $p < 0.05$ and marked with '*' at $p < 0.01$.

		Perspective 1		**Perspective 2**		**Perspective 3**		**Perspective 4**	
No.	**Policy Actions**	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*
41	Unified municipal system	0	0.20	5	2.02*	0	0.17	1	0.34
25	Open-source innovations	-1	-0.44	3	0.87	-1	-0.27	0	-0.15
39	Taxes on plastic	4	1.33	1	0.49	5	2.27	5	1.71
38	Social return	-3	-0.72	1	0.42	-3	-1.26	-1	-0.52
35	Restrict sales in Global South	2	0.81	-1	-0.65	-4	-1.27	3	0.95
7	Promote compostable plastics	-4	-1.47	-2	-0.66	0	-0.02	5	1.95
30	Recycled content requirements	3	1.09	-3	-0.94*	4	1.46	4	1.47
9	Ban controversial fossil plastics	0	-0.09	-5	-1.74*	-2	-0.60	-1	-0.28
27	Material passport	1	0.39	-5	-2.03*	1	0.39	0	0.05

4.6.2.3. Qualitative comments of interviewed Q participants

The qualitative comments of the people who were interviewed, completed the Q survey, and loaded significantly on this perspective are used to further complement this narrative on the assumptions, goals, and means as much as possible. In this case, this were PPO1 and PAO2.

The highest score 'unified municipal system' (41) can partly be explained by PAO2 as follows: "*it depends on the region how we design our products because this needs to be very much aligned with the existing infrastructure. But it is also about consumer communication, for instance, that waste is separated in the right way. Of course, in the Netherlands that is pretty difficult because we have a 'doorgepolderde' packaging recycling infrastructure which is different in any municipality, which is*

crazy and not helpful" (interview with Sustainability Director of multinational consumer-product brand). However, PPO1 adds that currently, "*the industry fears that it is the easy way out for authorities to shift more and more of the financial burden to the industry, but there is also a limit. For instance, if you start pushing too hard at some point, the business model will stop and then the waste will become a societal problem because industries will no longer be involved*" (interview with Managing Director from a plastic producing organisation). Together, both comments clearly explain the need for a better uniform system, but not simply by shifting all costs to the industry.

4.6.2.3.1. Assumptions

Overall, PPO1 explains that "*specifically for plastics, scarcity of resources is not an issue. Too many people with a too limited focus on the circular economy wants to scale up too fast*" (interview with Managing Director from a plastic producing organisation). According to PAO2, "*the risk of what is happening right now is that a lot of people think that plastic is evil. However, we shouldn't stigmatise plastic as evil because plastic is a great product with great features in terms of protection and the way you can shape it, flexible, that it can be recycled, and that it has a relatively low environmental impact. But it shouldn't end up in nature. It should be made fully circular"* (interview with Sustainability Director of multinational consumer-product brand). This partly explains the high score on the 'benefits of plastics' (3) and 'marketing on recyclability' (22), because plastic is considered as a great product.

4.6.2.3.2. Goals

PAO2 highlighted that the circular economy can be achieved before 2050, it is all about the right incentives, willingness and policies. This includes "*decoupling plastic production from virgin fossil fuel feedstock, and reducing its greenhouse life-cycle impacts, improving the economics quality of plastic recycling, and reducing plastic leakage into the environment*" (interview with Sustainability Director of multinational consumer-product brand). Whereas PPO1 explains that "*we would appreciate very much recognition for the positive aspects of plastics, and we want to focus on the negative aspects. For instance, part of the problem is that you cannot replace all the plastics too much, because if the goal is to replace all the plastics that would make everything heavier, which means more CO2 emissions from transport. Also, replacing that with wood or aluminium would mean more excavation of forests for paper, and iron ore for aluminium. So, you cannot simply do that*" (interview with Managing Director from a plastic producing organisation). These goals illustrate that we need plastics probably for a very long time, so we need better governance such as 'enforcement and control' (14), 'innovation fund' (21), 'expand EPR to other plastics' (15) and a 'unified municipal system' (41).

4.6.2.3.3. Means

PPO1 emphasised that "*the circular economy is a means towards a sustainable goal. So, if you achieve that sustainable goal without being 100% circular, okay, deal with that*" (interview with Managing Director from a plastic producing organisation). The means can be further explained by PAO2 as follows by "*using less plastic where it is possible, better plastic in terms of more circular, recycled feedstock and fully recyclable, and no plastic where it doesn't make sense with really guarding the risk with coming up with alternatives with a higher environmental footprint*" (interview with Sustainability Director of multinational consumer-product brand). Clearly, the means partly explain the high score on 'discourage incineration' (12) and 'design for sustainability' (11). Furthermore, PPO1 explained that "*sustainability follows functionality. This means that when you only use sustainable materials, you can make a product that is not functional. And if it is not functional altogether, it is not sustainable. For instance, if you make a 100% sustainable pipe that leaks, it is not sustainable. So, first of all, always have look at the function. This means that, where packaging is concerned, some packaging that for the time being is difficult or not easy to recycle*" (interview with Managing Director from a plastic producing organisation).

4.6.2.4. Linkage to Discourse Typology Framework (Friant, et al., 2020)

In short, this perspective is focused on governance and recycling (Figure 16), and holds a more neutral opinion on the importance of policy actions of wealth distribution and social justice such as 'social return' (38) and 'open-source innovations' (25) (Table 12). Altogether, looking at the most important policy actions, this perspective has some affiliations with Reformist Circular Society (e.g. the importance of 'social return' and 'discourage incineration') and Transformational Circular Society discourse (e.g. the semi-importance of 'open-source innovations'). Overall, this perspective does not consider social changes important, therefore, by taking into account the assumptions, goals, and means this perspective has strong linkages with Techno Circular Economy proposition.

4.6.3. Perspective 3 focused on Recycling

4.6.3.1. Normalised perspective loadings on policy actions

This perspective is supported by most participants, and is formed by twelve people: three people from the government (GOV1, GOV3, and GOV4); two people from plastic applying organisations (PAO1 and PAO3); two persons from consultancies (COO1 and COO2); one person from civil society organisation (CSO3); three waste management companies (WMC3, WMC4, and WMC5), and; one person from an organisation which was not specified (ANO1). From Figure 17 it becomes clear that the core belief on the most important policy action shared by participants in this group is: 'taxing virgin fossil-based plastics and non-recyclable plastics and reduce the taxes on recycled plastics' (39). Furthermore, the view highlights the importance of 'design for sustainability' (11), 'recycling targets' (32), 'recycled content' (30), and 'expanding the EPR system' (15).

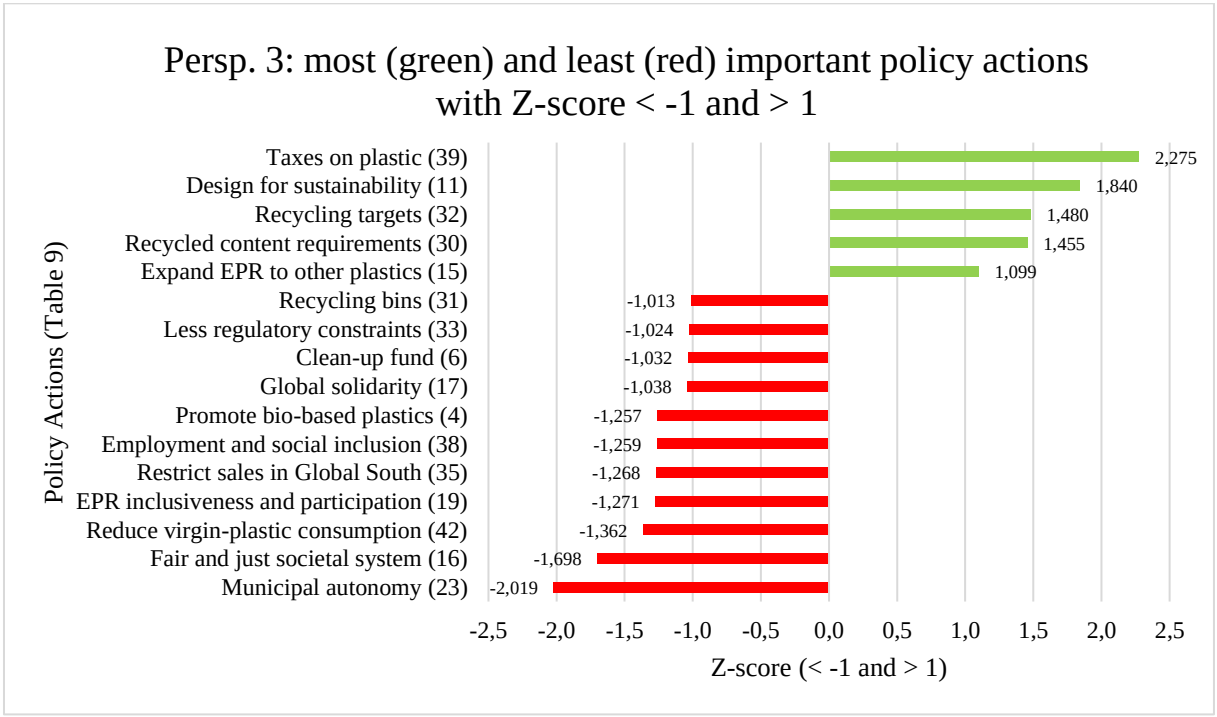


Figure 17 Most and least important policy actions of perspective 3 with Z-score < -1 and > 1.

4.6.3.2. Distinguishing policy actions

Table 13 shows the significantly distinguishing policy actions between perspective 3 and all other perspectives. Both, the Q-SV and the Z-SCR are shown. These are statistically significant at $p < 0.05$, and values indicated by an asterisk (*) have a statistical significance at $p < 0.01$. Looking at the results, this perspective is clearly distinguished by its specific focus on 'polymer types' (28), 'increase fees' (20), moderate focus on 'reusability' (36), and compared to others relatively high focus on a 'product

ecological footprint' (29). Furthermore, this view is neutral about 'composability' (7) and 'non-recyclability' (24). This view especially highlights 'restrict sales' (35), 'inclusiveness and participation' (19), and 'fair and just societal system' (16) less important.

Table 13 Significant distinguishing policy actions of perspective 3 at $p < 0.05$ and marked with '*' at $p < 0.01$.

		Perspective 1		Perspective 2		Perspective 3		Perspective 4	
No.	**Policy Actions**	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*
28	Restrict polymer types	-2	-0.57	-4	-1.24	3	0.88*	-5	-1.90
20	Increase EPR fees	-1	-0.37	-2	-0.67	2	0.56	-1	-0.38
36	Promote reusable packaging	5	2.10	-3	-0.97	1	0.54*	-3	-0.90
29	Product ecological footprint	-3	-1.16	-1	-0.62	1	0.48*	-3	-1.05
10	Deposit return system	5	1.57	-1	-0.65	1	0.48*	-3	-1.19
7	Promote compostable plastics	-4	-1.47	-2	-0.66	0	-0.02	5	1.95
24	Ban non-recyclable plastics	3	0.90	-4	-1.10	0	-0.03	-2	-0.81
35	Restrict sales in Global South	2	0.81	-1	-0.65	-4	-1.27	3	0.95
19	EPR inclusiveness and participation	0	-0.36	0	0.24	-4	-1.27*	0	-0.05
16	Fair and just societal system	0	0.17	2	0.69	-5	-1.70*	2	0.67

4.6.3.3. Qualitative comments of interviewed Q participants

The qualitative comments of the people who were interviewed, completed the Q survey, and loaded significantly on this perspective are used to further complement this narrative on the assumptions, goals, and means as much as possible. In this case, this were GOV1, PAO3, COO1, and WMC4.

4.6.3.3.1. Assumptions

Concerning the challenges related to plastics, GOV1 explained that "*if you look purely at a material, there's no problem. But if you look at the effects on the environment, how do they get the oil out of the ground, if you burn it, you get CO_2 emissions and so on. That are the big problems for us, but it is not about that oil will be scarce in the next two decades*" (interview with Secretary of Plastic Pact NL from national government). Besides, the comment of GOV1 and WMC4 stresses that most "*environmental challenges are related to marine litter, littering of plastics, and plastics pollution, and microplastics*" (interview with Secretary of Plastic Pact NL from national government, and Director from a large recycling firm). So, according to PAO3, "*it is really about how we put products in the store right now. So, we put them in there and then customers take it. But, we are not responsible anymore for anything that the customer does with it. Of course, we can help recycling by putting logo's on it where customers can throw it away the best way, etc., but we are not responsible for that part of the chain. I think that makes it difficult*" (interview with Corporate Sustainability employee from a multinational retail firm). Eventually, as GOV1 explained *"consumers like we are, should think about, do I need this product? And if they are discarding it, where do they discard it? And they make sure that all their plastics are being collected. And then that is a big problem*" (interview with Secretary of Plastic Pact NL from national government). After all, WMC4 assumes that "*the circular economy can ultimately allow for the decoupling of economic growth from environmental degradation. However, the level of urgency and importance is a slow-moving issue. Also, our consumption patterns need to change, and other changes of attitude and behaviour such as re-using more*" (interview with Director from a large recycling firm). However, PAO3 also highlighted that, eventually, "*the circular economy is not the only way and only thing necessary to decouple economic growth from environmental degradation*" (interview with Corporate Sustainability employee from a multinational retail firm).

4.6.3.3.2. Goals

GOV1 explained that "*the circular economy is about getting the raw materials as long as possible in the loop*" (interview with Secretary of Plastic Pact NL from national government). Additionally to the comment of GOV1, PAO3 emphasises that "*the circular economy, ideally, it would mean that there is no waste anymore at all. So, everything it is not even called waste. It is just called a resource. So, we*

try to reduce first, then to reuse, and also then at last to recycle" (interview with Corporate Sustainability employee from a multinational retail firm). However, GOV1 also acknowledged that "*if you study science, it is not possible that you get a 100% circular economy. There always will be some waste*" (interview with Secretary of Plastic Pact NL from national government). Moreover, WMC4 emphasises that "*the use of plastics and the growth of plastics is one of those big advantages and sustained achievements of our society. If you substitute plastic products for traditional materials then the need for raw materials goes up by 3.7%, energy use goes up by 50%, and CO_2 emissions go up by 50%. So, using plastics and rubber is an enormous effort and achievement for sustainability. This is a message we have to get across to policymakers and the general public*" (interview with Director from a large recycling firm). Clearly, these goals illustrate the reason why this group values 'recycled content requirements' (30), 'recycling targets' (32), 'design for sustainability' (11) and 'taxes on plastic' (39) the most, and why this group distinguishes on 'restricting polymer types' (28), since these policy actions are all in favour of the continuation of using plastics, which partly explains the overarching goal of better and more recycling.

4.6.3.3.3. Means

WCC4 emphasises that "*the circular economy is not a goal on itself, but it is a path to make plastics and the plastics industry more sustainable. For instance, it does not necessarily mean that when a product is circular, it is also really sustainable*" (interview with Director from a large recycling firm). This way of thinking quite aligns with PPO1 of perspective 2. Furthermore, GOV1 explains that "*we should give companies the time to make the change, but not too much, of course. Because if you give them 10, year, that 10 years, they take exactly 10 years. So we should push them a little bit. If we don't see that the results are not as good as we expected, then I think it will be good to for the Ministry to say, well, if we do not reach the goals, then we take action"* (interview with Secretary of Plastic Pact NL from national government). This way of reasoning aligns emphasises the sustainability of capitalism and that economic innovations possibly will, eventually, lead to more sustainability when companies are pushed into a certain direction.

4.6.3.4. Linkage to Discourse Typology Framework (Friant, et al., 2020)

In short, this perspective is recycling focused (Figure 17) and does not seriously consider policy actions of wealth distribution and social justice (Table 13) such as 'inclusiveness and participation' (19) and a 'fair and just societal system' (16) important at all. Altogether, looking at the most important policy actions, assumption, goals, and means, this perspective has most linkages with Techno Circular Economy propositions. For instance, this perspective highly values recycling-related measures, and assumes that environmental degradation can be decoupled from economic growth. These are typically Techno Circular Economy propositions.

4.6.4. Perspective 4 focused on Alternatives

4.6.4.1. Normalised perspective loadings on policy actions

This perspective was formed by four people: one person from a waste management company (WMC1); two people from research institutes (RIN1 and RIN4), and; one person from a plastic producing organisation (PPO4). From Figure 18 it becomes clear that the core belief on the most important policy action shared by participants in this group is: 'promote the use of compostable plastics for applications where it is suitable' (7). Furthermore, this view values the importance of 'taxes on plastic' (39), 'promote bio-based plastics' (4), 'recycled content requirements' (30), 'recycling targets' (32), and 'less regulatory constraints for bio-based, biodegradable, and recycled plastics, especially for food-uses' (15).

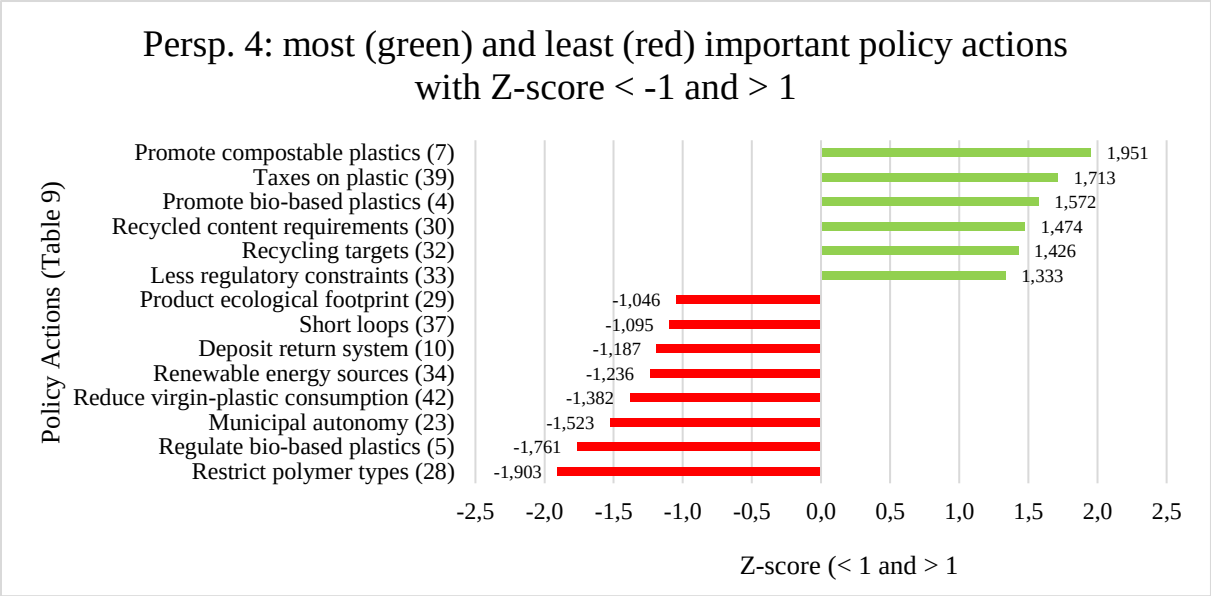


Figure 18 Most and least important policy actions of perspective 4 with Z-score < -1 and > 1.

4.6.4.2. Distinguishing policy actions

Table 14 shows the significantly distinguishing policy actions between perspective 4 and all other perspectives. Both, the Q-SV and the Z-SCR are shown. These are statistically significant at $p < 0.05$, and values indicated by an asterisk (*) have a statistical significance at $p < 0.01$. Looking at the results, this perspective is characterised by its specific focus on 'promoting compostable plastics' (7), 'promote bio-based plastic' (4), 'less regulatory constraints for bio-based, biodegradable, and recycled plastics, especially for food-uses' (33), and 'investigating and promoting sustainable alternative materials to plastic' (1). This view has a neutral opinion about policy actions related to 'consumer responsibility' (8), and 'better communicating the benefits of plastics by the media' (3). Furthermore, this perspective emphasises 'expand EPR to other plastics' (15) and in particular 'regulating bio-based plastic production to prevent that they compete with food production and biodiversity conservation ' (5) as less important policy actions.

Table 14 Significant distinguishing policy actions of perspective 4 at $p < 0.05$ and marked with '*' at $p < 0.01$.

		Perspective 1		**Perspective 2**		**Perspective 3**		**Perspective 4**	
No.	**Policy Actions**	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*	*Q-SV*	*Z-SCR*
7	Promote compostable plastics	-4	-1.47	-2	-0.66	0	-0.02	5	1.95*
4	Promote bio-based plastics	-2	-0.59	-3	-0.81	-3	-1.26	4	1.57*
33	Less regulatory constraints	-4	-1.67	-2	-0.79	-2	-1.02	3	1.33*
1	Alternatives to plastic	-1	-0.41	0	-0.37	0	-0.09	3	0.95*
8	Consumer responsibility	-5	-1.83	2	0.85	3	0.92	0	-0.10
3	Benefits of plastics	-4	-1.53	4	1.38	3	0.95	0	-0.19*
15	Expand EPR to other plastics	2	0.68	3	1.13	4	1.10	-2	-0.76*
5	Regulate bio-based plastics	-1	-0.43	2	0.59	2	0.79	-5	-1.76*

4.6.4.3. Qualitative comments of interviewed Q participants

The qualitative comments of the people who were interviewed, completed the Q survey, and loaded significantly on this perspective are used to further complement this narrative on the assumptions, goals, and means as much as possible. In this case, this was RIN1.

4.6.4.3.1. Assumptions

"*If we don't take drastic measures on climate change but also materials, I think we will not survive".*
"*In my view, we do not need that much of oil if we make plastics circular, so then you do not need to have fossil oil as a virgin material. So, in my view, making plastics circular is very important, and the*

technologies are there, it is a matter of organising the value chain" (interview with Professor from University representing a high-tech recycling company). "*The problem currently is more on the collection and the upstream logistics than on the downstream*" (interview with Professor from University representing a high-tech recycling company). "*One of the main challenges is that you have to compete with virgin production, and that would be the case for all plastic recycling methods*" (interview with Professor from University representing a high-tech recycling company). This partly explains why this group values 'taxes on plastic' (39) as important, because this can potentially benefit the competition with the production of virgin fossil-based plastics.

4.6.4.3.2. Goals

"*In my view, there would be a need to make a sort of a ladder of Lansink for chemical recycling*". "*Normally, with basic chemicals, size is what matters, and all production processes are very marginal from economic points of views, so scaling up is very important to compete with virgin plastic*" (interview with Professor from University representing a high-tech recycling company). However, "*I would like to find it far more interesting whether it is feasible to set up small-scale facilities that compete with virgin plastics because in case of smaller scales you have less travel distances*" (interview with Professor from University representing a high-tech recycling company). But "*it all has to do with the economic conditions. So, it is not on purpose that they want to have it on large scale, it is because they have to compete with virgin production*" (interview with Professor from University representing a high-tech recycling company). Possibly, this also partly explains the strong focus of this group on 'promoting compostable plastic' (7), 'promote bio-based plastics' (4) and 'alternatives to plastic' (1), since these have potential to compete with virgin fossil-based plastics.

4.6.4.3.3. Means

I think biobased plastics are relevant. Also, for instance, in plastics like PET, you can produce it fully from biobased materials, you can produce glycol from biobased materials, you can process biobased PET, so you can get rid of virgin materials" (interview with Professor from University representing a high-tech recycling company), because, "*on polymer level bio-based plastics they are identical*" (interview with Professor from University representing a high-tech recycling company). "*So, I think we need still biobased virgin inputs for a closed cycle*" (interview with Professor from University representing a high-tech recycling company). Altogether, the comments of RIN1 partly explain the high score on 'recycling targets' (32), 'recycled content requirements' (30), 'promote bio-based plastic' (4), and 'taxes on plastic' (39). However, concerning compostable plastics, RIN1 commented "*biodegradable is a nice word but in practice it is not very applicable. There is a risk that people think it can be degraded so you can put it in the composted bin, composting plastic is a bad idea, it doesn't compost and results in emissions*" (interview with Professor from University representing a high-tech recycling company). Yet, this specifically distinguishes this perspective significantly from others on importance (Table 14).

4.6.4.4. Linkage to Discourse Typology Framework (Friant, et al., 2020)

In short, this perspective is especially focused on an alternative to fossil-based plastics (Figure 18), and does not mention policy actions of wealth distribution and social justice important (Table 14). Altogether, looking at the most important policy actions, assumption, goals, and means, this perspective has most linkages with Techno Circular Economy propositions, but also a few with the Fortress Circular Economy discourse. For instance, this perspective strongly believes in other plastics than fossil-based ones, but also assumes that drastic measures are required, otherwise "I think we will not survive" (interview with Professor from University representing a high-tech recycling company). This comes close to "ecological collapse" from the Fortress Circular Economy discourse. Yet, this perspective mainly emphasises the importance of innovation of plastics, typically following Techno Circular Economy propositions.

5. Discussion

This chapter discusses the theoretical (5.1), policy (5.2), and methodological (5.3) implications.

5.1. Theoretical Implications

First of all, the concept of the circular economy was incorporated in Dutch governmental policy in 2013 to reduce the ecological footprint of human activity with the underlying reason that human activity depletes natural resources and the habitability of the physical environment (CPB Netherlands Bureau for Economic Policy Analysis, 2019). Over the past decade, the CE gained a lot more attention in society, especially from 2016. This trend was observed by the increase of governmental policies and news articles in the Dutch national newspapers (Figure 10). It is remarkable what some interviewees commented about the essence and meaning of the circular economy concept: "*what has changed is, in thirty years, it used to be named as "waste processing" and is now called "circularity", of course, there are some differences, but it is not a major difference, we still try to solve the same type of challenges*" (interview with Professor from University representing a high-tech recycling company). With this respect, the circular economy concept is rather a refurbished concept than a new one, which was also stated by Reike, et al. (2018).

5.1.1. Governance Mechanisms

The realisation of the Dutch circular plastics economy is represented by all five modes of governance (Driessen, et al., 2012). First, an enforced *public-private* mode of governance (Driessen, et al., 2012) is dominant in the EPR schemes for packaging (e.g. Framework Agreement on Packaging 2014), since the Agreement contains commitments between market and governmental parties. Secondly, a *centralised* mode of governance (Driessen, et al., 2012) is prevalent through the National Waste Management Plans (of the Ministry of Infrastructure and Water Management) and Packaging Management Decree 2014 (of the Ministry of Infrastructure and Environment). For instance, the National Waste Management Plan was implemented because "*Europe and the Environmental Management Act oblige to do so*" (National Waste Management Plan 3 Policy Framework 2017-2019, p. 8), and the European Directive 94/62/EC obliges the establishment of the Packaging Management Decree 2014. Thirdly, a *decentralised* mode of governance (Driessen, et al., 2012) becomes prevalent in the collection, sorting and recycling infrastructure of plastic packaging waste, since municipalities are free to organise this by themselves. Fourthly, an *interactive* mode of governance (Driessen, et al., 2012) becomes prevalent in the Plastic Pact NL, since this Pact contains (voluntary) agreements and commitments between public, private and civil society stakeholders in the Dutch plastic value chain. Finally, the *self-governance* mode (Driessen, et al., 2012) becomes prevalent by the private investments of, for instance, Unilever and Coca Cola who help to solve plastic related issues in the Global North and Global South. Overall, these organisations do more than national legislation requires of them. Furthermore, local citizen initiatives exist to solve plastic issues. For instance, volunteers who work for circular initiatives such as repair cafes or workshops where citizens teach each other how to make new products out of plastic waste (statements 4, 17 and 53 in Appendix C). Such initiatives are especially founded by citizens who are passionately against plastic pollution.

5.1.2. Legal Binding Policies

The European Commission set the ultimate goal is to "*close the loop*" (European Commission, 2018). It is stressed that "*the plastics industry is very important to the European economy, and increasing its sustainability can bring new opportunities for innovation, competitiveness and job creation*" (European Commission, 2018). With this respect, the circular economy seems rather an economic opportunity than a deep reform of the current system. Furthermore, "*the design and production of plastics and plastic products fully respect reuse, repair and recycling needs and more sustainable materials are developed and promoted*" (European Commission, 2018). Especially practices related to reuse (R2), repair (R4) and recycling (R7) are promoted to reduce plastic pollution, to reduce plastic waste generation and to

eventually reduce plastic waste. Eventually, the European Commission aims that "*plastic waste generation is decoupled from growth*" (European Commission, 2018), where citizens are aware of avoiding plastic waste. Overall, reducing plastic usage is mostly mentioned in the context of more reusing, repairing or recycling. However, less emphasis is given to reduce plastic usage per capita.

The European Commission's approach influences legally enforced policies in the Netherlands, such as the National Waste Management Plans and Packaging Management Decree (2014). In essence, these represent several European Directives (Appendix A). Therefore, the Dutch approach looks similar to the European Commission strategy. For instance, Dutch policies often emphasise "eco-design", "Cradle-2-Cradle", "recyclability of plastics", and "resource-efficiency" which are mentioned in several Dutch policy documents, such as the 'program: from waste to raw material (2013)', and 'National Waste Management Plan 2 (2014)' (Appendix A). Overall, aimed to lower the environmental impact of plastics. Furthermore, the Dutch government wants "*to grow by greening by providing our prosperity with both renewable and non-renewable raw materials through optimum use of natural resources*" (Dutch Parliament, 2013, p. 2). All in all, by looking at the Dutch government's approach, it seems that the government mainly follows a Technocentric Circular Economy proposition (Friant, et al., 2020).

As a consequence, most-talked-about solutions vest much hope in technologies that do not exist yet, especially concerning chemical recycling. However, in the coming years these very expensive technologies still have to be developed, must be implemented and be proven (cost-)effective on a large scale. At the same time, the plastic production and consumption will increase tremendously in the coming years. Knowing that our current waste management infrastructure is not able to process all plastics in an environmentally responsible way, it is likely that effective progress will take a long time. Therefore, the question remains to what extent this is acceptable or not.

5.1.3. Not legal Binding Policies

The Plastic Pact NL is a collective voluntary agreement/policy that is supported by a wide variety of private, public and civil society stakeholders who agree on the environmental issues related to plastics, and common objectives to accelerate and achieve the transition to a circular plastics economy. Overall, "*the Plastic Pact is interesting because it is the first initiative that brings all stakeholders in the whole value chain together*" (interview with Secretary of Plastic Pact NL from national government). However, the Pact only includes "*front runners, which are the companies that say what they can do one step further than legislation is asking from them*" (interview with Secretary of Plastic Pact NL from national government). So, there are also many other (large) organisations, such as Shell, who did not sign the Plastic Pact NL. This means that the Pact is susceptible to free-riders. Also, opinions of the stakeholders who signed the Plastic Pact NL are diverse within the boundaries of the agreement. For example, the Plastic Pact NL is praised, "*the Plastic Pact is a great thing because it is absolute reduction figures but also some freedom for the markets how to fill this in*" (interview with Sustainability Director of a multinational consumer-product brand), but also criticised, "*the time is over for all this type of agreements and we now need a strict market mechanism to facilitate circularity or we have regulation*" (interview with Professor from University representing a high-tech recycling company). The main aim of the Plastic Pact NL states that: "*parties have the ambition to jointly simplify and close the plastic chain, by marketing as many reusable and exclusively recyclable plastic products and packaging as possible, by not using more (types of) plastic than necessary, by recycling more plastic, and to re-use biobased plastics in new products and packaging*" (Article 1). This policy typically emphasises innovations related to re-use (R2) and recycling (R7) practices. Yet, the main goal of the parties who agreed intend to reduce the environmental impact of plastics and to promote circularity. These are typically Technocentric Circular Economy propositions (Friant, et al., 2020). So, it seems that the Plastic Pact NL also follows a Technocentric Circular Economy disoucrse. Also, other recent (not legal binding) national policies seem to include other measures as well. For instance, the necessity to "*promote new ways of consumption*" (Dutch Parliament, 2016, p. 15). However, such socio-technological measures are not legally enforced and remain still quite vague formulated.

5.1.4. Practices

In the Netherlands, practices are currently mainly focused on recycling (R7), incineration with energy recovery (R8) (Figure 9) and export of plastic waste. On paper, achieving 100% circularity is feasible when you export plastic waste for "recycling" to other countries. For instance, as one of the interviewees commented: *"you can be 100% circular when you do business with China, they do for recycling, for example, the waste of the Netherlands*" (interview with Senior Policy Advisor of local governments). However, "*the idea that it is recycled in the Global South is, of course, a non-sense argument"* (interview with Professor from University representing a high-tech recycling company). This argument is reinforced by what the Afvalfonds Verpakkingen stated in their monitoring report of 2017: "*there is uncertainty about the quantities and actual recycling of plastic packaging waste that has been exported to customers outside the EU*" (p. 44). This questions the representativeness of the achieved recycling percentages. As a consequence, there is a possibility that the actual recycling percentages, in reality, are lower than they are presented in the monitoring reports.

Furthermore, it is, in reality, "*impossible to create a zero-waste economy and full circular plastics economy*" (interview with Director and a Chemical Engineer of a consultancy firm). Simply, because there will always be waste, and it is technically not feasible to recycle all materials over and over again as the quality of the material degrades over time (Ragaert, et al., 2017). With this respect, the aim to create a zero-waste economy and to achieve full circularity seems rather an idealistic objective than a realistic one. All in all, from a critical point of view, the focus on recycling (either mechanical or chemical) (R7), incineration with energy recovery (R8), and export are only a (temporary) part of the solution. Therefore, the strong focus on these practices seem rather a way to continue business-as-usual.

5.1.5. Societal perspectives

The Q methodology found four significant perspectives on policy actions in Dutch society on the transition towards a circular plastics economy. Altogether, the quantitative results from the Q method and qualitative comments from the interviews, showed that perspectives two, three, and four (cumulative 20 participants) mainly follow Technocentric Circular Economy propositions, while only one perspective has strong linkages with a Transformational Circular Society discourse (cumulative 4 participants, 3 confounders, and 1 negative significant loading). All in all, these results indicate that societal perspectives are mainly centred around Technocentric Circular Economy discourse.

5.2. Policy Implications

This research represents many different societal perspectives, opinions, beliefs and assumptions from government agencies, plastic producer organisations, plastic applying organisations/brand owners, consultancies, waste management companies (recyclers and collectors), civil society organisations, and research institutes actively involved in the transition to a circular plastics economy in the Netherlands. Since 2013 the Dutch recycling system for plastics has reached about 50% recycling (R7) and 50% incineration with energy recovery (R8). In general, interviewees found the EPR system for packaging effective, but interviewees also stated that this system has many limitations and weaknesses, especially concerning the collection, sorting, recycling infrastructure, legislation, fossil-based plastics, bio-based plastics, and biodegradable plastics. The Q method helped to determine which policy actions are considered *most* and *least* important by the stakeholders with different perspectives. Therefore, for future policy design, recommendations are given on the policy actions on which consensus exist about the (less) importance among the different perspectives.

5.2.1. Consensus on important policy actions

1. *Tax virgin fossil-based plastics and non-recyclable plastics and reduce the taxes on recycled plastics:* Nowadays, the price of virgin plastics is too low to make plastic recycling economic viable (Forrest, et al., 2019). Current forecasts show that the plastic waste generation will increase (UNEP, 2019). Therefore, it will be vital that the waste management industry can

develop and innovate at a higher pace than the virgin plastic production and consumption will. However, current recycling technologies are very expensive or still have to be improved (Ragaert, et al., 2017). Therefore, it is likely that effective progress will take a long time. By making virgin fossil-based plastics and non-recyclable plastics more expensive through taxes, this could stimulate to produce and consume recyclable plastics. This policy action has a high chance for being accepted in future policy design, since it is considered important by perspectives 1, 3 and 4 (Figure 15, 17 and 18), whereas perspective 2 considered it important, but to a lesser extent than the other perspectives (Table 12). This policy recommendation also aligns with Hartley, et al., (2020, p. 4) recommendation: "*alterations to taxes on CE-based products*".

2. *Establish a fund focused on innovation and R&D of circular solutions (such as new sorting and recycling technologies) financed by fees on virgin materials*: Currently, innovation main challenges are related to the cost-effectiveness, especially concerning chemical recycling (Ragaert, et al. (2017). These costs can be reduced when certain fees are charged on virgin plastics. This can be done in line with the first recommendation. This policy action has a high chance of being accepted in future policy design since it is considered important by all perspectives (Appendix J). Besides, this recommendation is in line with the advice of the CPB Netherlands Bureau for Economic Policy Analysis (2019) recommendation to stimulate innovation through 'Green Deals', subsidies and other financial measures.
3. *Establish financial and legal incentives to discourage the incineration of lower grade plastics (with or without energy recovery) and promote their recycling*: It is obvious that aiming for a circular plastics economy simultaneously means that incineration should be discouraged and recycling should be promoted. However, Gradus, et al. (2017) conducted a case study on the cost-effectiveness between recycling and incineration of Dutch household plastic waste. It appears that the total costs of recycling are about €767 per tonne, and the total costs of incineration about €561 per tonne (Gradus, et al., 2017, p. 25). This price difference is not desired when incineration has to be discouraged. Therefore, financial and legal incentives could be effective to make recycling more cost-effective. This policy action has a high chance of being accepted in future policy design since it is considered important by all perspectives (Appendix J). This policy action aligns with the Dutch government target to become fully circular by 2050.
4. *Always design for recyclability and lower overall environmental impacts throughout a product's lifecycle (including resource use and hazardous substances)*: To some extent, this policy action aligns with "*increasing plastic recycling targets*" and "*ensure that claims about recyclability and composability are not misleading and deceptive*". For this reason, they are combined in one recommendation. Currently, the plastic producing industry and plastic applying organisations are increasingly overwhelming the plastic waste management industry with many plastic materials which contain all kind of extra additives. This negatively impacts the recyclability of plastics, therefore, it is not surprising that the waste management industry cannot keep up in recycling these plastics. This partly results in that much plastic waste is exported (and mismanaged) or incinerated with energy recovery. Therefore, CPB Netherlands Bureau for Economic Policy Analysis (2019) already recommended to regulate certain types of plastics, additives and colouring agents to improve the recyclability. Overall, these three policy actions have a high chance of being accepted in future policy design since these are considered important by all perspectives (Appendix J). Besides, these recommendations also align with Hartley, et al. (2020, p. 4) who recommended to the European Commission to further adapt "*circular design standards and norms at the EU level*".
5. *Ban the export of plastic waste outside Europe so plastic waste is recycled and processed within European borders:* As Afvalfonds Verpakkingen stated, the actual recycling percentages of plastic waste are unknown once it is exported to outside the European Union (Afvalfonds Verpakkingen monitoring report 2017, p. 44). Thus, essentially, mismanagement of plastic waste already starts within European borders. Besides, it is vital to be able to monitor what

happens to our waste once exported if we want to achieve full circularity. Therefore, export to outside the European Union can be prevented by simply not allowing it. This policy action has a high chance of being accepted in future policy design, since it is considered important by all four perspectives (Appendix J). However, this policy recommendation seems to be in contrast with Hartley, et al. (2020) who recommended on the European level for the "*liberalization of waste trading*" (Hartley, et al., 2020, p. 5). Based on the findings of this research, the liberalisation of waste trading is better to be promoted within European borders.

5.2.2. Consensus on less important policy actions

In total, eleven policy actions were considered as less important for the achievement of the circular plastics economy in the Netherlands. For each less important policy action, at least three perspectives loaded a negative value (i.e. '-'). During the semi-structured expert interviews, question 31 was specifically focused on "*what policy measures and mechanisms do you find important to foster this transition to Circular Plastic Economy*" (Appendix E). This helped to reveal to some extent the motivations about the importance of certain policy actions. However, it did not clarify motivations about why certain policy actions were considered less important. Thus, these motivations could not be completely explained through this research. The eleven policy actions that were considered less important are listed below (Appendix J).

1. The government and companies should encourage and highly increase the use of bio-based plastics.
2. The government should ban plastics made from controversial sources such as tar sands and shale gas.
3. Government and companies from the Global North should provide financial assistance and technology transfers to countries in the Global South so they can better manage plastic waste, as that is where most ocean plastics come from.
4. Regulatory agencies should strengthen and improve the enforcement of health, safety, and hazardous substances standards (OHS and REACH) on plastic products, and their production process.
5. Afvalfonds Verpakkingen should increase the waste management contribution fee paid to the EPR system because the current price is too low to foster the best recovery practices.
6. Municipalities should have more autonomy in the management of their recycling systems so that small-scale plastic recovery initiatives can be created and develop disruptive innovations.
7. The government should restrict the types of polymers and additives allowed in the market so there are only a handful of plastic streams that can be easily sorted and recycled.
8. The government should place less regulatory constraints for bio-based, biodegradable, and recycled plastics, especially for food-uses.
9. The government and companies should ensure that all products contain a health, environment, and social footprint label (which includes information about the packaging), so consumers have full information to make sustainable choices.
10. Companies should keep plastic loops short and minimise transport costs by using local products and materials as well as local sorting, recycling, and production facilities.
11. The government should place targets to reduce overall plastic consumption per capita.

5.3. Methodological Implications

Firstly, the theoretical framework used in this research was a useful way to understand and analyse CE discourses in Dutch society. It helped to structure the results on commonality and it simplified their linkages to the discourse typology framework of Friant, et al., (2020). However, this is simultaneously also a limitation of the findings. The identified perspectives are not that "black and white" distinguishable, therefore, cannot easily be appointed fully to a certain discourse in the matrix. Overall, it seems that the perspectives are rather a mix of a few discourses with some nuances between

perspectives. This was also emphasised as a limitation by Friant, et al. (2020). However, the theoretical framework did help to reduce the complexity of subjectivities concerning the transition to a circular plastics economy and did provide a general understanding of the societal discourses.

Secondly, one limitation of the case study approach on a single country is that the results cannot be generalised to other contexts. Therefore, the outcomes and recommendations of this research are most relevant for the Netherlands. However, the Netherlands is one of the leading countries in the world in exporting plastic waste (Brooks, et al, 2018). Therefore, the policy recommendations could potentially still have an impact on the global market for plastic waste. Besides, most policy recommendations align with CPB Netherlands Bureau for Economic Policy Analysis (2019), and also on the European level from the research of Hartley, et al. (2020). With this respect, the findings and recommendations are relevant on the national level as well as the international level.

Thirdly, the Q methodology is sometimes criticised for the lack of generalisability of the results (Exel and Graaf, 2005). However, the purpose of a Q study is to find different patterns of thought and not their prevalence in a large population. This means that generalisation is not a major concern in a Q study. In this research, 24 experts were interviewed, and 26 professionals completed the Q survey who all had different sector backgrounds and other ways of thought, in which each sector was quite evenly represented. This helped to explore the variety of perspectives professionals have on the transition to a circular plastics economy. After all, the factor analysis successfully identified four different perspectives on the transition to a Dutch circular plastics economy. With this respect, the aim of the Q study was achieved in this research.

Fourthly, the literature describes that participants find the Q-sort process difficult and overwhelming (Webler, et al., 2009). This became also prevalent in this study. For instance, some participants considered the Q-sort process as “not user-friendly”, but others found the method also “unique”. Also, a few participants criticised the Q statements. For instance, some found them “difficult to rank”, “too general”, “too many statements”, “too little distinction between statements”, and “too government and recycling-centred”. Especially, the latter comment on “too government-centred” is interesting. This reveals an opinion about the findings of the media analysis in Figure 11, where the government was mentioned most often in the newspapers between 2010 and 2020. Perhaps, newspaper articles cover the circular plastics economy transition also as a “too government-centred” responsibility. What would the impact be when this focus is more balanced to the responsibilities of citizens? This is also considered semi-important by three of the four perspectives (Appendix J).

Finally, in further research, workshops or group discussions could be organised with the professionals to complement the findings of this research. Besides, as this research was mainly focused on professionals in the plastic value chain, this study could also be conducted on citizen perspectives to identify discrepancies in discourses between citizens and professionals. Furthermore, this research could be extended to a comparative case study which focuses on similar study objects (i.e. discourses, governance, policies and practices), but in another social, economic and geographical context. These results can lead to more insights in the transition to a circular plastics economy.

6. Conclusion

In the Netherlands, the circular plastics economy is implemented through all different modes of governance (Driessen, et al., 2012). Currently, it appears that the Technocentric Circular Economy discourse (Friant, et al., 2020) is most represented in Dutch society. This becomes evident in Dutch national policies, such as the National Waste Management Plans, but also in voluntary agreements, such as the Plastic Pact NL. Also, currently available practices mainly follow Technocentric Circular Economy practices, such as mechanical recycling (R7), incineration with energy recovery (R8) and export of plastic waste. Developing practices such as reusable packaging (R2) and chemical recycling (R7) have to be further researched and developed in the coming few years. Also, the Q methodology identified four significant societal perspectives of which three have strong linkages with Technocentric Circular Economy propositions, and one who mainly follows Transformational Circular Society propositions. This unbalance indicates that, based on the findings of this research, it can be concluded that Dutch societal discourses are mainly centred around Technocentric Circular Economy propositions. However, the perspectives could not be fully appointed to one perspective due to nuances in reasoning. Yet, the theoretical framework did help to reduce the complexity of subjectivities concerning the transition to a circular plastics economy in the Netherlands and did provide an understanding of societal discourses.

As a concluding remark, the results of this research do not only affirm the findings of Hobson and Lynch (2016) and Merli, et al. (2018) that the social implications of the circular economy are often underrepresented, but the results also affirm the findings of Friant, et al. (2020) that societal discourses in Dutch context mainly follow a Technocentric Circular Economy proposition. In further research, workshops or group discussions can be organised with the professionals that loaded significantly on one of the four perspectives to complement and validate the findings of this research. Also, this research could be extended to a comparative case study which focuses on similar study objects (i.e. discourses, governance, policies and practices), but in another social, economic and geographical context. These results can lead to more insights in the transition to a circular plastics economy.

Acknowledgement

This report is the result of my master thesis project as part of the master's degree in Sustainable Development Earth System Governance at the University of Utrecht. I gratefully acknowledge my supervisors Walter Vermeulen and Martin Calisto Friant, and second reader Frank van Laerhoven from the University of Utrecht who provided me with constructive feedback, suggestions and assistance during the project. Furthermore, I would like to thank Anna Walker for sharing information, and Kieran Cambell-Johnston, Kaustubh Thapa and my friends who tested the Q-sort survey. I also would like to thank all people for being part of the research and volunteering their time for a personal interview; and Q participants who volunteered their time to participate in the Q survey. This research would not have been possible without you! Thank you all!

Funding

This project received funding from the European Commission Horizon 2020 Research and Innovation Programme under Marie Sklodowska-Curie grant agreement No 765198.

References

Afvalfonds Verpakkingen (2018). *Monitoring Verpakkingen. Resultaten inzameling en recycling 2017.*, Leidschendam: Afvalfonds Verpakkingen.

Afvalfonds Verpakkingen (2020). Taken van het Afvalfonds Verpakkingen. Retrieved on 12-2-2020 from: https://afvalfondsverpakkingen.nl/organisatie/taken-van-het-afvalfonds

Ahmed, R. G. (2016). Maternal bisphenol A alters fetal endocrine system: Thyroid adipokine dysfunction. *Food and chemical toxicology*, *95*, 168-174.

Ampe, K., Paredis, E., Asveld, L., Osseweijer, P., & Block, T. (2019). A transition in the Dutch wastewater system? The struggle between discourses and with lock-ins. *Journal of Environmental Policy & Planning*, 1-15.

Andra, S. S., & Makris, K. C. (2012). Thyroid disrupting chemicals in plastic additives and thyroid health. *Journal of Environmental Science and Health, Part C*, *30*(2), 107-151.

Andrady, A. L. (2011). Microplastics in the marine environment. *Marine pollution bulletin*, *62*(8), 1596-1605.

Baas, L. W. (1995). Cleaner production: beyond projects. *Journal of Cleaner Production*, *3*(1-2), 55-59.

Barry, J., & Proops, J. (1999). Seeking sustainability discourses with Q methodology. *Ecological economics*, *28*(3), 337-345.

Bouwmeester, H., Hollman, P. C., & Peters, R. J. (2015). Potential health impact of environmentally released micro-and nanoplastics in the human food production chain: experiences from nanotoxicology. *Environmental science & technology*, *49*(15), 8932-8947.

Boyle, W. C. (1977). Energy recovery from sanitary landfills-a review. In *Microbial energy conversion* (pp. 119-138). Pergamon.

Bråte, I. L. N., Eidsvoll, D. P., Steindal, C. C., & Thomas, K. V. (2016). Plastic ingestion by Atlantic cod (Gadus morhua) from the Norwegian coast. *Marine pollution bulletin*, *112*(1-2), 105-110.

Bråte, I. L. N., Huwer, B., Thomas, K. V., Eidsvoll, D. P., Halsband, C., Almroth, B. C., & Lusher, A. (2017). *Micro-and macro-plastics in marine species from Nordic waters*. Nordic Council of Ministers.

Brooks, A. L., Wang, S., & Jambeck, J. R. (2018). The Chinese import ban and its impact on global plastic waste trade. *Science advances*, *4*(6), eaat0131.

Brophy, J. T., Keith, M. M., Watterson, A., Park, R., Gilbertson, M., Maticka-Tyndale, E., ... & DeMatteo, R. (2012). Breast cancer risk in relation to occupations with exposure to carcinogens and endocrine disruptors: a Canadian case–control study. *Environmental Health*, *11*(1), 87.

Brown, L. R. (2011). "The New Geopolitics of Food" *Foreign Policy*, no. May/June (2011)

Brown, S. R. (1980). *Political subjectivity: Applications of Q methodology in political science*. Yale University Press.

Brown, S. R. (1993). A primer on Q methodology. *Operant subjectivity*, *16*(3/4), 91-138.

Catton, W. R. (1982). *Overshoot: The ecological basis of revolutionary change*. University of Illinois Press.

CE Delft (2019). Plasticgebruik en verwerking van plastic afval in Nederland. Retrieved on 12 November 2019 from: https://www.ce.nl/publicaties/2298/plasticgebruik-en-verwerking-van-plastic-afval-in-nederland

Coelho, P. M., Corona, B., ten Klooster, R., & Worrell, E. (2020). Sustainability of reusable packaging-Current situation and trends. *Resources, Conservation & Recycling: X*, 100037.

Cole, M., Lindeque, P., Fileman, E., Halsband, C., Goodhead, R., Moger, J., & Galloway, T. S. (2013). Microplastic ingestion by zooplankton. *Environmental science & technology*, *47*(12), 6646-6655.

Collins, M., Knutti, R., Arblaster, J., Dufresne, J-L., Fichefet, T., Friedlingstein, P., ... Booth, B. B. B. (2013). Long-term Climate Change: Projections, Commitments and Irreversibility. In T. F. Stocker, D. Qin, G-K. Plattner, M. M. B. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, ... P. M. Midgley (Eds.), *Climate Change 2013 - The Physical Science Basis: Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1029-1136). (Intergovernmental Panel on Climate Change). New York NY USA: Cambridge University Press.

CPB Netherlands Bureau for Economic Policy Analysis (2019). The Circular Economy of Plastics in the Netherlands. In *Environmental Sustainability and Education for Waste Management* (pp. 43-56). Springer, Singapore.

Curt, B. 1994: Textuality and tectonics: troubling social and psychological science. Buckingham: Open University Press.

de Sousa Jabbour, A. B. L., Jabbour, C. J. C., Godinho Filho, M., & Roubaud, D. (2018). Industry 4.0 and the circular economy: a proposed research agenda and original roadmap for sustainable operations. *Annals of Operations Research*, *270*(1-2), 273-286.

DeMatteo, R., Keith, M. M., Brophy, J. T., Wordsworth, A., Watterson, A. E., Beck, M., ... & Dayna, R. (2013). Chemical exposures of women workers in the plastics industry with particular reference to breast cancer and reproductive hazards. *New Solutions: A Journal of Environmental and Occupational Health Policy*, *22*(4), 427-448.

Denzine, G. M. (1998). The use of Q methodology in student affairs research and practice. *Student Affairs Journal Online*.

Derraik, J. G. (2002). The pollution of the marine environment by plastic debris: a review. *Marine pollution bulletin*, *44*(9), 842-852.

Dodiuk, H., & Goodman, S. H. (Eds.). (2013). *Handbook of thermoset plastics*. William Andrew.

Driessen, P. P., Dieperink, C., van Laerhoven, F., Runhaar, H. A., & Vermeulen, W. J. (2012). Towards a conceptual framework for the study of shifts in modes of environmental governance–experiences from the Netherlands. *Environmental policy and governance*, *22*(3), 143-160.

Dryzek, J. S. (2013). *The politics of the earth: Environmental discourses*. Oxford university press.

Economy, S. C. (2017). Social Circular Economy—Opportunities for People, Planet and Profit.

Ehrlich, P. R., Parnell, D. R., & Silbowitz, A. (1971). *The population bomb* (Vol. 68). New York: Ballantine Books.

European Commission (2011). *Roadmap to a Resource Efficient Europe*. Brussels: Publications Office of the European Union.

European Commission (2015). *Closing the loop - An EU action plan for the Circular Economy*. Brussels: Publications Office of the European Union.

European Commission (2018). *A European Strategy for Plastics in a Circular Economy*. Brussels: Publications Office of the European Union.

Exel, J. Van, & De Graaf, G. (2005). Q methodology: A sneak preview. *Retrieved January 24*, 2009.

Fairclough, I., & Fairclough, N. (2013). *Political discourse analysis: A method for advanced students*. Routledge.

Feola, G. (2015). Societal transformation in response to global environmental change: a review of emerging concepts. *Ambio*, *44*(5), 376-390.

Forrest, A., Giacovazzi, L., Dunlop, S., Reisser, J., Tickler, D., Jamieson, A., and Meeuwig, J. J. (2019). Eliminating Plastic Pollution: How a Voluntary Contribution From Industry Will Drive the Circular Plastics Economy. *Frontiers in Marine Science*, *6*, 627.

Fratini, C. F., Georg, S., & Jørgensen, M. S. (2019). Exploring circular economy imaginaries in European cities: A research agenda for the governance of urban sustainability transitions. *Journal of Cleaner Production*, *228*, 974-989.

Frenken, K. (2017). Political economies and environmental futures for the sharing economy. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *375*(2095), 20160367.

Friant, M. C., Vermeulen, W. J., & Salomone, R. A Typology of Circular Economy Discourses: Navigating the Diverse Visions of a Contested Paradigm.

Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. *Science advances*, *3*(7), e1700782.

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner production*, *114*, 11-32.

Gigault, J., Ter Halle, A., Baudrimont, M., Pascal, P. Y., Gauffre, F., Phi, T. L., ... & Reynaud, S. (2018). Current opinion: What is a nanoplastic?. *Environmental pollution*, *235*, 1030-1034.

Giurca, A., & Metz, T. (2018). A social network analysis of Germany's wood-based bioeconomy: Social capital and shared beliefs. *Environmental innovation and societal transitions*, *26*, 1-14.

Gradus, R. H., Nillesen, P. H., Dijkgraaf, E., & Van Koppen, R. J. (2017). A cost-effectiveness analysis for incineration or recycling of Dutch household plastic waste. *Ecological Economics*, *135*, 22-28.

Guide, V. D. R., Harrison, T. P., & Van Wassenhove, L. N. (2003). The challenge of closed-loop supply chains. *Interfaces*, *33*(6), 3-6.

Hahladakis, J. N., and Iacovidou, E. (2019). An overview of the challenges and trade-offs in closing the loop of post-consumer plastic waste (PCPW): Focus on recycling. *Journal of hazardous materials*, *380*, 120887.

Hajer, M. A. (1995). *The politics of environmental discourse: ecological modernization and the policy process* (p. 40). Oxford: Clarendon Press.

Hajer, M., & Versteeg, W. (2005). A decade of discourse analysis of environmental politics: Achievements, challenges, perspectives. *Journal of environmental policy & planning*, *7*(3), 175-184.

Hardin, G. (1968). The tragedy of the commons. *science*, *162*(3859), 1243-1248.

Hartley, K., van Santen, R., & Kirchherr, J. (2020). Policies for transitioning towards a circular economy: Expectations from the European Union (EU). *Resources, Conservation and Recycling*, *155*, 104634.

Herrington, N., & Coogan, J. (2011). Q methodology: an overview. *Research in Teacher Education*, *1*(2), 24-28.

Hobson, K., & Lynch, N. (2016). Diversifying and de-growing the circular economy: Radical social transformation in a resource-scarce world. *Futures*, *82*, 15-25.

Hopewell, J., Dvorak, R., & Kosior, E. (2009). Plastics recycling: challenges and opportunities. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1526), 2115-2126.

International Resource Panel, United Nations Environment Programme. Sustainable Consumption, & Production Branch. (2011). *Decoupling natural resource use and environmental impacts from economic growth*. UNEP/Earthprint.

Kabir, E. R., Rahman, M. S., & Rahman, I. (2015). A review on endocrine disruptors and their possible impacts on human health. *Environmental toxicology and pharmacology*, *40*(1), 241-258.

Kaffine, D., & O'Reilly, P. (2013). What have we learned about extended producer responsibility in the past decade? A survey of the recent EPR economic literature. *Organisation for Economic Co-operation and Development (OECD)*.

Kemp, R., Loorbach, D., & Rotmans, J. (2007). Transition management as a model for managing processes of co-evolution towards sustainable development. *The International Journal of Sustainable Development & World Ecology* , *14* (1), 78-91.

KIDV, (2017). Overzicht van de keten van kunststofverpakkingsafval, Den Haag: Kennisinstituut Duurzaam Verpakken (KIDV).

Kitzinger, C. (1987). *The social construction of lesbianism* (Vol. 1). Sage, Bristol.

Klundert, M. van de. (9 June 2018) "'Brandende Poolse Afvalbergen Zijn Ecologische Ramp'." *NOS*, retrieved on 4 March 2020 from: https://nos.nl/artikel/2235757-brandende-poolse-afvalbergen-zijn-ecologische-ramp.html

Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular economy: the concept and its limitations. *Ecological economics*, *143*, 37-46.

Korhonen, J., Nuur, C., Feldmann, A., & Birkie, S. E. (2018). Circular economy as an essentially contested concept. Journal of Cleaner Production, 175, 544-552.

Lang, I. A., Galloway, T. S., Scarlett, A., Henley, W. E., Depledge, M., Wallace, R. B., & Melzer, D. (2008). Association of urinary bisphenol A concentration with medical disorders and laboratory abnormalities in adults. *Jama*, *300*(11), 1303-1310.

Latouche, S. (2009). Farewell to Growth Polity Press. *Cambridge, UK*.

Lazarevic, D., & Valve, H. (2017). Narrating expectations for the circular economy: Towards a common and contested European transition. *Energy research & social science*, *31*, 60-69.

Lehner, R., Weder, C., Petri-Fink, A., and Rothen-Rutishauser, B. (2019). Emergence of nanoplastic in the environment and possible impact on human health. *Environmental science and technology*, *53*(4), 1748-1765.

Li, J., Yang, D., Li, L., Jabeen, K., & Shi, H. (2015). Microplastics in commercial bivalves from China. *Environmental pollution*, *207*, 190-195.

Liebezeit, G., & Liebezeit, E. (2013). Non-pollen particulates in honey and sugar. *Food Additives & Contaminants: Part A*, *30*(12), 2136-2140.

Liebezeit, G., & Liebezeit, E. (2014). Synthetic particles as contaminants in German beers. *Food Additives & Contaminants: Part A*, *31*(9), 1574-1578.

Lindhqvist, T. (2000). *Extended producer responsibility in cleaner production: Policy principle to promote environmental improvements of product systems* (Vol. 2000, No. 2). Lund University.

Loorbach, D., Frantzeskaki, N., & Avelino, F. (2017). Sustainability transitions research: transforming science and practice for societal change. *Annual Review of Environment and Resources*, *42*, 599-626.

Lowy, M. (2011). *Écosocialisme: l'alternative radicale à la catastrophe écologique capitaliste*. Fayard/Mille et une nuits.

Lüdeke-Freund, F., Gold, S., & Bocken, N. M. (2019). A review and typology of circular economy business model patterns. *Journal of Industrial Ecology*, *23*(1), 36-61.

MacArthur, D. E., Waughray, D., & Stuchtey, M. R. (2016). The New Plastics Economy, Rethinking the Future of Plastics. In *World Economic Forum*.

Manikkam, M., Tracey, R., Guerrero-Bosagna, C., & Skinner, M. K. (2013). Plastics derived endocrine disruptors (BPA, DEHP and DBP) induce epigenetic transgenerational inheritance of obesity, reproductive disease and sperm epimutations. *PloS one*, *8*(1), e55387.

McKeown, M., Hinks, M., Stowell-Smith, M., Mercer, D., & Forster, J. (1999). Q methodology, risk training and quality management. *International Journal of Health Care Quality Assurance*.

Meadows, D. H. (1999). Leverage points: Places to intervene in a system.

Merli, R., Preziosi, M., & Acampora, A. (2018). How do scholars approach the circular economy? A systematic literature review. *Journal of Cleaner Production*, *178*, 703-722.

Ministry of Infrastructure and the Environment and Ministry of Economic Affairs (2016). "A Circular Economy in the Netherlands by 2050". Retrieved on 12 November 2019 from: https://www.government.nl/documents/policy-notes/2016/09/14/a-circular-economy-in-the-netherlands-by-2050

Ministry of Infrastructure and Water Management (2020). "Besluit maatregelen kunststof drankflessen" *Staatsblad van het Koninkrijk der Nederlanden (stb-2020-122)*, retrieved on 29 April 2020 from: https://zoek.officielebekendmakingen.nl/stb-2020-122.html

Morris, J. (1996). Recycling versus incineration: an energy conservation analysis. *Journal of Hazardous Materials*, *47*(1-3), 277-293..

Nadal, A. (2013). Obesity: Fat from plastics? Linking bisphenol A exposure and obesity. *Nature Reviews Endocrinology*, *9*(1), 9.

Nederlandse Omroep Stichting (2020) "Statiegeld op kleine flesjes: veel consumenten positief, industrie ziet op tegen kosten" *NOS*, retrieved on 29 April 2020 from: https://nos.nl/artikel/2331649-statiegeld-op-kleine-flesjes-veel-consumenten-positief-industrie-ziet-op-tegen-kosten.html

OECD. Publishing. (2001). *Extended producer responsibility: A guidance manual for governments*. Organisation for Economic Co-operation and Development.

Ohlson, C. G., & Hardell, L. (2000). Testicular cancer and occupational exposures with a focus on xenoestrogens in polyvinyl chloride plastics. *Chemosphere*, *40*(9-11), 1277-1282.

Olsson, P., Gunderson, L., Carpenter, S., Ryan, P., Lebel, L., Folke, C., & Holling, C. S. (2006). Shooting the rapids: navigating transitions to adaptive governance of social-ecological systems. *Ecology and society*, *11*(1).

Pacheco-Torgal, F., Jalali, S., & Fucic, A. (Eds.). (2012). *Toxicity of building materials*. Elsevier.

Pearce, D. W., & Turner, R. K. (1990). *Economics of natural resources and the environment*. JHU Press.

Plastic Soup Foundation (2016). ONTHULLENDE RAPPORTAGE OVER LOBBY AFSCHAFFING STATIEGELD. Retrieved from: https://www.plasticsoupfoundation.org/2016/01/onthullende-rapportage-over-lobby-afschaffing-statiegeld/

Ragaert, K., Delva, L., & Van Geem, K. (2017). Mechanical and chemical recycling of solid plastic waste. *Waste Management*, *69*, 24-58.

Raworth, K. (2017). *Doughnut economics: seven ways to think like a 21st-century economist*. Chelsea Green Publishing.

Reber, B. H., Kaufman, S. E., & Cropp, F. (2000). Assessing Q-assessor: a validation study of computer-based Q-sorts versus paper sorts. *Operant Subjectivity*, *23*(4), 192-209.

Reike, D., Vermeulen, W. J., & Witjes, S. (2018). The circular economy: New or refurbished as CE 3.0?—Exploring controversies in the conceptualization of the circular economy through a focus on history and resource value retention options. *Resources, Conservation and Recycling*, *135*, 246-264.

Robinson, J. (2004). Squaring the circle? Some thoughts on the idea of sustainable development. *Ecological economics*, *48*(4), 369-384.

Ryan, C. J., Hosken, M., & Greene, D. (1992). EcoDesign: design and the response to the greening of the international market. *Design Studies*, *13*(1), 3-22.

Sauvé, S., Bernard, S., & Sloan, P. (2016). Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research. Environmental Development, 17, 48-56.

Schmolck P, Atkinson J. PQMethod software and manual. 2002;2:11

Shankar, A., & Teppala, S. (2011). Relationship between urinary bisphenol A levels and diabetes mellitus. *The Journal of Clinical Endocrinology & Metabolism*, *96*(12), 3822-3826.

Smith, A., & Kern, F. (2009). The transitions storyline in Dutch environmental policy. *Environmental Politics*, *18*(1), 78-98.

Stainton Rogers, R., Stenner, P., Gleeson, K. and Stainton Rogers, W. 1995: Social psychology: a critical agenda. Cambridge: Polity Press.

Stevenson, H. (2019). Contemporary discourses of green political economy: AQ method analysis. *Journal of Environmental Policy & Planning*, *21*(5), 533-548.

Stooker, C. (29 January 2019) "Chinese plasticban is goudmijn voor recyclers: 'Aanbod is vervijfvoudigd' *RTLZ*, retrieved on 9 April 2020 from https://www.rtlz.nl/business/artikel/4583566/plastic-recyclen-goudmijn-china-plasticban-nederland

Tencati, A., Pogutz, S., Moda, B., Brambilla, M., & Cacia, C. (2016). Prevention policies addressing packaging and packaging waste: Some emerging trends. *Waste management*, *56*, 35-45.

Teuten, E. L., Rowland, S. J., Galloway, T. S., & Thompson, R. C. (2007). Potential for plastics to transport hydrophobic contaminants. *Environmental science & technology*, *41*(22), 7759-7764.

The Guardian, (10 May 2019). "Nearly all countries agree to stem flow of plastic waste into poor nations", *The Guardian*, retrieved on 4 March 2020 from: https://www.theguardian.com/environment/2019/may/10/nearly-all-the-worlds-countries-sign-plastic-waste-deal-except-us

Trainer, T., & Alexander, S. (2019). The simpler way: envisioning a sustainable society in an age of limits. *real-world economics review*, 247.

United Nation Environmental Programme and the Ellen MacArthur Foundation (2019). The New Plastics Economy Global Commitment 2019 Progress Report. Retrieved on 12 November 2019 from: https://www.ellenmacarthurfoundation.org/news/first-annual-new-plastics-economy-global-commitment-progress-report-published

United Nations Environment Programme (2019). Single-use plastics: A roadmap for sustainability | UN Environment. Retrieved on 12 November 2019 from: https://www.unenvironment.org/resources/report/single-use-plastics-roadmap-sustainability

UNWCED: United Nations World Commission on Environment and Development, (1987). *Our Common Future* (Brundtland Report). Oxford: Oxford University Press.

Velis, C., & International Solid Waste Association. (2017). Global recycling markets: plastic waste: A story for one player–China. A report from the ISWA Task Force on Globalisation and Waste Management.

Vince, J., & Hardesty, B. D. (2018). Governance solutions to the tragedy of the commons that marine plastics have become. *Frontiers in Marine Science*, *5*, 214.

Watkins, E., Gionfra, S., Schweitzer, J. P., Pantzar, M., Janssens, C., & ten Brink, P. (2017). EPR in the EU Plastics Strategy and the Circular Economy: A focus on plastic packaging. *Institute for European Environmental Policy (IEEP)*.

Watts S, Stenner P. Doing Q methodological research – theory method and interpretation. London: Sage; 2012.

Watts, S., & Stenner, P. (2005). Doing Q methodology: theory, method and interpretation. *Qualitative research in psychology*, *2*(1), 67-91

Webler, T., Danielson, S., & Tuler, S. (2009). Using Q method to reveal social perspectives in environmental research. *Greenfield MA: Social and Environmental Research Institute*, *54*, 1-45.

World Wide Fund (2007), *One Planet Business: Creating Value Within Planetary Limits* (World Wide Fund, 2007)

Yang, D., Shi, H., Li, L., Li, J., Jabeen, K., & Kolandhasamy, P. (2015). Microplastic pollution in table salts from China. *Environmental science & technology*, *49*(22), 13622-13627.

Zabala, A., Sandbrook, C., & Mukherjee, N. (2018). When and how to use Q methodology to understand perspectives in conservation research. *Conservation Biology*, *32*(5), 1185-1194.

Zoete, T. (16 May 2019). "New UN Rules on Plastic Waste Exports, Following China's Bans." *Recycling Netwerk Benelux*, on 4 March 2020 from: https://recyclingnetwerk.org/2019/05/16/new-un-rules-on-plastic-waste-exports-following-chinas-bans/

Appendix

A: Analysis of European and Dutch Plastic Management Policies

European Union	**Directive 2015/720/EU on reducing consumption plastic bags**	COM/2018/028: A European Strategy for Plastics in a Circular Economy
Founder(s)	European Commission and Parliament	European Commission and Parliament
Historical context	Amending Directive 94/62/EC as regards reducing the consumption of lightweight plastic carrier bags.	Amending COM(2015) 614 final: European Union Action Plan for the Circular Economy
Governance	Centralised	Centralised
Storyline	***Circumstances***: "*The current consumption levels of plastic carrier bags result in high levels of littering and an inefficient use of resources and are expected to increase if no action is taken. Littering of plastic carrier bags results in environmental pollution and aggravates the widespread problem of litter in water bodies, threatening aquatic eco-systems worldwide. Furthermore, the accumulation of plastic carrier bags in the environment has a clearly negative impact on certain economic activities*". ***Goals***: "*Prevent or reduce the impact of packaging and packaging waste on the environment*". ***Means***: Through financial incentives: "*1) Lightweight plastic carrier bags are not provided free of charge at the point of sale of goods or products from 2019; 2) Not exceed 90 lightweight plastic carrier bags per person from 2020; and 3) Not exceed 40 lightweight plastic carrier bags per person from 2026*".	***Circumstances***: "*Global production of plastics has increased twentyfold since the 1960s*" (p. 6); "*Around 25.8 million tonnes of plastic waste are generated in Europe every year*" (p. 6); "*landfilling and incineration rates of plastic waste remain high*"(p. 6); "*Demand for recycled plastics today accounts for only around 6 % of plastics demand in Europe*" (p. 6); "*plastics production and the incineration of plastic waste give rise globally to approximately 400 million tonnes of CO2 a year*" (p. 6); "*the plastics sector employs 1.5 million people*" (p. 6); "*Reuse and recycling of end-of-life plastics remains very low*" (p. 6); "*Globally, 5 to 13 million tonnes of plastics — 1.5 to 4 % of global plastics production — end up in the oceans every year*" (p. 7); "*In the EU, 150 000 to 500 000 tonnes of plastic waste enter the oceans every year*" (p. 7); and an "*increasing amount of plastic waste generated each year*" (p. 7). ***Goals***: "*A smart, innovative and sustainable plastics industry, where design and production fully respects the needs of reuse, repair, and recycling, brings growth and jobs to Europe and helps cut EU's greenhouse gas emissions and dependence on imported fossil fuels*", and "*government and industry support more sustainable and safer consumption and production patterns for plastics"* (p. 9). From 2030, all plastic packaging placed on the Union market is re-usable and at least 100% recyclable. The overall aim is to 'close the loop'. ***Means***: "*improving the economics and quality of plastics recycling*" (p. 10), "*curbing plastic waste and littering*" (p. 13), "*driving innovation and investment towards circular solutions*" (p. 15), "*harnessing global action*" (p. 16).
	Legal binding	Not legal binding

European Union	**Directive 2018/851 on waste**	**Directive 2018/852 on packaging and packaging waste**	**Directive 2019/904 on the reduction of the impact of certain plastic products on the environment (also referred to as 'Single-use Plastics Directive')**
Founder(s)	European Commission and Parliament	European Commission and Parliament	European Commission and Parliament
Historical context	Amending Directive 2008/98/EC on waste.	Amending Directive 94/62/EC on packaging and packaging waste.	European Strategy for Plastics
Governance	Centralised	Centralised	Centralised
Storyline	***Circumstances***: "*It is necessary to take additional measures on sustainable production and consumption, by focusing on the whole life cycle of products in a way that preserves resources and closes the loop. The more efficient use of resources would also bring substantial net savings for Union businesses, public authorities and consumers, while reducing total annual greenhouse gas emissions*". ***Goals***: "*Improving the efficiency of resource use and ensuring that waste is valued as a resource can contribute to reducing the Union's dependence on the import of raw materials and facilitate the transition to more sustainable material management and to a circular economy model*". ***Means***: The preparing for re-use and the recycling of municipal waste is increased in 2020 to 50% by weight; in 2025 to 55 % by weight; in 2030 to 60% by weight; and in 2035 to 65% by weight.	***Circumstances***: "*Waste management in the Union should be improved, with a view to protecting, preserving and improving the quality of the environment, protecting human health, ensuring prudent efficient and rational utilisation of natural resources, promoting the principles of the circular economy, enhancing the use of renewable energy, increasing energy efficiency, reducing the dependence of the Union on imported resources, providing new economic opportunities and contributing to long-term competitiveness*". ***Goals***: "*Increasing the recycling of packaging waste to make them better reflect the Union's ambition to move to a circular economy*". ***Means***: 2009: recycle 22,5% of plastic packaging waste; 2025: recycle 32,5% of plastic packaging; and 2030: 38,5% of plastic packaging.	***Circumstances***: "*The significant negative environmental, health and economic impact of certain plastic products calls for the setting up of a specific legal framework to effectively reduce those negative effects*". ***Goals***: "*Promote circular approaches that give priority to sustainable and non-toxic re-usable products and re-use systems rather than to single-use products, aiming first and foremost to reduce the quantity of waste generated*" ***Means***: Ban on selected 10 single-use plastic products for which alternatives exist, as well as measures to reduce consumption, new Extended Producer Responsibility schemes (including clean-up costs), and new targets for plastic bottles: from 2025, PET-bottles contain at least 25 % recycled plastic; from 2030, PET-bottles contain at least 30 % recycled plastic. In addition, by 2025, 77% single-use plastics is separately collected; and by 2030, 90% single-use plastics is separately collected.
	Legal binding	Legal binding	Legal binding

Netherlands	**National Waste Plan 1, sector plan 19**	**Packaging and Paper and Cardboard Management Decree (2007)**	**Framework Agreement on Packaging and litter (2007)**
Target year(s)	2003 – 2013	2007 – 2015	2008 - 2012
Founder(s)	National government	National government	National government and market actors
Historical context	***European Directives***: 94/62/EC, and 1999/31/EC ***Dutch laws/policies***: Environmental Management Act	***European Directives***: 94/62/EC, and 2004/12/EC on packaging and packaging waste. ***Dutch laws/policies***: Environmental Management Act articles 10.15 till 10.18, 10.64 (second paragraph), and 15.32.	***European Directives***: 94/62/EC on packaging and packaging waste. ***Dutch laws/policies***: Packaging and Paper and Cardboard Management Decree (2007).
Governance	Centralised	Centralised	Public-private
Storyline	***Circumstances***: "*Companies have an important role in achieving waste prevention by taking the environmental impacts into account when designing a product*" (p. 166), i.e. Eco-design. ***Goals***: "*The Government and business community aim to promote the prevention, separation and useful application* (i.e. R7: material recycling) *of plastic packaging waste*" (p. 166). ***Means***: Recycle (R7) useful and separately collected plastic waste (Directive 94/62/EC: at least 22,5% by weight), e.g. by pyrolysis to derive basic chemicals, and energy recovery (R8) for non-reusable, not separately collected and high calorific plastic waste (Directive 94/62/EC: at least 50% and maximum 65% by weight). Import and export of plastic waste for material recycling (R7) allowed (article 5.2), but not allowed for energy recovery (R8) or landfilling (article 5.1).	***Circumstances***: Producers and importers are (financially) responsible for prevention, separation, and collection of packaging waste, and report annually on performance (i.e. EPR). ***Goals***: Promote the prevention, separation and useful application (R7: material recycling) of plastic packaging waste. ***Means***: "*1) Plastic beverage packaging waste >= 5 decilitres at least 95% separately collected and recycled; 2) Plastic beverage packaging waste <= 5 decilitres at least 55% separately collected and recycled; and 3) Other plastic packaging waste at least 45% useful applied of which at least 27% recycled*" (article 4).	***Circumstances***: The business community and municipalities worked together on the development of a collection and separation structure for plastic packaging waste. "*Because the collection, sorting and processing of plastic packaging waste has not yet developed structures in the Netherlands, the development of these structures must be tackled quickly*" (p. 1). ***Goals***: "*It is necessary that an integrated collection system is established throughout the Netherlands. Otherwise, the recycling targets will not be achieved*" (p. 1). ***Means***: Achieving by the founding of the 'Afvalfonds Verpakkingen' by the Ministry of Housing, Spatial Planning and the Environment, the Association of Dutch Municipalities, and the packaging industry in 2007. In addition, an integrated material recycling (R7) target for plastic packaging waste was set due to the implementation of a new certification system for post-separation installations. The recycling target was set from *"32% in 2009 increasing to 38% in 2010, and up to 42% in 2012"* (article 9).
	Legal binding	Legal binding	Legal binding. Voluntary commitments within the boundaries of the agreement.

Netherlands	**Program: From waste to raw material (2013)**	**Framework Agreement on Packaging (2014)**	**National Waste Plan 2, sector plan 11**
Target year(s)	2013 - 2020	2013-2022	2014 - 2021
Founder(s)	Ministry of Infrastructure and Environment	National government and market actors	National government
Historical context	***European***: Roadmap to a Resource Efficient Europe, COM (2011) 571 ***Dutch Chamber document***: Chamber documents 32 852 nr. 1, 32 852 nr. 8, and 33 043, nr. 14	***European Directives***: 94/62/EC on packaging and packaging waste, and 2008/98/EC on waste. ***Dutch laws/policies***: Replaced 'Packaging and Paper and Cardboard Management Decree (2007)	***European Directives***: 94/62/EC, 1999/31/EC, 2004/12/EC, and 2008/98/EC. ***Dutch laws/policies***: replaced National Waste Plan 1, Program: From waste to raw material (2013), and the Cabinet's ambition of 'Green Growth'.
Governance	Centralised	Public-private	Centralised
Storyline	***Circumstances***: "*In the 20th century the world population started to use 34 times more materials, 27 times more minerals, 12 times more fossil fuels and 3.6 times more biomass. This is caused due to rising consumption and increase of the world population and increase of prosperity. This is expected to continue. The population continues to grow and passes the 9 billion mark around 2050. Despite the economic crisis, it is also expected that global economic growth remains high in the coming decades"* (p. 2). *"The challenge is to grow by greening, by providing our prosperity with both renewable and non-renewable raw materials through optimum use of natural resources. Sustainability is central here. After all, we want to be secure not only today, but also tomorrow"* (p. 2). ***Goals***: "*Strive for a 100% circular economy*" (p. 4). ***Means***: 1) "*Focusing on existing waste policy on circular economy and innovation*"; 2) "*addressing specific chains and waste streams*"; 3) "*Improving waste separation and collection";* 4) "*The development of financial and other market incentives*"; 5) "*Making consumption patterns more sustainable*"; 6) Eco-design; 7) "*Simplify and standardize goals, criteria, assessment methods, indicators and labels*"; and 8) "*Linking knowledge and education to the circular economy*" (p. 6).	***Circumstances***: The parties have a shared ambition to achieve a transition to a 'closed raw materials cycle'. ***Goals***: Article 3 states: "*1) prevent waste and more efficient use of raw materials; 2) increase the percentage of re-used materials; 3) recycle packaging materials; and 4) deploy new materials with a lower environmental impact*". Furthermore, "*5) increase re-used PET from soda bottles; 6) reduce PVC in packaging by producers and importers; 7) reduce usage of plastic bags; 8) reduction of plastics in packaging; and 9) reduce plastic wraps to addressed printed matter*". ***Means***: new ambitious material recycling (R7) targets, "*ranging from 44% in 2013, up to 52% in 2017, with an annual increase of 2%*" (article 9).	***Circumstances***: "*Only limited success is accomplished in reducing the depletion of energy sources and raw materials*". A shift from waste policy to material chain policy is therefore emphasised in the policy framework. This means that "*the entire process from the extraction of a raw material up to and including the processing of a waste*" (p. 8). ***Goals***: "*A further reduction of the environmental impact is needed, since the impact of material chains is still far too high to achieve a sustainable society*" (p. 8). Therefore, "*1) stimulate resource efficiency; 2) smart design of products (e.g. eco-design); 3) extent lifetime of products through re-using and reparation; and 4) optimal use of residual waste streams*" (p. 10). ***Means***: The way of meeting the goal is to get inspired by Cradle-to-Cradle (C2C) concept. Furthermore, the minimum standard for useful and separately collected plastic waste remains material recycling (R7), and for non-reusable / not separately collected / high calorific plastic waste / polluted plastic / recycling route too expensive (more than €175 per tonne) becomes other useful application, e.g. energy recovery (R8). Import only allowed if in line with minimum standard. Export for material recycling (R7), energy recovery (R8) and landfilling not allowed. Export for (provisional) useful application (R7) allowed if domestic recycling route is higher than €175 per tonne.
	Not legal binding	Legal binding. Voluntary commitments within the boundaries of the agreement.	Legal binding

Netherlands	**Packaging Management Decree (2014)**	**A circular economy in the Netherlands by 2050**	**National agreement on the circular economy**
Target year(s)	2016 - 2022	2016 – 2030, 2050	2017 – 2021, 2025, 2030
Founder(s)	National government	National government	National government, Market and Civil Society
Historical context	***European Directives***: 94/62/EC, and 2013/2/EU on packaging and packaging waste ***Dutch laws/policies***: Environmental Management Act articles 9.5.2 (first paragraph), 10.41 and 15.32, and replaced Packaging and Paper and Cardboard Management Decree (2007)	Dutch Chamber documents 'Kamerstukken II, 34 300 XII, nr. 27'.	***Dutch laws/policies***: A circular economy in the Netherlands by 2050
Governance	Centralised	Centralised	Interactive
Storyline	***Circumstances***: There is too little attention for sustainability and there is more potential for recycling. Freedom is desired when choosing a collection method. Producers and importers are (financially) responsible for prevention, separation, and collection of packaging waste, and report annually on performance (i.e. EPR). ***Goals***: Minimise impact of plastic packaging waste on the environment. Make plastic packaging more sustainable and ensure that plastic packaging material can be reused as raw material. Improve sustainability of packaging by realising higher recycling targets. ***Means***: Recycle at least 45% of plastic packaging by weight in 2015, up to 51% in 2021, with an increase of 1% every year, (reduce, re-use, recycle, re-new)	***Circumstances***: There are limits to the capacity of the earth, while human population increases. At the same time, the demand for raw materials increases, while available resources keep on falling. Action is needed at every level of society to move away from a throw-away society by changing the way of production, consumption and mindset. We should start managing raw materials in a smarter way today. Otherwise, we cannot lead prosperous lives on a healthy planet in the future. ***Goals***: To create a future-proof and sustainable economy for current and future generations by: "*Raw materials in existing supply chains are utilised in a high-quality manner*", "*in cases in which new raw materials are needed, fossil-based, critical and non-sustainably produced raw materials are replaced by sustainably produced, renewable, and generally available raw materials",* and *"develop new production methods, design new products and organise areas differently. We also promote new ways of consumption"* (p. 15). ***Means***: The way of meeting the goal is to achieve a 50% reduction of primary raw materials (minerals, fossil and metals) by 2030, and being 100% circular without any harmful emissions released in the environment by 2050.	***Circumstances***: "*Our need for raw materials will only increase in the years to come, both in the Netherlands and in the rest of the world. At the same time, we waste an abundance of raw materials, thus unnecessarily losing the value they have for us, polluting the environment and impacting the climate. It is estimated that by 2050 there will be more than nine billion people on earth that will need sufficient amounts of food and clean water. They will also want to live in good health, in safety and in prosperity within the limits that our planet can bear (the SDGs, sustainable development goals). To make this possible, we must and can take action now. It is time for the circular economy*" (p. 2). ***Goals***: The Partners of the agreement "*have the shared ambition of accelerating the transition to the circular economy*" (p. 2). Same goals as mentioned in 'A circular economy in the Netherlands by 2050' ***Means***: "*by reducing our dependency on non-renewable, critical raw materials and by bringing a halt to wastage and pollution. One way to achieve this is by designing products and services for long-term use, with a focus on reducing a loss in value as much as possible. This will save costs and create new jobs. It would be good for the environment and good for the economy*" (p. 2).
	Legal binding	Not legal binding	Not legal binding

Netherlands	**Transition agenda circular economy for plastics**	**Plastic Pact NL**	**National Waste Plan 3, sector plan 11**
Target year(s)	2018 - 2030	2019 – 2025	2019 - 2029
Founder(s)	National government, Market and Civil Society	National government, Market and Civil Society	National government
Governance	Interactive	Interactive	Centralised
Historical context	***Dutch laws/policies***: 'A circular economy in the Netherlands by 2050', and 'National agreement on the circular economy'	***European Directives***: EU Strategy for plastics ***Dutch laws/policies***: 'A circular economy in the Netherlands by 2050', and 'National agreement on the circular economy'.	***European Directives***: 94/62/EC and 2008/98/EC ***Dutch laws/policies***: replaced National Waste Plan 2, Environmental Management Act, Program: From waste to raw material (2013), and Packaging Management Decree (2014)
Storyline	***Circumstances***: "*Currently, only 250-300 kton of plastic is recycled per year in the Netherlands, while plastic producers' market around 2,000 kton. Set against the amount of discarded plastic materials (1,700 kton), this means that 300 kton more will remain in use annually with a recycling percentage of 15-17% of the potential flow of plastics to be processed. More than 5 times as much is currently being sent to waste incinerators (1,313 kton)*" (p. 4). ***Goals***: By 2030, a decrease of 44% of plastics that are incinerated will result in a reduction of 1 Mton CO_2 emissions, and by 2050, "*the transition to a fully circular plastic economy*" (p. 10) (definition of CE is adopted from the Ellen MacArthur Foundation report: The new plastics economy, p. 102). ***Means***: "*1) Prevention, more with less and the avoidance of leakage; 2) More supply and demand for renewable plastics; 3) Better quality, more environmental efficiency; and 4) Strategic (chain) cooperation (between industry, science, NGOs, and governments*" (p. 10). In addition, the transition requires a social task. "*Every individual has, to a greater or lesser extent, a co-responsibility for this transition*" (p. 47).	***Circumstances***: "*Although plastic is a strong, light, flexible and easily applicable material, the large-scale application of plastic also has disadvantages. The use of primary fossil raw materials puts pressure on the environment, valuable raw materials are lost due to a lack of recycling and the spread of plastic litter and microplastics result in growing pollution of our ecosystems*" (p. 1). ***Goals***: Reduce environmental impact of plastics, improve circularity of plastics, and take measures to accelerate to transition to a circular plastics economy. ***Means***: "*1) all single-use plastic products and packaging are reusable and 100% recyclable; 2) reduce plastic usage by 20% less volume of plastic (in kg) relative to the total volume products brought on the market compared to base year 2017; 3) at least 70% (EU target is 55%) of the weight of all single-use plastic products and packaging are recycled in a high quality manner; and 4) All non-reusable plastic products and packaging contain the highest possible percentage of recycled plastics (in kg) in 2025, with an average per company of at least 35% (EU target is 25% of PET-bottles). In addition, as much as possible sustainably produced biobased plastics will be used to reduce use of primary fossil plastics*" (p. 2).	***Circumstances***: The motivation for a new LAP is because the European Union and the Environmental Management Act require this, and in addition, the growing attention for the transition to a circular economy. ***Goals***: "*Limit waste generation, limit the environmental impacts of production chains, and optimise the use of waste in a circular economy, i.e. prevent loss of raw materials*" (policy framework A.3). ***Means***: the minimum standard for useful and separately collected plastic waste remains material recycling (R7), and for non-reusable / not separately collected / high calorific plastic waste / polluted plastic / recycling route too expensive (more than €205 per tonne) becomes other useful application, e.g. energy recovery (R8). Import only allowed if in line with minimum standard. Export for material recycling (R7), energy recovery (R8) and landfilling not allowed. In general, export allowed if recycling route higher than €205 per tonne, and export of thermoset plastics and elastomers is allowed, but not allowed for landfilling.
	Not legal binding	Not legal binding	Legal binding

B: Newspaper Articles

1. Hugo Bellaart. (26 februari 2019 dinsdag). Plastic afval maakt stinkende wonden. *NRC Handelsblad.* Retrieved from https://advance-lexis com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5VHD-4Y31-DYMH-R0T9-00000-00&context=1516831.
2. Pieter Hotse Smit / vk. (16 januari 2018 dinsdag). Kringloopeconomie komt op gang. *Nederlands Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5RDN-H8M1-JBKF-M3PK-00000-00&context=1516831.
3. Marcel aan de Brugh, Daniël Niessen. (24 February 2018). De lange weg van plastic prut naar krat en bloembak. *NRC Handelsblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5RR3-0NY1-DYMH-R03H-00000-00&context=1516831
4. ESTHER BIJLO, REDACTIE DUURZAAMHEID & NATUUR. (6 november 2019 woensdag). CPB: Statiegeld en exportverbod plastic komen recyclen ten goede. *Trouw.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5XF8-TMJ1-DYRY-X164-00000-00&context=1516831.
5. JENDA TERPSTRA, REDACTIE ECONOMIE. (4 oktober 2016 dinsdag). Bij recyclen moet de kop dringend praten met de staart. *Trouw.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5KVN-GSX1-JC8X-61VV-00000-00&context=1516831.
6. ESTHER BIJLO. (6 november 2017 maandag). De circulaire economie bloeit nog niet. *Trouw.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5PWM-3HY1-JC8X-6487-00000-00&context=1516831.
7. (06 March 2018). Voer statiegeld in voor PET-flessen en blikjes. *NRC Handelsblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5RT8-H161-JC5G-13K4-00000-00&context=1516831.
8. (11 december 2019 woensdag). We kunnen epidemie stoppen. *de Volkskrant.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5XPR-T4R1-DYRY-X03F-00000-00&context=1516831.
9. TCHARLOT VERLOUW. (19 juli 2018 donderdag). Circulaire economie, maar hoe dan?. *Trouw.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5STX-FV81-DYRY-X3JW-00000-00&context=1516831.
10. ESTHER BIJLO. (11 januari 2019 vrijdag). De circulaire economie is al groter dan gedacht. *Trouw.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5V5H-HTB1-JC8X-610G-00000-00&context=1516831.
11. Hans Verbraeken. (28 februari 2018 woensdag). 'Ons plastic is even goed als plastic uit olie'. *Het Financieele Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5RRX-MVM1-DYWB-S2DT-00000-00&context=1516831.
12. NAÏM DERBALI, REDACTIE BINNENLAND. (12 september 2018 woensdag). Hoe groen is een fietspad van plastic?. *Trouw.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5T7M-VW21-DYRY-X0T2-00000-00&context=1516831.

13. Hella Hueck. (4 december 2018 dinsdag). Lego-blokje blijft nog lang van plastic. *Het Financieele Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5TWD-VB71-JCD9-210G-00000-00&context=1516831.
14. ESTHER BIJLO. (19 januari 2019 zaterdag). Het moet met minder plastic. *Trouw.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5V77-9FM1-DYRY-X0SC-00000-00&context=1516831.
15. Petra Noordhuis. (16 juli 2019 dinsdag). Banken verdienen geld aan plastic. *Nederlands Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5WK3-SPY1-JBKF-M00J-00000-00&context=1516831.
16. JOEP ENGELS & MAAIKE VAN HOUTEN. (21 september 2017 donderdag). CPB: thuis gewoon doorgaan met scheiden van plastic. *Trouw.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5PHR-7N51-DYRY-X1KP-00000-00&context=1516831.
17. Michael Persson. (14 oktober 2011 vrijdag). 'We moeten grondstoffen zo oneindig mogelijk gebruiken'; interview marga hoeK, directeur de Groene Zaak. *de Volkskrant.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5418-RBM1-DYRY-N24D-00000-00&context=1516831.
18. (30 september 2017 zaterdag). plastic fantastic. *Het Financieele Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5PKS-5KC1-JCD9-209C-00000-00&context=1516831.
19. (4 april 2017 dinsdag). Bioplastic geen oplossing voor plastic soep. *Nederlands Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5N7F-RJV1-DYRY-N01K-00000-00&context=1516831.
20. Hans Verbraeken. (10 januari 2017 dinsdag). De plasticroute: van cellofaantje om de haring tot bermpaal. *Het Financieele Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5MKM-PTH1-JCD9-21NM-00000-00&context=1516831.
21. Hans Verbraeken. (28 december 2018 vrijdag). Recyclingsector groeit dankzij afvalstop China. *Het Financieele Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5V2J-4RB1-DYWB-S09R-00000-00&context=1516831.
22. GERARD REIJN. (20 mei 2019 maandag). Luiheid dreigt bij verduurzamers. *de Volkskrant.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5W4Y-JVX1-JC8X-603H-00000-00&context=1516831.
23. (25 januari 2016 maandag). 'Meer plastic dan vis in de oceanen in 2050'; nrc.checkt. *NRC Handelsblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5HXW-0J11-JC8W-Y471-00000-00&context=1516831
24. (19 december 2017 dinsdag). Europees akkoord over terugdringen van afvalberg. *Trouw.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5R6S-VDV1-DYRY-X373-00000-00&context=1516831.
25. Hans Verbraeken. (3 oktober 2016 maandag). Kunststofindustrie roept op tot andere aanpak bij recycling. *Het Financieele Dagblad.* Retrieved from https://advance-lexis-

com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5KVF-D1P1-JCD9-223H-00000-00&context=1516831.
26. HANS NAUTA. (17 januari 2018 woensdag). China wil ons afval niet meer en dat biedt kansen. *Trouw*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5RF0-0T71-DYRY-X0MG-00000-00&context=1516831.
27. Gerard Reijn / vk. (30 november 2017 donderdag). Statiegeld op kleine flesjes en blikjes lijkt nabij. *Nederlands Dagblad*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5R2M-YR91-JBKF-M4SN-00000-00&context=1516831.
28. Petra Noordhuis beeld Rufus de Vries, Stichting Klean. (21 maart 2015 zaterdag). raap elke dag een stuk zwerfvuil op Succesvolle statiegeldregeling in de prullenbak . *Nederlands Dagblad*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5FJP-9RM1-JC8W-Y1WD-00000-00&context=1516831.
29. CHARLOT VERLOUW. (17 oktober 2018 woensdag). Op weg naar het ultieme keurmerk. *Trouw*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5TH3-VBB1-DYRY-X35F-00000-00&context=1516831.
30. RENÉ DIDDE. (4 januari 2018 donderdag). Friesland pakt uit in de strijd tegen verspilling. *de Volkskrant*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5RB6-C9X1-JC8X-63NW-00000-00&context=1516831.
31. Warna Oosterbaan Foto Thomas Nondh Jansen. (12 oktober 2019 zaterdag). Maken,maken, niet kopen; En nu?; Repareer! Is het kapot?Maak het gewoon weer ; Geen idee hoe we onze spullen kunnen repareren. *NRC Handelsblad*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5X7Y-XH51-JC5G-1000-00000-00&context=1516831.
32. ESTHER BIJLO, REDACTIE DUURZAAMHEID EN NATUUR. (25 januari 2017 woensdag). Grondstoffenakkoord met bedrijfsleven is rond. *Trouw*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5MPV-RF71-JC8X-63SG-00000-00&context=1516831.
33. ESTHER BIJLO. (15 mei 2017 maandag). Circulair ben je niet zomaar als bedrijf. *Trouw*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5NJ7-0R51-JC8X-60H1-00000-00&context=1516831.
34. Tekst Hans Marijnissen. (13 juni 2014 vrijdag). Van deze fles maakt Lidl een nieuwe . *Trouw*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5CDS-71H1-JC8W-Y0RC-00000-00&context=1516831.
35. JOOP BOUMA, REDACTIE DUURZAAMHEID & NATUUR. (28 september 2019 zaterdag). Uitstel heeft geen zin: alleen statiegeld helpt tegen zwerfafval. *Trouw*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5X50-8MR1-JC8X-605N-00000-00&context=1516831.
36. YASEMIN CEGEREK, WAS PVDA-TWEEDE KAMERLID EN PARLEMENTAIR RAPPORTEUR CIRCULAIRE ECONOMIE. (21 augustus 2017 maandag). Zet een prijs op alle verpakkingen. *Trouw*. Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5P94-4S91-DYRY-X3M5-00000-00&context=1516831.

37. anp. (17 januari 2018 woensdag). Strategie Brussel tegen plasticafval. *Nederlands Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5RDW-HHY1-DY2H-B1RK-00000-00&context=1516831.
38. Door onze redacteurBarbara Rijlaarsdam. (17 december 2015 donderdag). Groene bazen willen inspireren. *NRC Handelsblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5HMJ-4751-JC8W-Y417-00000-00&context=1516831.
39. VAN ONZE VERSLAGGEVER GERARD REIJN. (14 september 2016 woensdag). 'Weg met onze wegwerpmentaliteit'. *de Volkskrant.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5KPD-36R1-DYRY-X435-00000-00&context=1516831.
40. (7 januari 2017 zaterdag). ' Waarschijnlijk eindigen we boven de 3 graden Celsius'. *Het Financieele Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5MK0-T6H1-DYWB-S0WJ-00000-00&context=1516831.
41. (15 december 2017 vrijdag). Zonder statiegeld lost Nederland de vervuiling door zwerfafval niet op. *Het Financieele Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:5R5X-V2C1-DYWB-S211-00000-00&context=1516831.
42. (1 mei 2010 zaterdag). Stef Kranendijk, alias Mister Desso. *Het Financieele Dagblad.* Retrieved from https://advance-lexis-com.proxy.library.uu.nl/api/document?collection=news&id=urn:contentItem:7YC0-P0D1-2R54-T01N-00000-00&context=1516831.

C: Statements derived from News Articles

Statements are ordered based on date of publication in the newspaper.

Date of publication	ID	Source newspaper	Organisation	English translation of statement
1-5-2010	19	Het Financieele Dagblad	Desso	'Plastics contain all kinds of volatile substances that enter the air and are unhealthy. So, we started looking very critically at the functionality of our products. That requires that you as a company take a vulnerable position, because not everything we do is good. That also means that you have to analyze all your raw materials for purity. You must ensure that the loop is closed. And that only works if you set yourself a long-term goal '
1-5-2010	91	Het Financieele Dagblad	Desso	Everything you leave behind can be reused in a high-quality way for new products.
14-10-2011	52	De Volkskrant	Groene Zaak	Because raw materials are becoming increasingly scarce, there is a growing awareness that we must also see our waste as raw material. But reuse does not happen automatically, that requires smart designs and innovation. As a company you can profile yourself with that.
14-10-2011	51	De Volkskrant	Groene Zaak	'It's about using as many of our raw materials as possible as infinitely as possible. That means that you want to close the cycle from raw material to waste, so that waste is just as valuable as the virgin raw material you start with. That is the circular economy. '
8-3-2014	23	Het Financieele Dagblad	PGGM	These days we are very busy with the circular economy, where the design of products is already thinking about how they should be reused. This is difficult for a financial institution.
13-6-2014	20	Trouw	Lidl	'We need the system to get enough raw materials for new bottles that consist of no less than 60 percent recycled material.'
21-3-2015	26	Nederlands Dagblad	Stichting KLEAN	We are here with 16.7 million Dutch people. If a quarter of the Dutch decide today to clean up one piece of litter a day, we have a problem tomorrow. There are only four million pieces of litter

21-3-2015	104	Nederlands Dagblad	Plastic Soup Foundation	You come across many half-liter bottles on the street, because no deposit is charged on them. In Belgium there is no deposit scheme at all, and large bottles are also on the street. In Germany, where there is a deposit scheme for large and small bottles, it is spotless. It is strange that the EU insists on deposit schemes and that we abolish a properly functioning deposit scheme.
21-3-2015	105	Nederlands Dagblad	Stichting KLEAN	Why don't we just drink from a plastic bottle that you can refill a thousand times? I'm not against plastic, but we're using it the wrong way. It is just as sustainable as gold: the oil it is made from has taken thousands of years to form. We should be careful with it, but we use plastic as a disposable material.
21-3-2015	106	Nederlands Dagblad	Stichting KLEAN	'Every second, about 350 kilos of plastic are added to the ocean. Stopping growth is more important than cleaning up the plastic soup. That is mopping with the tap open. What is now on the land is very easy to clean up. '
21-3-2015	66	Nederlands Dagblad	Stichting KLEAN	There must be a deposit on everything: cans, bags, packages, you name it. People will then say: pack the food better, so that we don't have to bring back so much. In addition, the extraction of raw materials must be taxed. Then companies will automatically ensure that they get them back. If the deposit system is abolished, more people will throw bottles in the household waste and they will be burned, while they can be recycled better.
21-3-2015	67	Nederlands Dagblad	Federatie Nederlandse Levensmiddelen Industrie	'We are still investigating that. That will bring us out soon. 'Maintaining two plastic collection systems is not efficient, he says. 'The fuller the bins, the lower the collection costs. The costs must be reduced in order to build the circular economy, because then the collected plastic is also more interesting for reuse. ' He also believes that one collection system is more consumer-friendly.
21-3-2015	68	Nederlands Dagblad	Universiteit Utrecht	'It's not just about efficiency and costs, but also about environmental effectiveness,'

21-3-2015	69	Nederlands Dagblad	Wageningen University & Research	'With the deposit you indicate that waste is valuable.' Price incentives also work. This is also apparent in Germany, a country that is much farther from waste separation than the Netherlands, he says. 'In a number of German municipalities, citizens have to pay for emptying their waste bin with residual waste. As a result, they better separate waste, because the more plastic, paper, organic waste and electrical appliances they manage to keep out of the residual waste, the less they have to pay. '
21-3-2015	70	Nederlands Dagblad	Stichting KLEAN	We cannot say from scientists that all that plastic affects our health, but we also have something like a common sense, 'says Peter Smith. 'Microplastics are in fish, in snails, in beer, in organic honey and even in the snow on top of Mount Everest.'
17-12-2015	92	NRC Handelsblad	Dutch Sustainable Growth Coalition	The circular economy sounds abstract but revolves around something concrete: the reuse of products and materials. Despite the superficial cries that some top executives made last Monday - 'it's about the mindset', and 'you have to find the win-wins'
17-12-2015	80	NRC Handelsblad	Dutch Sustainable Growth Coalition	The circular economy sounds abstract but revolves around something concrete: the reuse of products and materials. Despite the superficial cries that some top executives made last Monday - 'it's about the mindset', and 'you have to find the win-wins'
25-1-2016	60	NRC Handelsblad	Ellen MacArthur Foundation	the ocean will contain more plastic than fish in 2050 (by weight)
25-1-2016	93	NRC Handelsblad	Wageningen University & Research	It's a topic to worry about seriously. But the prediction of Davos seems exaggerated.
14-9-2016	10	De Volkskrant	Dutch Government	'That is an economy where all the waste is reused as raw material as much as possible. So that there is no waste anymore. We want to achieve that in 2050. In that year we only have to use recycled raw materials. That means we have to get rid of our disposable mentality, both industry and consumers. If we continue on the current basis, we need an extra earth. We want to reduce raw material consumption by half by 2030. '

14-9-2016	103	De Volkskrant	Dutch Government	Re-using raw materials is already yielding a lot, which is already big business. TNO has already calculated that, until 2024, reuse will produce 54,000 jobs.
3-10-2016	63	Het Financieele Dagblad	Nederlandse Rubber- en Kunststofindustrie	'It is very difficult to get recycling done. Something fundamental needs to change, 'says Erik de Ruijter, director of policy and advice at the NRK. 'Otherwise there will be no large-scale recycling of land in the Netherlands and Europe.
4-10-2016	28	Trouw	Wageningen University & Research	The government should therefore not only focus on collection, but on knowledge about how all that waste can be reused
4-10-2016	30	Trouw	Nederlandse Rubber- en Kunststofindustrie	According to the NRK, consumers must receive more appreciation for recycled packaging. 'We are already used to recycled material in paper and glass. Now plastic,' says NRK's Erik de Ruijter. 'Consumers are not yet sufficiently prepared to pay extra for recycled material',
4-10-2016	29	Trouw	Wageningen University & Research	It means that recyclers will talk to companies 'at the back': 'what you make now, I can't handle that'. And vice versa, designers in the food packaging industry have to think about the end of a product. That is currently not happening enough. If the government does not direct this, you will not get what you want.
7-1-2017	18	Het Financieele Dagblad	Corbion	This is an economy in which raw materials are extracted in a sustainable manner, are used efficiently and are optimally reused. State Secretary Sharon Dijksma has submitted a nice plan.
10-1-2017	55	Het Financieele Dagblad	CE Delft	recycling plastic household waste is better from an environmental point of view than incineration. With plastic incineration by waste processors, you indeed recover your heat and energy. But, says Geert Bergsma from CE Delft research agency, if you recycle plastic, you don't have to make new plastic. And for new plastic, oil is needed as a raw material, which in turn incinerates extra CO2 into the atmosphere and thus contributes to global warming. 'We use up less fossil raw material through recycling of plastic, and therefore we produce less CO2.' But reducing CO2 emissions through recycling of plastic packaging should not be exaggerated. 'If you want to save the world, then you should better fly less or not eat meat,' says Bergsma. In 2010, plastic packaging in the Netherlands contributed only around 0.9% to CO2 emissions. 'But small environmental measures are also needed.'

25-1-2017	74	Trouw	MKB Nederland	We see that there is a scarcity of resources. The exhaustion already manifests itself, take the log of wood. It is therefore good to use as few raw materials as possible for products and to keep as many raw materials as possible used in the production chain. That is also good for the reduction of CO2 emissions.
4-4-2017	54	Nederlands Dagblad	Plastic Soup Foundation	As far as she is concerned, the solution is to minimize the use of plastic. She can do that without sacrificing too much luxury. 'We have only been using plastic as a disposable since the mid-1950s.'
15-5-2017	75	Trouw	Radboud Universiteit Nijmegen	'If you want to make a part of your activity's circular, you have to work together. First you have to ask yourself: who am I in the circle with, how should we redesign that, how do we distribute the earning capacity? Suppose you want to do something with circular use plastic. Then it must be made, used, collected and processed in such a way that a cycle is actually created. ' Whether the consumer is waiting for that plastic is still the question. 'Imagine making a coffee machine with recycled plastic. If new plastic is cheaper, why would that customer want it?'
21-8-2017	76	Trouw	Aldi	The German concern has announced that it will no longer sell plastic bags next year
21-8-2017	5	Trouw	PVDA	The solution lies in the circular economy, where you avoid waste and reuse waste. Waste as a raw material. As a Member of Parliament, I have submitted a motion to arrive at a government-wide program for this circular economy.
21-9-2017	49	Trouw	Centraal Planbureau	the more plastic waste there is, the more difficult it will be to get rid of it, according to Verrips. 'But you can't translate that individually, that's why you have to stop,' she says. 'Separation remains good, because it reduces CO2 emissions. Just continue as you were busy, make sure you are tidy in your waste streams. Do not put plastic on the old paper, and do not throw it in the container for fruit and vegetables either. that is really bad for the environment. '

21-9-2017	50	Trouw	Rijksuniversiteit Groningen	'Which unsustainable problem needs to be solved?' Asks Professor Loos. 'The depletion of raw materials - almost all plastics are made from petroleum or gas -, their one-time use or their poor degradability in the environment?' Rarely does the alternative meet all three requirements. For example, there are so-called bioplastics made from vegetable waste, such as sugar beet or sugar cane residues. But they are often not degradable.
30-9-2017	17	Het Financieele Dagblad	Citizen initiative	Someone who passionately campaigns against plastic pollution and for recycling is Dave Hakkens. With his Precious Plastic project, he tries to convince people all over the world to start their own local plastic workshop. He builds mobile workshops, where locals can make new products from their own plastic waste.
30-9-2017	53	Het Financieele Dagblad	Citizen initiative	Alessandro Iadarola and Bob Vos van Polimeer also combine social with circular design, by involving communities in the local recycling of raw materials. For an Amsterdam housing association, they design signs, made of plastic bags, that are collected by the residents. Iadarola and Vos speak of 'upcycling', because they upgrade the material from disposable to quality product.
6-11-2017	14	Trouw	Universiteit Utrecht	You have to make good products with better properties. You can't expect all consumers to buy that stuff just because they are so durable. '
6-11-2017	31	Trouw	Universiteit Utrecht	'It's a complicated concept. You can't make money quickly with it. '
30-11-2017	65	De Volkskrant	CE Delft	Reducing litter by 90 percent in such a short time is only possible if you introduce a clear price incentive for the return of small bottles. Deposit is a good option.
15-12-2017	16	Het Financieele Dagblad	Recycling Netwerk	The solution is high-quality recycling. That is not the recycling of plastic bottles into fleece jerseys, which then release plastic particles into the washing machine, as is currently the case. We have to put the plastics back into high-quality products as much as possible. And as an environmental organization, we add that we have to use fewer plastics.

19-12-2017	61	Trouw	European Commission	An important agreement that will greatly reduce the landfill and incineration of waste ', EU Environment Commissioner Karmenu Vella responded. He believes the new goal for plastic packaging in 2030 will make a huge contribution to reducing marine pollution
19-12-2017	62	Trouw	GroenLinks	Now it is important to tackle the production side in addition to the waste side of the circular economy. Our current economic model, in which we continually extract new raw materials and then throw them away as if they were nothing, is untenable. Never before has EU legislation laid down so clearly that we have to get rid of it
4-1-2018	72	De Volkskrant	Circulair Friesland	Because a circular economy is not only about preventing wastage of earthly capital, it will also make better use of human capital'
16-1-2018	43	Nederlands Dagblad	TNO	'The government, hundreds of companies and knowledge institutions now seem to realize that the pressure on raw materials is constantly increasing and that they will be used up at some point.'
16-1-2018	24	Nederlands Dagblad	Former CDA member of parliament	It is a mentality problem.
16-1-2018	25	Nederlands Dagblad	TNO	Companies must also look at what they can do to improve waste flows, says Wijngaard of TNO. 'This is how work is being done on a packaging chip for waste processing.' A waste separation machine can then recognize the packaging material on the basis of such a chip. Nevertheless, there is still a long way to go before no more waste ends up in the incinerator in 2050, as the parties involved want. For the time being, our poorly sorted plastic is mainly disappearing in street furniture and roadside posts.
17-1-2018	79	Nederlands Dagblad	European Commission	'The only long-term solution is to reduce plastic waste by recycling and reusing more.'
17-1-2018	64	Trouw	Vereniging Afvalbedrijven	'But we must see this as an opportunity. Let us invest in our processing capacity and increase the quality of the waste.'
24-2-2018	1	NRC Handelsblad	TU Delft	Design the packaging so that it is easy to recycle

24-2-2018	90	NRC Handelsblad	4PET Recycling	at the same time, he sees a tendency for manufacturers to make increasingly complex packaging. And in the end with such a manufacturer the marketer wins over the recycler.
24-2-2018	27	NRC Handelsblad	Wageningen University & Research	The system is not yet very efficient, 'say Thoden van Velzen and Molenveld. There is still a long way to go. But it is a good way.' Because for billions of euros each year we make new packaging, use it once and throw it away., that is a huge waste.
28-2-2018	45	Het Financieele Dagblad	QCP	Houtermans and his associates had seen earlier employers that there were opportunities in the plastic. In fact, in the words of Houtermans, there is a golden future. Because: the climate problem in the world is becoming more urgent and the pressure to emit fewer greenhouse gases is increasing, certainly due to the Paris climate agreement of December 2015. The pressure on the chemical industry, which is still running almost entirely on fossil carbons, is also increasing. The chemical cycle must be closed. 'In itself, plastic is a wonderful material. The problem is throwing it away or burning it, 'says Houtermans. One of the solutions to the plastic problem is reuse, or recycling.
6-3-2018	6	NRC Handelsblad	Wageningen University & Research, Universiteit Utrecht, Universiteit Leiden, Universiteit Maastricht, Open Universiteit, Universiteit van Amsterdam, Rijksuniversiteit Groningen, Erasmus Universiteit, Vrije Universiteit, TU Delft, Universiteit Twente	In any case, it is essential to handle products and raw materials more carefully so that they can be reused as often as possible, thereby protecting the environment and the economy, for ourselves, our children and grandchildren. We are not doing that right now. As scientists, we learn more every week about the health and environmental problems that plastic waste creates at sea, in surface water, for humans and animals. The tons of waste for a lock in the Seine provide an insight into the extent of litter. This picture is of course not in keeping with a circular economy
19-7-2018	44	Trouw	Milieu Centraal	In fact, a circular economy is an economy in which waste does not exist, 'says Kirsten Palland of the Milieu Centraal information organization.' It is a raw material. Either you give it a second life as it is now, for example by exchanging or donating clothes that you have been bored of, or you make something else out of it. 'Raw materials for new products are then saved. That is important, because those raw materials are affected on

19-7-2018	7	Trouw	PBL, CBS, SCP	According to Luesink, small steps are a good way to alleviate that pain. She cites the approach of plastic bags as an example. 'By changing the norm that you no longer get such a bag for free everywhere, that behavior has changed. So the government can also stimulate these steps.
12-9-2018	46	Trouw	Vrije Universiteit	At least Koudstaal understands that something has to be done with the large plastic waste mountain, says Heather Leslie, environmental scientist at VU University Amsterdam. 'In addition to the ambition to be more aware of waste, the project shows a noble pursuit of a circular economy.' But recycling is not the answer to everything. As soon as someone does something with plastic, Leslie wonders what part of the problem is being solved and what problem is being created. 'Of course, we have to use less plastic on the one hand,' she says. 'It is tempting to turn it into a flower box or a cycle path. But looking through the glasses of the circular economy, the question arises with this cycle path: is the plastic still reusable after that or is it then end of the exercise cycle? What do you then with the material? The problem of 'reduction of the plastic waste mountain' may only have been solved temporarily.
12-9-2018	47	Trouw	Plastic Soup Foundation	That's how you shift the problem, says Harmen Spek of the Plastic Soup Foundation. Characteristic of plastic is that it contains all kinds of additives to create certain properties. 'Think of plasticizers to make the material flexible, dyes, flame retardants or UV blockers. These are often polluting compounds. Recycled or not: these substances remain in the plastic. Due to heat, rinsing or wear, microplastics always find their way to the living environment How healthy is such a cycle path and what effect do microplastics and toxic substances have on the immediate environment?
12-9-2018	94	Trouw	Vrije Universiteit	It makes recycling plastic a dilemma. 'Glass, aluminum or other metals can be recycled endlessly, without compromising the quality of the secondary materials,' says Leslie. 'Plastic is a more difficult job. You can see the plastic as a plate of spaghetti. The chemicals are the sauce that give the material its functionality. There are thousands of types of chemical additives, with different functions. Quite a few harmful additives found in certain plastic waste streams you do not want to see again in new products, such as a cycle path. '

17-10-2018	71	Trouw	Philips	'This new calculation method helps us to further develop our policy. But ultimately, customers determine whether this information adds value to them,' says sustainability director Eelco Smit. 'Because sustainability is an integral part of our strategy, we know exactly how many grams of copper, steel and plastic is in our MRI scanners, where it comes from and how much has been recycled.'
16-11-2018	15	Het Financieele Dagblad	TU Delft	'We must do fundamental research like crazy,' says Herder. 'The whole story is in 2050 the industry will no longer run on fossil fuels and raw materials. That is the implication of the Paris Climate Agreement and the Dutch Climate Agreement. But how can we achieve that transformation? The entire industry must be overhauled. '
4-12-2018	48	Het Financieele Dagblad	Lego	'It is one big search,' says Nelleke van der Puil, the Dutch vice president of materials at Lego at the head office, where you almost stumble over the Lego dolls. 'The plastic that we now mainly use cannot be replaced one-on-one. In addition to recycling existing plastic, we must look for a different type of material and make a new recipe out of it. '
28-12-2018	56	Het Financieele Dagblad	RoyalhaskoningDHV	The pile of plastic is so large that traders and recyclers become more critical when purchasing. The lesser quality waste plastic is being displaced, according to specialist Erik van Dijk from the Royal HaskoningDHV agency. Recyclers can increasingly opt for the pure fractions. 'Ultimately, a situation arises where the costs of recycling are higher than those of burning and landfilling waste.'
28-12-2018	95	Het Financieele Dagblad	Aterro	There is too little sorting and recycling infrastructure in Europe, with the result that there is more plastic in the residual waste and is incinerated.
28-12-2018	57	Het Financieele Dagblad	Suez	For the longer term, the China import stop is good for the recycling market in Europe. 'Good for the circular economy,' says Droogh, from Suez. 'Quality becomes important because of the large range. For too long, high-quality plastic recycling has been forgotten in Europe.
11-1-2019	2	Trouw	PBL	It shows that it is not so difficult that circularity is not something that only the elite are concerned with, 'says Rood.' You can bring it very close to the people. This is important because part of the population wonders what they should do with the entire climate and greening discussion. You can create support in this way.

11-1-2019	3	Trouw	PBL	Recycling is fairly easy to integrate into existing activities. But other ways to use fewer resources are more likely. The creation of sub-platforms for cars and devices, for example, the completely different design of products or items to be reused in its entirety. A more drastic change in the economy is necessary in order to achieve the objectives of the government.
19-1-2019	12	Trouw	Unilever	It is a system change and it requires different technology. We have to create a new economy in which plastic waste gets value. Fortunately, other companies have followed us, that helps. There is now a risk of a shortage of recyclate, the granules made of used plastic. That is a good sign. Then you get a market for reusing plastic.
19-1-2019	13	Trouw	Unilever	We must have materials available all over the world and not compromise the safety of a product. At the same time, waste processors must be able to do something with the plastic and it must of course be collected.
19-1-2019	96	Trouw	Unilever	Typically, you cannot use 100 percent recycled plastic for a new package. There are no standards for its purity yet. That would help to develop the market. We work together as much as possible with waste processors, governments and other partners to solve all these questions.
19-1-2019	98	Trouw	Greenpeace	Nevertheless, an organization such as Greenpeace is critical about the plastic policy of large consumer companies. Unilever is at the forefront, but there are no hard targets to really reduce the amount of plastic, Greenpeace said in a recent report.
19-1-2019	97	Trouw	Unilever	I don't want to detract from the urgency of the problem, 'Hamer responds.' But it's not that simple. We do not want to lose the consumer on the road and the product must remain integrity. Those small packages are safe and affordable. That is why we offer them. We are looking for recyclable alternatives and are developing a technology, CreaSolv, to be able to dissolve the multi-layer material. We do this 'open source', everyone can take note of it and apply the technology.

26-2-2019	22	NRC Handelsblad	Municipality Gooise Meren	Meanwhile, the primary motivation for municipal collection is the excessive reimbursement and the pressure to reduce residual waste. An industrial waste chain has been created by perverse incentives. Through my own municipal PMD container I now see the unimaginable amount of packaging material that we throw away. But it is doubtful whether separating this waste, ie collecting it at the source, has a positive effect on the environment. A plastic pact with good intentions does not change that much
11-3-2019	77	NRC Handelsblad	Universiteit van Amsterdam	We are having a party, but this image is not really cheerful, 'says chemist Chris Slootweg in his office at Amsterdam Science Park.' It is more a doom scenario. It indicates that scarcity is imminent. ' A telephone call is signed for a number of elements. They are used for the production of smartphones. Many of them are in red colored boxes: 'serious threat in the next 100 years
11-3-2019	78	NRC Handelsblad	Universiteit van Amsterdam	My ideal image is circular chemistry, where chemistry is incorporated in the circular economy. We must focus on reuse, for example by reclaiming and re-using raw materials locally.
11-3-2019	99	NRC Handelsblad	Universiteit van Amsterdam	The current way of recycling can also be improved. For example, roadside posts are seen as an example of circularity, but actually the low-grade plastic is made from a mixture of plastic waste. You gave it a second life, but in the end, it will end in waste incineration. You have to view the entire production and processing cycle of a product to determine what is more sustainable and how you can best preserve the value of raw materials.
11-3-2019	100	NRC Handelsblad	Universiteit van Amsterdam	From the perspective of circular chemistry, we also want fewer different materials on the market. Ideally, for example, you would only have one type of plastic for which you can vary the material properties. This is possible with polyethylene, for example. With a low density you can make plastic bags out of it. And if you increase the density, you can form cables as strong as steel. Made from the same raw material, it can be recycled together.

11-3-2019	101	NRC Handelsblad	Universiteit van Amsterdam	How can chemistry make the use of raw materials more sustainable? ,, Scientific research plays an important role in this. Now scientists are mainly looking at making a process or product more sustainable. They usually do not take into account whether it is profitable. ,, For example, there is a green synthesis technique for adipic acid, one of the two building blocks for nylon. It was developed twenty years ago and meets all the requirements of green chemistry. Yet it is not applied in the industry. This is because the raw materials for it are not yet produced on a large scale. In addition, hydrogen peroxide, the reagent required for synthesis, is relatively expensive. It is therefore much cheaper to continue using the current, less sustainable, synthesis route. ,, The recovery and recycling is still in its infancy. New chemistry and new designs are needed to make that possible. Fascinating to work on. '
11-3-2019	102	NRC Handelsblad	Universiteit van Amsterdam	It requires a major change to set up the design and production so that a product is circular. Everything must be changed. But I think the time is right to do that.
20-5-2019	58	De Volkskrant	Kennisinstituut Duurzaam Verpakken	I expect that fundamental thinking about packaging will produce more results than setting quantitative goals.
16-7-2019	11	Nederlands Dagblad	ING	An ING spokesperson referred to the bank's views on plastic and shale gas extraction. The bank says it wants to tackle plastic waste and pollution by recycling more and more plastic. The ultimate goal is a circular economy in which plastics never turn into waste. Customers who develop activities in the field of shale gas are required to meet certain requirements. 'For example, they use the best available techniques in the field of environmental protection and safety.
28-9-2019	21	Trouw	Citizen initiative	We have far too many one-off packaging. Recycling, the State Secretary's favorite horse, is not a solution to the problem of plastic pollution, no matter how important it is.

12-10-2019	73	NRC Handelsblad	Citizen initiative	If you really want a circular economy, so if you strive for as much reuse as possible, make sure that repairing is just as easy as buying something new. That is not the case now. You can now order something new and you will have it the next day. If you want to repair something, you have to wait too long. 'She sees the repair cafes as an intermediate step.' Ultimately, more professional companies must be established where things can be repaired quickly.
6-11-2019	4	Trouw	Centraal Planbureau	Waste recycling in the Netherlands can be much better. Measures such as an export ban for plastic waste, a deposit on disposable items and taxes on poorly reusable plastic have significantly improved the environment.
11-12-2019	42	De Volkskrant	European Commission	Production and consumption patterns, lifestyles and work styles have to change, but those who are hit harder deserve protection and guidance.

D: Identified Stakeholders in the Dutch Plastic Sector

Organisation	**Actor**	**Type**	**# Mentioned in News**	**# Statements**	**National Agreement on CE**	**Plastic Pact**
4PET Recycling	Market	Business	3	1	yes	yes
ABN Amro	Market	Business	2		yes	yes
Aterro	Market	Business	3	1	yes	yes
Coöperatie Green Events Nederland	Market	Business			yes	yes
Friesland Campina Nederland B.V.	Market	Business			yes	yes
Ioniqa Technologies B.V.	Market	Business	2		yes	yes
Philips	Market	Business	4	1	yes	yes
Quality Circular Polymers (QCP)	Market	Business	2	1	yes	yes
SUEZ Recycling & Recovery Netherlands	Market	Business	2	1	yes	yes
Unilever	Market	Business	5	4	yes	yes
Veolia Polymers	Market	Business	2		yes	yes
Vereniging Afvalbedrijven	Market	Association	1	1	yes	yes
A New Zero	Market	Consultancy			yes	yes
TNO	Market	Consultancy	2	2	yes	yes
Foundation Natuur & Milieu (Nature & Environment Foundation)	Civil Society	Foundation			yes	yes
Foundation MVO Nederland	Civil Society	Foundation			yes	yes
Foundation Polymer Science Park	Civil Society	Foundation			yes	yes
Plastic Whale	Civil Society	NGO			yes	yes
National Government (Minister for the Environment and the Minister of Economic Affairs, also on behalf of the Minister for Housing and the Central Government Sector, and the Minister for Foreign Trade and Development Cooperation)	State	National	22		yes	yes

AEB Amsterdam	Market	Business	1		yes	
Afvalzorg	Market	Business			yes	
AkzoNobel	Market	Business			yes	
Boskalis	Market	Business	1		yes	
GreenWavePlastics	Market	Business			yes	
Interface	Market	Business	1		yes	
KplusV	Market	Business			yes	
MKB Nederland (representing small and medium-sized enterprises)	Market	Business	1	1	yes	
Natural Plastics	Market	Business			yes	
Packaging & Distribution Innovators BV	Market	Business			yes	
RoyalhaskoningDHV	Market	Business	1	1	yes	
Triodos Bank	Market	Business	1		yes	
UNIK (Unie Nederlandse Industriele Kunststofbewerkers)	Market	Business			yes	
Van Gansewinkel Groep	Market	Business			yes	
Van Werven Plastic Recycling	Market	Business	1		yes	
Vita Plastics	Market	Business			yes	
Vereniging Circulair Friesland	Market	Association	2	1	yes	
Afvalfonds Verpakkingen	Market	Branch organisation	3		yes	
Commissie Toezicht Monitoring Verpakkingen (= Afvalfonds Verpakkingen)	Market	Branch organisation	1		yes	
CE Delft	Market	Consultancy	3	2	yes	
Kennisinstituut Duurzaam Verpakken	Market	Consultancy	5	1	yes	
Nationaal Duurzaamheid Instituut	Market	Consultancy	1		yes	
VNO-NCW (Confederation of Netherlands Industry and Employers)	Market	Employee organisation	1		yes	
Stichting Nedvang	Market	Foundation	1		yes	

IPO, Interprovinciaal Overleg (Association of Provincial Authorities)	State	Association			yes	
Unie van Waterschappen (Association of Dutch Regional Water Authorities)	State	Association			yes	
Vereniging van Nederlandse Gemeenten (Association of Netherlands Municipalities)	State	Association	2		yes	
Province Drenthe	State	Province			yes	
Province Flevoland	State	Province			yes	
Province Fryslân	State	Province			yes	
Province Gelderland	State	Province			yes	
Province Groningen	State	Province			yes	
Province Noord-Brabant	State	Province			yes	
Province Overijssel	State	Province	1		yes	
Province Utrecht	State	Province			yes	
Province Zeeland	State	Province			yes	
Province Zuid-Holland	State	Province			yes	
WasteFreeOceansFoundation	Civil Society	Association			yes	
Milieu Centraal	Civil Society	Foundation	1	2	yes	
Plastic Soup Foundation	Civil Society	Foundation	4	3	yes	
Technische Universiteit Delft	Civil Society	Knowledge/Education	3	3	yes	
Universiteit Utrecht	Civil Society	Knowledge/Education	2	4	yes	
Dutch Federation of Trade Unions	Civil Society	Trade Union			yes	
FNV	Civil Society	Trade Union			yes	
VCP, Vakcentrale voor Professionals (Trade Union Federation for highly educated professionals)	Civil Society	Trade Union			yes	
Afvalsturing Friesland N.V	Market	Business				yes
Air Events	Market	Business				yes
Albert Heijn	Market	Business	2			yes

Aldi	Market	Business	2	1		yes
ASN Bank	Market	Business				yes
BRBS Recycling	Market	Business				yes
C.I.V. Superunie B.V.	Market	Business				yes
CLICK-NL	Market	Business				yes
Coca Cola Nederland	Market	Business	8			yes
Coöperatie Royal FloraHolland U.A.	Market	Business				yes
Cumapol B.V.	Market	Business				yes
Ekoplaza Franchise B.V.	Market	Business				yes
Filigrade Sustainable Watermarks B.V.	Market	Business				yes
Gampet Plastics B.V.	Market	Business				yes
Grolsch	Market	Business	1			yes
Haval Disposables B.V.	Market	Business				yes
HEMA B.V.	Market	Business				yes
Hordijk Spuitgietverpakkingen B.V.	Market	Business				yes
Hordijk Verpakkingsindustrie Zaandam B.V.	Market	Business				yes
HVC Group N.V.	Market	Business				yes
Inbev Nederland N.V.	Market	Business				yes
Indorama Ventures Europe B.V.	Market	Business	1			yes
ISS Catering Services	Market	Business				yes
Jumbo Supermarkten B.V.	Market	Business				yes
Kunststof Recycling Van Werven	Market	Business				yes
Kunststoffen Sorteer Installatie B.V.	Market	Business				yes
Lidl	Market	Business	1	1		yes
McDonald's	Market	Business	1			yes
Mojo Concerts B.V.	Market	Business				yes
Morssinkhof Plastics Heerenveen B.V.	Market	Business	1			yes
Nestlé	Market	Business	1			yes

NS Groep N.V.	Market	Business				yes
NS Stations B.V.	Market	Business				yes
Obbotec B.V.	Market	Business				yes
Oerlemans Packaging	Market	Business				yes
PaCombi Group B.V.	Market	Business				yes
Pathé Theatres B.V.	Market	Business				yes
Plus Retail B.V.	Market	Business				yes
PolyStyreneLoop B.V.	Market	Business				yes
Purac Biochem BV (Corbion)	Market	Business				yes
Renewi Nederland B.V.	Market	Business				yes
Sodexo B.V.	Market	Business				yes
Starbucks	Market	Business	1			yes
Total Corbion PLA B.V.	Market	Business	1	1		yes
Vomar Voordeelmarkt B.V.	Market	Business				yes
Vrumona B.V.	Market	Business	1			yes
Wellman International Ltd	Market	Business				yes
Federatie Nederlandse Rubber- en Kunststofindustrie	Market	Association	3	2		yes
NRK Recycling	Market	Association				yes
NRK Verpakkingen	Market	Association				yes
Nationaal Testcentrum Circulaire Plastics (NTCP)	Civil Society	Foundation (research)				yes
Foundation Vierdaagsefeesten	Civil Society	Foundation				yes
Foundation Holland Circular Hotspot	Civil Society	Foundation				yes
Aegon	Market	Business	1			
Airbnb	Market	Business	1			
Alliander	Market	Business	1			
Allianz	Market	Business	1			
Avri (waste processor)	Market	Business	1			

Bayards	Market	Business	1			
Be-Start	Market	Business	1			
Beter Bed	Market	Business	1			
Better Future Company	Market	Business	1			
Broeckx Plastic Recycling	Market	Business	2			
Bureau SLA	Market	Business	1			
Capgemini	Market	Business	1			
Caroda	Market	Business	1			
CeDo	Market	Business	1			
Chevron	Market	Business	1			
De Paauw Plastic Recycling	Market	Business	1			
Deloitte	Market	Business	1			
Desso	Market	Business	2	2		
DowDuPont	Market	Business	1			
DSM	Market	Business	1			
E&Y	Market	Business	1			
Exxon Mobil	Market	Business	1			
Fairphone	Market	Business	1			
Groene Zaak	Market	Business	1	2		
G-Star	Market	Business	1			
Ikea	Market	Business	2			
ING	Market	Business	1	1		
Kraft Heinz	Market	Business	1			
Kras Recycling	Market	Business	2			
Lego	Market	Business	2	1		
L'Oreal	Market	Business	1			
Nespresso	Market	Business	1			
New Marble	Market	Business	1			
NIBC	Market	Business	1			

Nike	Market	Business	1			
Omrin	Market	Business	2			
Overtreders W	Market	Business	1			
Pepsi	Market	Business	1			
PGGM	Market	Business	1	1		
PostNL	Market	Business	1			
Rabobank	Market	Business	1			
Red Bull	Market	Business	1			
Renault	Market	Business	1			
RetourMatras	Market	Business	1			
Sabic	Market	Business	1			
Shell	Market	Business	1			
Sita	Market	Business	1			
Spadel Nederland	Market	Business	2			
Swapfiets	Market	Business	1			
Thuiswinkel.org	Market	Business	1			
Volksbank	Market	Business	1			
Walmart	Market	Business	1			
Centraal Bureau Levensmiddelenhandel	Market	Business	1			
Dutch Sustainable Growth Coalition (= Philips, Shell, KLM, Unilever, Heineken, DSM, AkzoNobel, Friesland Campina)	Market	Business	1	2		
Federatie Nederlandse Levensmiddelen Industrie	Market	Association	1	1		
Nederlandse vereniging Frisdranken Waters en Sappen	Market	Association	1			
Vereniging Plastics Recyclers Europe	Market	Association	1			
European Commission	State	Supranational	11	3		

Verenigde Naties	State	Supranational	3			
WTO	State	Supranational	1			
City Amsterdam	State	Municipality	1			
City Groningen	State	Municipality	1			
City Rotterdam	State	Municipality	1			
Grondstoffen- en Afvaldienst	State	Municipality	1			
Noord-Oost Groningen	State	Municipality	1			
Noord-Veluwe	State	Municipality	1			
Algemene Rekenkamer	State	Agency	1			
Centraal Bureau voor Statistiek	State	Agency	1	1		
Centraal Planbureau	State	Agency	4	2		
Planbureau voor de Leefomgeving	State	Agency	2	3		
Rijkswaterstaat	State	Agency	1			
Sociaal- Cultureel Planbureau	State	Agency	1	1		
Citizen initiatives	Civil Society	Citizen	4	3		
Ellen MacArthur Foundation	Civil Society	Foundation	2	2		
Stichting Ideële Reclame	Civil Society	Foundation	1			
Stichting KLEAN	Civil Society	Foundation	1	5		
Erasmus Universiteit	Civil Society	Knowledge/Education	1	1		
Open Universiteit	Civil Society	Knowledge/Education	1	1		
Radboud Universiteit Nijmegen	Civil Society	Knowledge/Education	1	1		
Rijksuniversiteit Groningen	Civil Society	Knowledge/Education	2	2		
Universiteit Leiden	Civil Society	Knowledge/Education	1	1		
Universiteit Maastricht	Civil Society	Knowledge/Education	1	1		
Universiteit Twente	Civil Society	Knowledge/Education	1	1		
Universiteit van Amsterdam	Civil Society	Knowledge/Education	1	7		
Vrije Universiteit	Civil Society	Knowledge/Education	2	3		
Wageningen Universiteit	Civil Society	Knowledge/Education	7	6		

Eerlijke Bank- en Verzekeringswijzer (= cooperation between Amnesty International, FNV, Milieudefensie, Oxfam Novib, PAX and World Animal Protection)	Civil Society	NGO	1			
Greenpeace	Civil Society	NGO	2	1		
Recycling Netwerk (cooperation between environmental organisations, e.g. Greenpeace)	Civil Society	NGO	4	1		
Global Footprint Network	Civil Society	Think Tank	1			
GroenLinks	Civil Society	Political party	1	1		
PVDA	Civil Society	Political party	3	1		
VVD	Civil Society	Political party	1			
VVD councilor Gooise Meren	Civil Society	Political party	1	1		

E: Questionnaire of Interview

Date
Location
Name:
Organisation:
Position:

Introduction

- Presentations and explanation of CRESTING project.
- Explanation of interview's role in the research.
- Explanation of consent form, and permission for recording.

Background:

1. What is your position and role in the organisation? For how long?

General:

2. From your experience working in sustainability, what do you see as the main social and ecological issues with regards to plastics?

Circular economy

3. What does the circular economy mean for you? Is it necessary? Why?
4. Many say that a circular economy can allow the decoupling of econ growth from environmental degradation, do you agree? If not, does this means that circularity is incompatible with economic growth?

From your organisational perspective

5. What are your organisation's goals for the achievement of the circular plastics economy?
6. What are your organisation's activities and projects for the achievement of the circular plastics economy?
7. What obstacles and challenges does your organization face in the transition towards a 100% circular plastics economy? How to deal with them?

Governance and society

8. Do you have any role in the formulation of circular plastic economy policies at the local, national and international level? What measures and policies do you promote? Would you like to have a stronger role?
9. Is the current plastic governance system in the Netherlands effective? Why? Why not? How can it be improved?
10. Do you think that the government should increase the involvement of civil society organisations in the construction of policies and practices for the plastic sector?
11. Are the current plastic policies of the EU effective? Why? How can they be improved?

Technical issues with plastics

12. From your experience, what specific plastics are most circular and sustainable? To what extent are these used? And which ones are the least? Why are these still used?

13. How difficult is it to use only recycled plastics? How much more expensive are they compared to virgin plastics? How to stimulate the demand for recycled plastics?
14. How difficult is it to use only recyclable plastics? How much more expensive are they compared to virgin plastics? How to stimulate the demand for recyclable plastics?
15. What are your perspectives on reusable packaging, including re-usable alternatives to plastic? How much more expensive are they compared to SUP? Are reusable options more or less sustainable than SUP?
16. What are your perspectives on bio-based plastics?
17. What are your perspectives on biodegradable plastics?
18. What are your perspectives on other alternatives to plastic (metal, cardboard, glass etc.)?
19. What are your perspectives on chemical recycling?
20. What are your perspectives on mining for plastic waste in landfills (urban mining)?
21. What are your perspectives on CO2-plastics?
22. What are the health implications and concerns with recycled and re-usable plastic? How can they be overcome?
23. What are the main ecological and environmental impacts of recycling facilities? How can they be overcome?
24. The Netherlands is one of the largest plastic waste producers in the world. In this context is recycling enough or should we reduce plastic consumption in general as well?
25. Can there be a future without plastics? Why?

Global Perspectives

26. How can we deal with leakage of waste plastic to the Global South? Who should be responsible?
27. How can we deal with Ocean plastics and global clean-up activities? Who should be responsible? Considering that most of the pollution comes from river deltas in the Global South, should large corporations or wealthy countries give financial help and technology transfers to help countries in the Global South?
28. What are your perspectives on open-source technologies and community-based plastics recovery and transformation structures?
29. The transition often involves heavy costs through EPR systems etc. how can we prevent this does not disproportionally fall on the most vulnerable people?
30. Overall, do you think that the transition to a 100% circular plastics economy can be achieved by 2050 as the Dutch Government aims? Why?
31. What policy measures and mechanisms do you find important to foster this transition to Circular Plastic Economy?

Take-aways

32. What would you like to learn from this research? Do you have further questions, comments or hints about it?
33. Who else would you recommend we interview in the context of this research? Could you please introduce us to them?

F: Overview of Interviewees

#	Sector	Role	Organisation	Country
1	State	Senior Policy Advisor	Local governments	NL
2	State	Secretary of Plastic Pact NL	National government	NL
3	Academia	Professor in high-tech recycling	University / high-tech recycler	NL
4	Academia	Professor in plastic packaging	University	NL
5	Academia	Postdoctoral researcher in plastic packaging design	University	NL
6	Civil Society	Senior Program Leader CE	Environmental organisation	NL
7	Civil Society	Director	Environmental organisation (International)	NL
8	Civil Society	Chemical engineer and expert in international waste and plastic recycling	Non-governmental organisation specialised in the Global South	NL
9	Civil Society	Innovation & Solution Manager	Environmental organisation	NL
10	Business	1) Technical Engineer 2) Plastic Manager	Large recycling firm	NL
11	Business	Business Development Manager	Large recycling firm	NL
12	Business	Director	Large recycling firm	NL
13	Business	1) Innovation Consultant 2) Director of Policy, Advice, and Public Affairs	Branch association for plastic producers	NL
14	Business	Director	Plastic producers (International branch association)	NL
15	Business	Director	Plastic producer (Bio-based)	NL
16	Business	Managing Director	Plastic producer (Trade association)	NL
17	Business	Sustainability Director Benelux	Plastic applier (Multinational product-consumer brand)	NL
18	Business	Sustainability Manager	Plastic applier (Multinational brand owner)	NL
19	Business	Corporate Sustainability	Plastic applier (Multinational retail firm)	NL
20	Business	Director	Consultancy in biotechnology	NL
21	Business	Director	Consultancy in packaging	NL
22	Business	Associate Director Sustainability	Consultancy (multinational)	NL
23	Business	Consultant household waste	Consultancy in circular economy	NL
24	Business	Director & chemical engineer	Consultancy in circular economy, chemical recycling, and bioplastic	NL

G: Invited Participants for the Q-sort

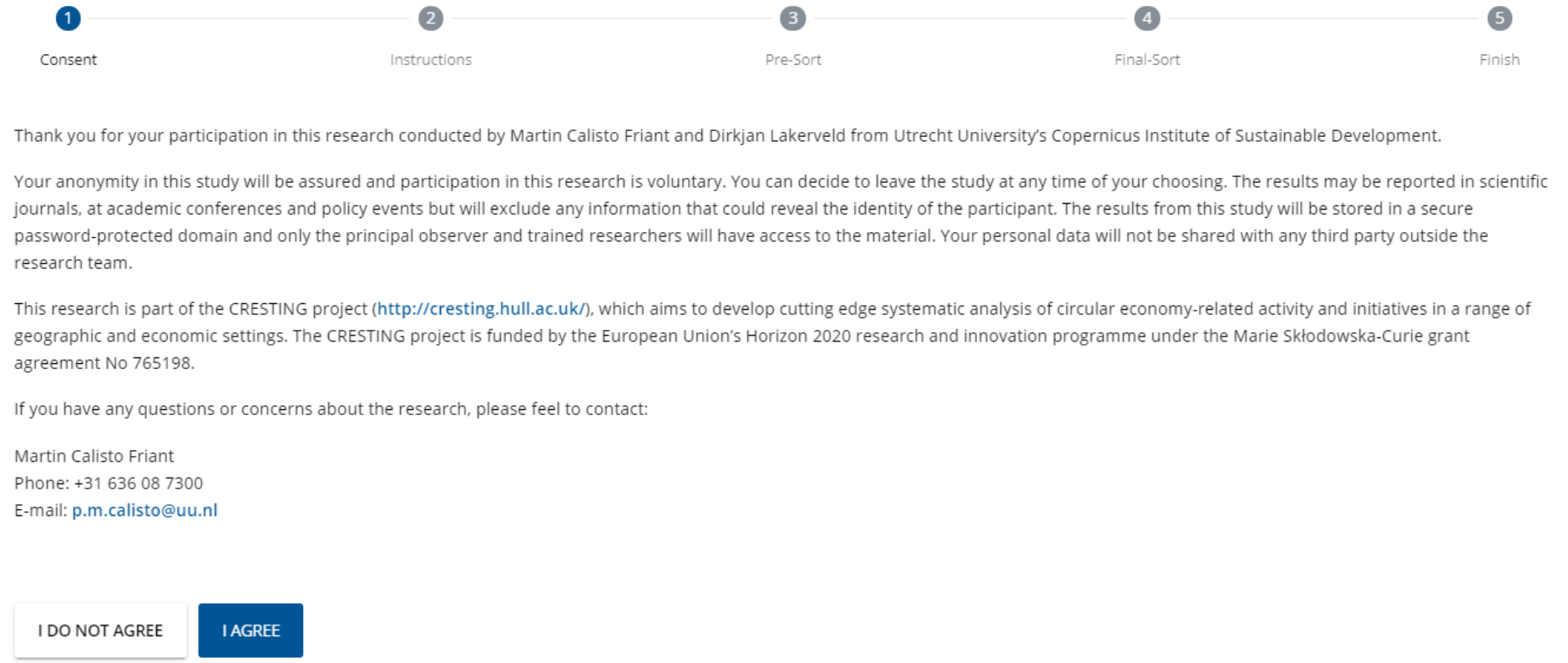
Invited participants for the Q survey	**Category**	**#**	**Response**
A New Zero	Consultancy	1	
Berenschot	Consultancy	1	
CE Delft	Consultancy	2	Yes
Den Hartog BV	Consultancy	1	
Ernst & Young Accountants LLP	Consultancy	1	
Green Serendipty	Consultancy	1	
Kiduara	Consultancy	1	
KplusV	Consultancy	1	Yes
Rebel Group	Consultancy	2	
RoyalhaskoningDHV	Consultancy	1	
Searious Business	Consultancy	1	
Triple Benefit	Consultancy	1	
Adessium Foundation	Civil Society Organisation	1	
CITIES FOUNDATION	Civil Society Organisation	1	
Enviu	Civil Society Organisation	1	
Greenpeace	Civil Society Organisation	1	
Natuur en Milieu	Civil Society Organisation	1	Yes
Plastic Soup Foundation	Civil Society Organisation	5	Yes (1)
Recycled Island Foundation	Civil Society Organisation	2	
Recycling Netwerk	Civil Society Organisation	1	
Seas At Risk	Civil Society Organisation	1	
Surfrider Foundation Europe	Civil Society Organisation	1	
The Ocean Clean-up	Civil Society Organisation	1	
Think Beyond Plastic	Civil Society Organisation	2	
WASTE	Civil Society Organisation	1	
WWF	Civil Society Organisation	1	
Kennisinstituut Duurzaam Verpakken	Research institute	2	Too late
PACE Material Science & Innovation	Research institute	1	
TNO	Research institute	3	
Twente University	Research institute	2	Yes (1)
University of Utrecht	Research institute	2	Yes (2)
Wageningen Food & Biobased Research	Research institute	1	Yes
Wageningen University	Research institute	3	
Aldi	Plastic applier / brand owner	1	Yes
Coca Cola European Partners	Plastic applier / brand owner	1	Too late
Dopper	Plastic applier / brand owner	1	
Interface	Plastic applier / brand owner	1	
Philips	Plastic applier / brand owner	1	
Plastic Circle B.V.	Plastic applier / brand owner	2	
Port of Rotterdam	Plastic applier / brand owner	1	
Sony	Plastic applier / brand owner	1	
Unilever	Plastic applier / brand owner	3	Yes (1)

4PET Recycling	Plastic recycling	1	
ARN Recycling	Plastic recycling	1	
Coolrec	Plastic recycling	2	
Corbion	Plastic recycling	1	
EXPRA / Dutch Wastefund	Plastic recycling	1	
De Pyr-Oil Group	Plastic recycling	1	
Dutch Waste Management Association	Plastic recycling	1	Yes
GreenWavePlastics	Plastic recycling	1	
Ioniqa Technologies B.V.	High quality PET recycling	1	
Midwaste (cooperation between companies)	Plastic recycling	2	
Morssinkhof Plastics	Plastic recycling	1	
NRK Recycling	Plastic recycling	2	Yes (1)
Omrin	Plastic recycling	1	
Plastics Recyclers Europe	Plastic recycling	1	
Polytential	Plastic recycling	1	
Quality Circular Polymers (QCP)	High quality plastic recycling	2	
Renewi	Plastic recycling	1	Yes
SABIC	Plastic recycling	3	Yes (1)
SUEZ	Plastic recycling	1	
Upp! UpCycling Plastic	Plastic recycling	1	
Van Gansewinkel Groep	Plastic recycling	1	
Van Werven Plastic Recycling	Plastic recycling	1	Yes
Veolia Polymers	Plastic recycling	1	
Vita Plastics	Plastic recycling	1	
Wellman Recycling	Plastic recycling	1	
Avantium	Plastic producer	2	
Borealis	Plastic producer	1	
BureauLeiding (rethinkplastics)	Plastic producer	1	Yes
DSM	Plastic producer	1	
DuPont de Nemours	Plastic producer	1	
Grow Bioplastics	Plastic producer	2	
LyondellBasell	Plastic producer	1	
Plastics Europe-NL	Plastic producer	3	
Save Plastics	Plastic producer	1	
Shell Chemicals	Plastic producer	1	Yes
Vibers	Plastic producer	1	
Flestic	Plastic producer packaging	1	
Full Cycle Bioplastics	Bioplastic producer	1	
Mobius PBC	Bioplastic producer	1	Yes
NatureWorks	Bioplastic producer	1	
Rodenburg Biopolymers	Bioplastic producer	1	
Total Corbion	Bioplastic producer	1	Yes
City of Rotterdam	City	1	
Municipality Rotterdam	Municipality	3	
Circulair Friesland	Province	1	

Association of Dutch Municipalities (VNG)	Dutch Municipalities	1	
Ministry of Economic Affairs	Government	2	
Ministry of Infrastructure and the Environment	Government	11	
Ministry of Infrastructure and Water Management	Government	2	Yes (2)
Rijkswaterstaat	Government	9	Yes (1)
Centraal Planbureau	Government agency	2	Yes (1)
Planbureau voor de Leefomgeving	Government agency	1	
	Total	**145**	3 not specified

H: Q method software process

Consent text



Instruction text (1)

Welcome to the Utrecht University CRESTING project survey on the circular plastic economy.

The questionnaire consists of four steps and takes 25 to 40 minutes in total. This part of the research aims to gain insight in which action statements **you consider most and least important** for a more circular and sustainable future for plastics in the Netherlands.

Please always keep the following question in mind when ranking the statements:

"How important do you consider the following action statements in the transition to a sustainable circular plastics economy in the Netherlands?"

Below is a brief explanation of the steps to help you through the process.

1. **Pre-sort the statements** (+/- 5-10 minutes)

The first stage of the sorting tasks is **pre-sorting**. Read all the 42 statements first. Then, go back to the first statement, and click the icon that corresponds with your feeling, belief, or attitude about the statement. There are three choices: 'not important' (thumb-down icon), 'neutral' (question mark) and 'important' (thumb-up icon). Don't worry about making mistakes at this stage. You can change the sorting and ranking of each statement in the next step. When all the statements have been pre-sorted, you will be directed to the final sorting page.

2. **Sort and rank the statements onto the grid** (+/- 15-20 minutes)

Please drag and drop each card at the top onto the distribution grid ranging on importance from -5 (least important) to 0 (neutral) and +5 (most important). You may find all the statements important, however, please make a choice based on *your* knowledge, opinion, and belief.

Use the zoom in (+) button on the left side of the screen to enlarge the Q-grid and make the statements easier to read. Click the zoom out (-) button to view the entire grid.

You can also:

- Click the help button (the question mark on the right) to view Q Method Software's help page.
- Click the reset button to return all the statements to the three piles and start over. If you click reset, a confirmation dialogue opens. Click Yes to confirm.

Instruction tekst (2)

3. **Review your Q-sort** (+/- 5-10 minutes)

When you're done placing the statements onto the distribution grid, please review your Q-sort. Drag and drop the statements to reorder them as you wish.

4. **Submit your Q-sort**

When you're happy with the Q-sort, click the Submit icon.

5. **Final Questions**

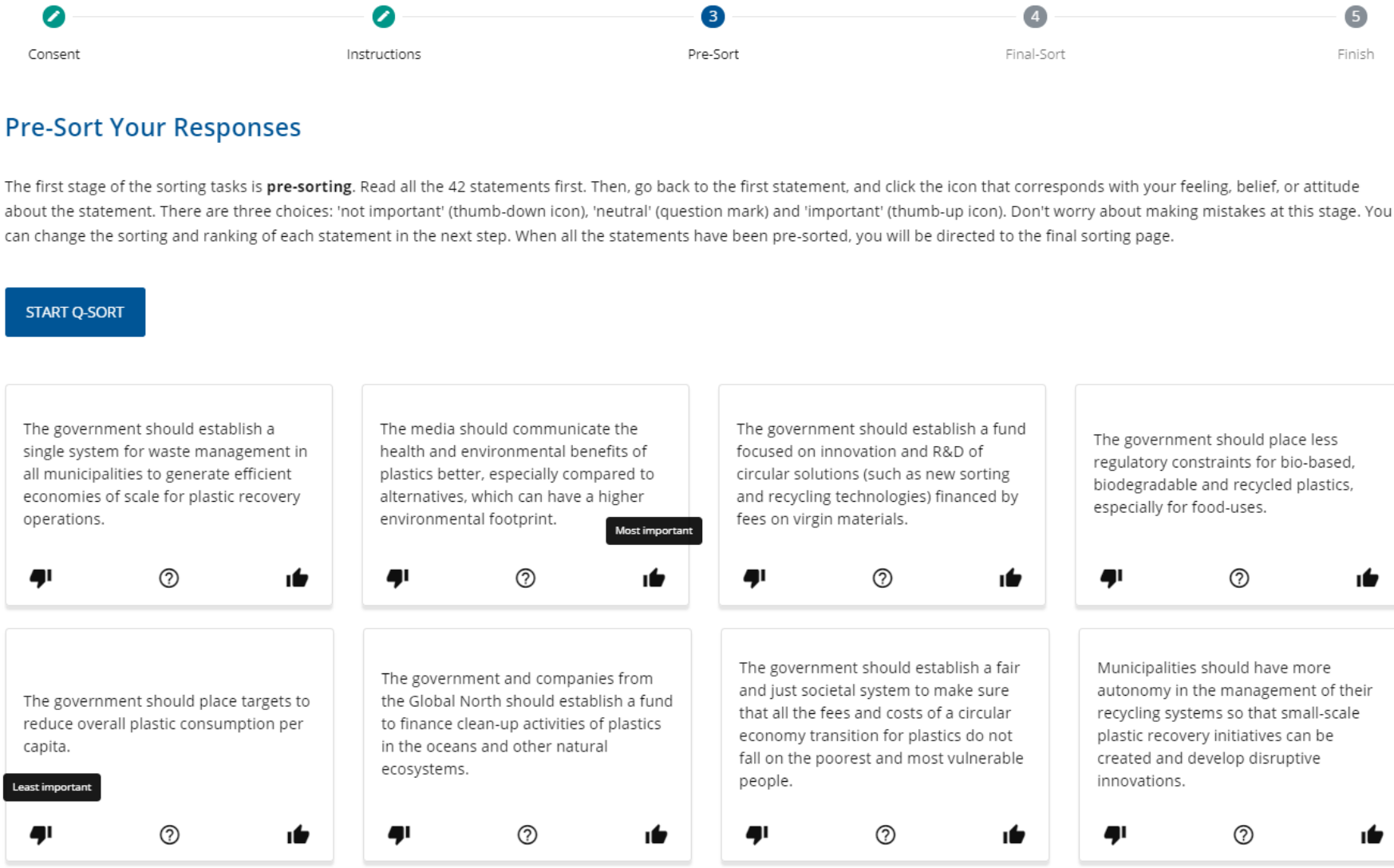
Please complete a few final questions.

Do not hesitate in sending us any questions or doubts regarding the questionnaire directly by phone or email.

Martin Calisto Friant
Phone: +31 636 08 7300
E-mail: p.m.calisto@uu.nl

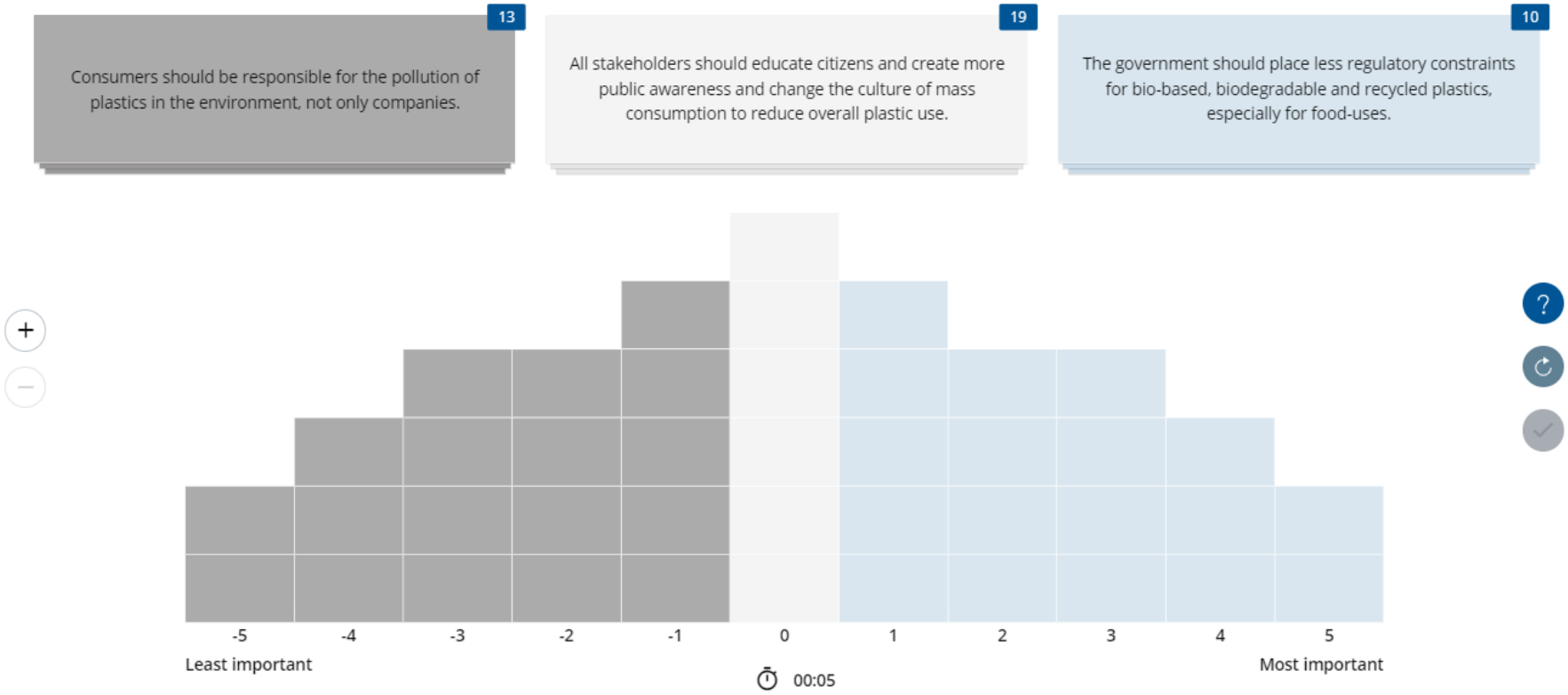
START SURVEY

Pre-sort process



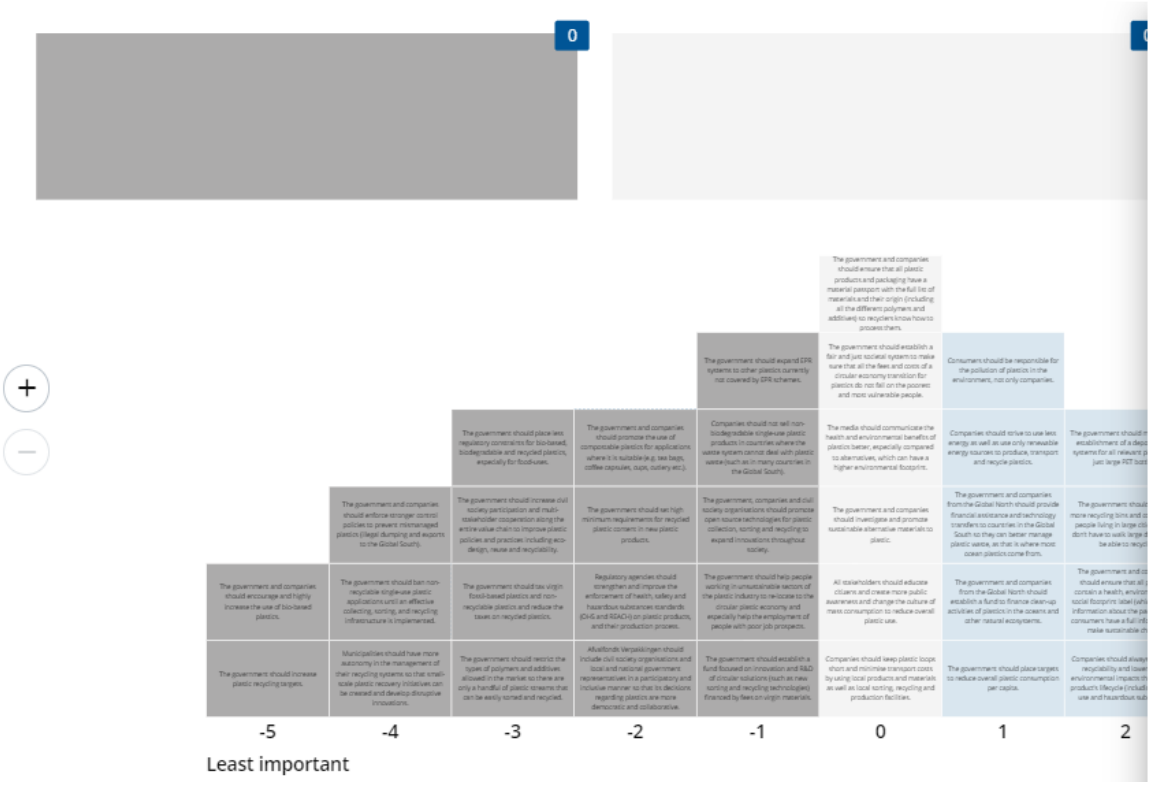
Etc.

Start of final Q-sort



Submit final Q-sort

This Q-sort is randomly filled in and was not submitted.



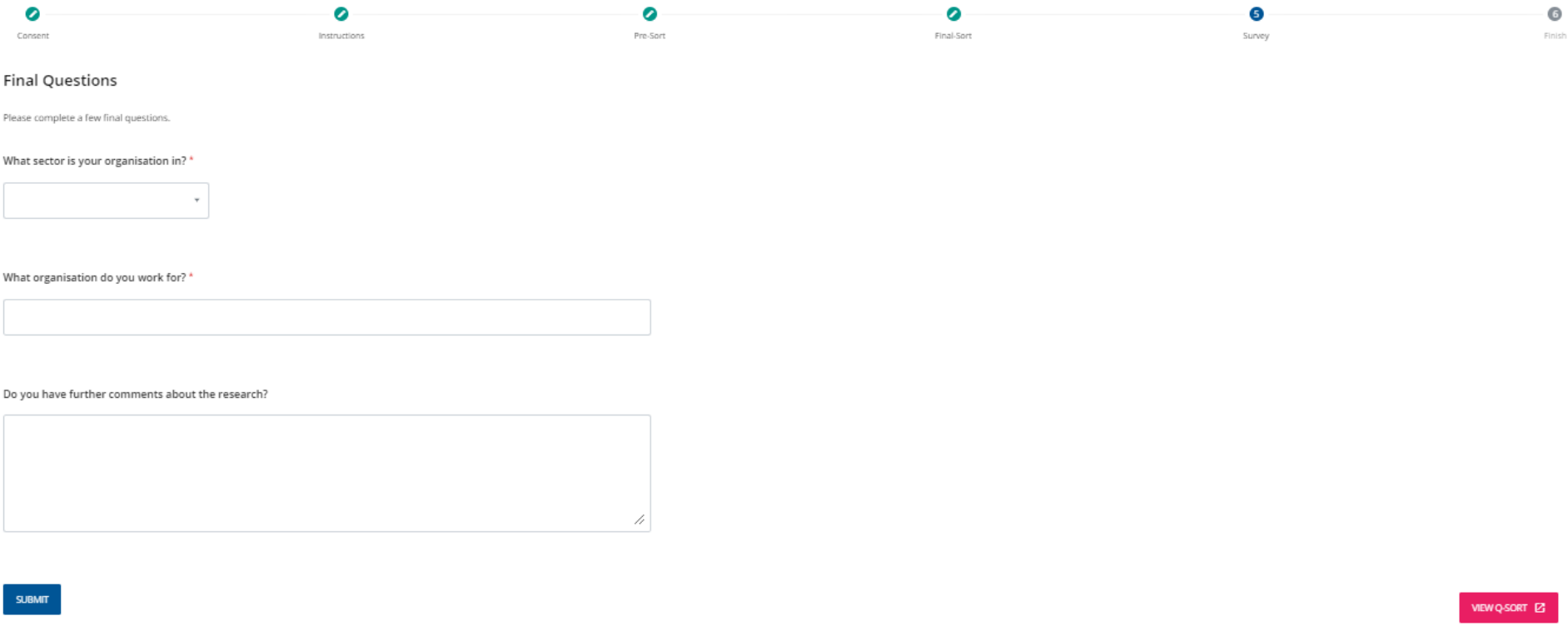
Submit Study

Are you sure that you want to submit at this time?

You cannot make changes after you submit, so please be sure that the items are sorted as you wish before agreeing to submit.

NO YES

Final Questions



I: Full data recycling percentages Afvalfonds Verpakkingen 2014 – 2018

Year	Brought on the market in Kton	Recycled (R7) in Kton	% Recycled (R7)	Energy recovery (R8) in Kton	% Energy recovery (R8)	% Energy recovery (R8) residual waste households and companies (not seperately collected)	% Energy recovery (R8) after sorting (*only households)*	Target % recycling (R7) (EU Directive 2018/852)	Target % recycling (R7) (Packaging Management Decree 2014)	Target % recycling (R7) (Framework Agreement on Packaging 2014)
2013	468	268	47%	200	53%	47%	6%	22,5%	43%	44%
2014	474	240	51%	234	49%	42%	7%	22,5%	44%	46%
2015	492	245	50%	247	50%	44%	6%	22,5%	45%	48%
2016	505	264	52%	241	48%	40%	8%	22,5%	46%	50%
2017	519	263	51%	256	49%	37%	12%	22,5%	47%	52%
2018	523	272	52%	251	48%	35%	13%	22,5%	48%	?

Year	Brought on the market in Kton	Recycled (R7) in Kton	% Recycled (R7)	Energy recovery (R8) in Kton	% Energy recovery (R8)	% Energy recovery (R8) residual waste households and companies (not seperately collected)	% Energy recovery (R8) after sorting (*only households)*
2013	468	268	47%	200	53%	47%	6%
2014	474	240	51%	234	49%	42%	7%
2015	492	245	50%	247	50%	44%	6%
2016	505	264	52%	241	48%	40%	8%
2017	519	263	51%	256	49%	37%	12%
2018	523	272	52%	251	48%	35%	13%

Source: Monitoring reports Afvalfonds Verpakkingen 2014, 2015, 2016, 2017, and 2018.

J: Output PQ Method

Correlation Matrix between individual Q-sorts

The correlation matrix between all sorts is shown below. The results are extracted from the PQ Method. Theoretically, loadings range from 100 (exact the same), 0 (neutral), and -100 (totally opposite) Q-sorts.

```
PQMethod2.35              Q study with organisations involved in the transtion to a Dutch circ                PAGE    1
Path and Project Name: C:\PQMethod\projects/Masterth                                                           May 23 20

Correlation Matrix Between Sorts

SORTS          1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25  26

  1 CSO1     100  11  17  13 -19  35  37  27  10  11  23  10  29  19  52  45  23  12  12  15 -16  -3 -12  -8  14  12
  2 GOV1      11 100   2  24  12  22  39  22  -2  25  33 -12   3  -7  10  51  35  40  25  13  14  11   3   8  32   6
  3 PAO1      17   2 100  50  29  -8  11  23  16  21  15  30   0  35  16  28  30  25  11  46   9  17  11  14  39  50
  4 WMC1      13  24  50 100  31 -20  30  35  31  44  22  18  15  32  25  42  16  21  37  39  -2  38  -1  49  10  43
  5 PAO2     -19  12  29  31 100 -17 -11   3  35  19  45  23  -1  51 -11  -1  21  27  22  16  22  42  18  -1  11  16
  6 CSO2      35  22  -8 -20 -17 100  13   4 -37   1  18 -26  19 -26  28  13  31  14 -10   0 -22  -4   7   3  10  -1
  7 RIN1      37  39  11  30 -11  13 100  20   6  15  13  19  13   3  31  51  10  13  37  -2  23  21   6  17  18  12
  8 COO1      27  22  23  35   3   4  20 100  10  15  32  -4  19  26  25  31  18  26  22  31   0  31   1  17  16  32
  9 PPO1      10  -2  16  31  35 -37   6  10 100   3  19  35  -2  59   5  18   4   1  32  24  21  23 -17  22  13   5
 10 ANO1      11  25  21  44  19   1  15  15   3 100  34   2   9  28   4  40  21  17  51  35  17   5  -8  14  30  39
 11 CSO3      23  33  15  22  45  18  13  32  19  34 100   9  28  36  26  30  29  37  35  26   4  19   6   0   1  25
 12 WMC2      10 -12  30  18  23 -26  19  -4  35   2   9 100   4  39   5  24   3  -6  17 -11  35   8   5   8  11  33
 13 GOV2      29   3   0  15  -1  19  13  19  -2   9  28   4 100  19  45  10  25  10  22  -3 -22   1   1   6 -15  38
 14 PPO2      19  -7  35  32  51 -26   3  26  59  28  36  39  19 100   7  22  21   1  30  14  26  17  -9  -8  22  29
 15 RIN2      52  10  16  25 -11  28  31  25   5   4  26   5  45   7 100  17  31  21   9  23 -33  13  -8   9 -13  21
 16 WMC3      45  51  28  42  -1  13  51  31  18  40  30  24  10  22  17 100  28  29  45   3   6  18  -3   5  25  37
 17 PAO3      23  35  30  16  21  31  10  18   4  21  29   3  25  21  31  28 100  43  32  29 -18  11  -8  -3  35  37
 18 COO2      12  40  25  21  27  14  13  26   1  17  37  -6  10   1  21  29  43 100  20  35 -16  35  21  15  11  17
 19 WMC4      12  25  11  37  22 -10  37  22  32  51  35  17  22  30   9  45  32  20 100  18   8   7  -8   5  15  40
 20 WMC5      15  13  46  39  16   0  -2  31  24  35  26 -11  -3  14  23   3  29  35  18 100  15   5 -12  13  42  21
 21 RIN3     -16  14   9  -2  22 -22  23   0  21  17   4  35 -22  26 -33   6 -18 -16   8  15 100  15  22   4  32  -6
 22 RIN4      -3  11  17  38  42  -4  21  31  23   5  19   8   1  17  13  18  11  35   7   5  15 100  19  44  -5  26
 23 PPO3     -12   3  11  -1  18   7   6   1 -17  -8   6   5   1  -9  -8  -3  -8  21  -8 -12  22  19 100   7 -14  -9
 24 PPO4      -8   8  14  49  -1   3  17  17  22  14   0   8   6  -8   9   5  -3  15   5  13   4  44   7 100 -21  11
 25 GOV3      14  32  39  10  11  10  18  16  13  30   1  11 -15  22 -13  25  35  11  15  42  32  -5 -14 -21 100  33
 26 GOV4      12   6  50  43  16  -1  12  32   5  39  25  33  38  29  21  37  37  17  40  21  -6  26  -9  11  33 100
```

Unrotated Factor Matrix

PQ Method automatically derived four factors (1, 2, 4 and 6) with an Eigen Value greater than 1. All factors with an EV greater than 1 can be considered as a potential factor to determine a certain perspective. After all, the Varimax rotation was necessary to arrive at the optimal solution.

```
Unrotated Factor Matrix
                Factors
                  1         2         3         4         5         6         7
SORTS
 1 CSO1         0.3697    0.4020    0.1195    0.2642    0.0655   -0.1405    0.0115
 2 GOV1         0.4169    0.3196    0.0735   -0.1795    0.0276    0.3851    0.1611
 3 PAO1         0.5422   -0.1743    0.0194    0.0392    0.0015    0.0339    0.0022
 4 WMC1         0.6572   -0.2058    0.0277    0.1778    0.0291    0.1142    0.0155
 5 PAO2         0.3804   -0.4653    0.1578   -0.4027    0.1603   -0.1116    0.0066
 6 CSO2         0.0457    0.5944    0.2970    0.1276    0.0156    0.0891    0.0101
 7 RIN1         0.4442    0.1027    0.0077    0.2528    0.0598    0.1477    0.0244
 8 COO1         0.4887    0.0809    0.0049    0.0962    0.0086    0.0643    0.0059
 9 PPO1         0.3309   -0.4239    0.1279   -0.1668    0.0237   -0.2627    0.0504
10 ANO1         0.4945    0.0898    0.0059   -0.2300    0.0465    0.0708    0.0069
11 CSO3         0.5730    0.0762    0.0044   -0.1716    0.0251   -0.1665    0.0174
12 WMC2         0.2738   -0.3933    0.1084    0.0831    0.0064   -0.2666    0.0522
13 GOV2         0.2692    0.2450    0.0426    0.2370    0.0522   -0.4574    0.1887
14 PPO2         0.4877   -0.3241    0.0713   -0.1945    0.0327   -0.4804    0.2143
15 RIN2         0.3558    0.3306    0.0789    0.3998    0.1633   -0.2677    0.0530
16 WMC3         0.6289    0.1926    0.0265    0.0694    0.0046    0.0679    0.0065
17 PAO3         0.5082    0.3421    0.0848   -0.1650    0.0232   -0.1023    0.0050
18 COO2         0.4713    0.1279    0.0117   -0.0183    0.0002    0.1501    0.0251
19 WMC4         0.5388    0.0872    0.0056   -0.1874    0.0302   -0.1155    0.0069
20 WMC5         0.4344    0.0060    0.0000   -0.2679    0.0643    0.1649    0.0298
21 RIN3         0.1350   -0.3735    0.0968   -0.1990    0.0343    0.2531    0.0673
22 RIN4         0.4155   -0.3362    0.0771    0.1962    0.0354    0.1602    0.0283
23 PPO3         0.0161   -0.1635    0.0170    0.1040    0.0100    0.2204    0.0514
24 PPO4         0.2273   -0.2205    0.0317    0.3374    0.1110    0.3036    0.0970
25 GOV3         0.3475    0.0725    0.0039   -0.3396    0.1082    0.2044    0.0446
26 GOV4         0.5769    0.0020    0.0001    0.1316    0.0159   -0.1030    0.0051

Eigenvalues     4.8648    2.0572    0.2000    1.2324    0.1017    1.2739    0.1381
% expl.Var.         19         8         1         5         0         5         1
```

Factor Scores per Perspective

The factor scores per perspective are shown in the table below, where 5 indicates most important, 0 neutral, and -5 least important policy actions. The results are derived from the PQ Method software.

			Scores per perspective			
#	**Themes**	**Q action statements**	*Persp. 1*	*Persp. 2*	*Persp. 3*	*Persp. 4*
1.	Alternatives to plastic	The government and companies should investigate and promote sustainable alternative materials to plastic.	-1	0	0	3
2.	Ban export outside the EU	The EU should ban the export of plastic waste outside Europe so plastic waste is recycled and processed within European borders.	4	1	2	2
3.	Benefits of plastics	The media should communicate the health and environmental benefits of plastics better, especially compared to alternatives, which can have a higher environmental footprint.	-4	4	3	0
4.	Promote bio-based plastics	The government and companies should encourage and highly increase the use of bio-based plastics.	-2	-3	-3	4
5.	Regulate bio-based plastics	The government should highly regulate bio-based plastic to prevent that they compete with food production and biodiversity conservation.	-1	2	2	-5
6.	Clean-up fund	The government and companies from the Global North should establish a fund to finance clean-up activities of plastics in the oceans and other natural ecosystems.	2	1	-3	-2
7.	Promote compostable plastics	The government and companies should promote the use of compostable plastics for applications where it is suitable (e.g. tea bags, coffee capsules, cups, cutlery etc.).	-4	-2	0	5
8.	Consumer responsibility	Consumers should be responsible for the pollution of plastics in the environment, not only companies.	-5	2	3	0
9.	Ban controversial fossil plastics	The government should ban plastics made from controversial sources such as tar sands and shale gas.	0	-5	-2	-1
10.	Deposit return system	The government should mandate the establishment of a deposit return systems for all relevant plastics (not just large PET bottles).	5	-1	1	-3
11.	Design for sustainability	Companies should always design for recyclability and lower overall environmental impacts throughout a product's lifecycle (including resource use and hazardous substances).	4	4	5	3

12.	Discourage incineration	The government should establish financial and legal incentives to discourage the incineration of lower grade plastics (with or without energy recovery) and promote their recycling.	3	5	2	1
13.	Education & awareness	All stakeholders should educate citizens and create more public awareness and change the culture of mass consumption to reduce overall plastic use.	0	0	-1	1
14.	Enforcement and control	The government and companies should enforce stronger control policies to prevent mismanaged plastics (illegal dumping and exports to the Global South).	1	3	1	-1
15.	Expand EPR to other plastics	The government should expand EPR systems to other plastics currently not covered by EPR schemes.	2	3	4	-2
16.	Fair and just societal system	The government should establish a fair and just societal system to make sure that all the fees and costs of a circular economy transition for plastics do not fall on the poorest and most vulnerable people.	0	2	-5	2
17.	Global solidarity	Government and companies from the Global North should provide financial assistance and technology transfers to countries in the Global South so they can better manage plastic waste, as that is where most ocean plastics come from.	3	-1	-3	-2
18.	Health, safety and toxicity	Regulatory agencies should strengthen and improve the enforcement of health, safety, and hazardous substances standards (OHS and REACH) on plastic products, and their production process.	-3	-3	-1	0
19.	EPR inclusiveness and participation	Afvalfonds Verpakkingen should include civil society organisations and local and national government representatives in a participatory and inclusive manner so that its decisions regarding plastics are more democratic and collaborative.	0	0	-4	0
20.	Increase EPR fees	Afvalfonds Verpakkingen should increase the waste management contribution fee paid to the EPR system because the current price is too low to foster the best recovery practices.	-1	-2	2	-1
21.	Innovation fund	The government should establish a fund focused on innovation and R&D of circular solutions (such as new sorting and recycling technologies) financed by fees on virgin materials.	1	3	0	1
22.	Marketing on recyclability	The government and companies should ensure that claims about recyclability and composability are not misleading and deceptive.	0	4	3	1
23.	Municipal autonomy	Municipalities should have more autonomy in the management of their recycling systems so that small-scale plastic recovery initiatives can be created and develop disruptive innovations.	-3	-2	-5	-4
24.	Ban non-recyclable plastics	The government should ban non-recyclable single-use plastic applications until an effective collecting, sorting, and recycling infrastructure is implemented.	3	-4	0	-2

25.	Open-source innovations	The government, companies, and civil society organisations should promote open source technologies for plastic collection, sorting, and recycling to expand innovations throughout society.	-1	3	-1	0
26.	Multi-stakeholder participation and collaboration	The government should increase civil society participation and multi-stakeholder cooperation along the entire value chain to improve plastic policies and practices including eco-design, reuse, and recyclability.	1	2	-1	-1
27.	Material passport	The government and companies should ensure that all plastic products and packaging have a material passport with the full list of materials and their origin (including all the different polymers and additives) so recyclers know how to process them.	1	-5	1	0
28.	Restrict polymer types	The government should restrict the types of polymers and additives allowed in the market so there are only a handful of plastic streams that can be easily sorted and recycled.	-2	-4	3	-5
29.	Product ecological footprint	The government and companies should ensure that all products contain a health, environment, and social footprint label (which includes information about the packaging), so consumers have full information to make sustainable choices.	-3	-1	1	-3
30.	Recycled content requirements	The government should set high minimum requirements for recycled plastic content in new plastic products.	3	-3	4	4
31.	Recycling bins	The government should provide more recycling bins and containers to people living in large cities, so they don't have to walk large distances to be able to recycle.	-2	0	-2	2
32.	Recycling targets	The government should increase plastic recycling targets.	1	1	4	4
33.	Less regulatory constraints	The government should place less regulatory constraints for bio-based, biodegradable, and recycled plastics, especially for food-uses.	-4	-2	-2	3
34.	Renewable energy sources	Companies should strive to use less energy as well as use only renewable energy sources to produce, transport, and recycle plastics.	-2	0	0	4
35.	Restrict sales in Global South	Companies should not sell non-biodegradable single-use plastic products in countries where the waste system cannot deal with plastic waste (such as in many countries in the Global South).	2	-1	-4	3
36.	Promote reusable packaging	The government and companies should highly increase the use of reusable packaging.	5	-3	1	-3
37.	Short loops	Companies should keep plastic loops short and minimise transport costs by using local products and materials as well as local sorting, recycling, and production facilities.	-5	-1	-2	-3

38.	Employment and social inclusion	The government should help people working in unsustainable sectors of the plastic industry to re-locate to the circular plastic economy and especially help the employment of people with poor job prospects.	-3	1	-3	-1
39.	Taxes on plastic	The government should tax virgin fossil-based plastics and non-recyclable plastics and reduce the taxes on recycled plastics.	4	1	5	5
40.	Transparency on pledged commitments	Companies should publicly disclose data on their use of plastics including information on plastic recycling and bioplastics, as well as data regarding the progress on the achievement of pledged commitments such as the Plastic Pact.	-1	0	-1	2
41.	Unified municipal system	The government should establish a single system for waste management in all municipalities to generate efficient economies of scale for plastic recovery operations.	0	5	0	1
42.	Reduce virgin-plastic consumption	The government should place targets to reduce overall plastic consumption per capita.	2	-4	-4	-4

Z-scores per perspective 1

Factor Scores -- For Factor 1

No.	Statement	No.	Z-SCORES
36	The government and companies should highly increase the use	36	2.101
10	The government should mandate the establishment of a deposit	10	1.566
2	The EU should ban the export of plastic waste outside Europe	2	1.334
39	The government should tax virgin fossil-based plastics and n	39	1.326
11	Companies should always design for recyclability and lower o	11	1.272
12	The government should establish financial and legal incentiv	12	1.157
30	The government should set high minimum requirements for recy	30	1.093
24	The government should ban non-recyclable single-use plastic	24	0.896
17	Government and companies from the Global North should provid	17	0.849
6	The government and companies from the Global North should es	6	0.834
35	Companies should not sell non-biodegradable single-use plast	35	0.814
15	The government should expand EPR systems to other plastics c	15	0.678
42	The government should place targets to reduce overall plasti	42	0.648
32	The government should increase plastic recycling targets.	32	0.636
14	The government and companies should enforce stronger control	14	0.590
27	The government and companies should ensure that all plastic	27	0.391
21	The government should establish a fund focused on innovation	21	0.355
26	The government should increase civil society participation a	26	0.240
41	The government should establish a single system for waste ma	41	0.203
16	The government should establish a fair and just societal sys	16	0.171
13	All stakeholders should educate citizens and create more pub	13	0.136
22	The government and companies should ensure that claims about	22	0.110
9	The government should ban plastics made from controversial s	9	-0.088
19	Afvalfonds Verpakkingen should include civil society organis	19	-0.355
40	Companies should publicly disclose data on their use of plas	40	-0.362
20	Afvalfonds Verpakkingen should increase the waste management	20	-0.370
1	The government and companies should investigate and promote	1	-0.411
5	The government should highly regulate bio-based plastic to p	5	-0.430
25	The government, companies, and civil society organisations s	25	-0.438
34	Companies should strive to use less energy as well as use on	34	-0.555
28	The government should restrict the types of polymers and add	28	-0.574
4	The government and companies should encourage and highly inc	4	-0.589
31	The government should provide more recycling bins and contai	31	-0.678
38	The government should help people working in unsustainable s	38	-0.717
23	Municipalities should have more autonomy in the management o	23	-0.896
29	The government and companies should ensure that all products	29	-1.163
18	Regulatory agencies should strengthen and improve the enforc	18	-1.169
7	The government and companies should promote the use of compo	7	-1.470
3	The media should communicate the health and environmental be	3	-1.531
33	The government should place less regulatory constraints for	33	-1.669
8	Consumers should be responsible for the pollution of plastic	8	-1.833
37	Companies should keep plastic loops short and minimise trans	37	-2.101

Z-scores per perspective 2

Factor Scores -- For Factor 2

No.	Statement	No.	Z-SCORES
41	The government should establish a single system for waste ma	41	2.022
12	The government should establish financial and legal incentiv	12	1.834
11	Companies should always design for recyclability and lower o	11	1.487
3	The media should communicate the health and environmental be	3	1.382
22	The government and companies should ensure that claims about	22	1.345
15	The government should expand EPR systems to other plastics c	15	1.133
21	The government should establish a fund focused on innovation	21	1.126
14	The government and companies should enforce stronger control	14	1.002
25	The government, companies, and civil society organisations s	25	0.868
8	Consumers should be responsible for the pollution of plastic	8	0.849
26	The government should increase civil society participation a	26	0.724
16	The government should establish a fair and just societal sys	16	0.691
5	The government should highly regulate bio-based plastic to p	5	0.594
6	The government and companies from the Global North should es	6	0.499
39	The government should tax virgin fossil-based plastics and n	39	0.492
2	The EU should ban the export of plastic waste outside Europe	2	0.454
38	The government should help people working in unsustainable s	38	0.420
32	The government should increase plastic recycling targets.	32	0.390
19	Afvalfonds Verpakkingen should include civil society organis	19	0.242
40	Companies should publicly disclose data on their use of plas	40	0.241
34	Companies should strive to use less energy as well as use on	34	0.192
31	The government should provide more recycling bins and contai	31	0.126
1	The government and companies should investigate and promote	1	-0.371
13	All stakeholders should educate citizens and create more pub	13	-0.495
37	Companies should keep plastic loops short and minimise trans	37	-0.545
17	Government and companies from the Global North should provid	17	-0.599
29	The government and companies should ensure that all products	29	-0.616
35	Companies should not sell non-biodegradable single-use plast	35	-0.647
10	The government should mandate the establishment of a deposit	10	-0.654
7	The government and companies should promote the use of compo	7	-0.661
20	Afvalfonds Verpakkingen should increase the waste management	20	-0.668
23	Municipalities should have more autonomy in the management o	23	-0.766
33	The government should place less regulatory constraints for	33	-0.787
4	The government and companies should encourage and highly inc	4	-0.810
18	Regulatory agencies should strengthen and improve the enforc	18	-0.890
30	The government should set high minimum requirements for recy	30	-0.943
36	The government and companies should highly increase the use	36	-0.967
24	The government should ban non-recyclable single-use plastic	24	-1.097
28	The government should restrict the types of polymers and add	28	-1.243
42	The government should place targets to reduce overall plasti	42	-1.583
9	The government should ban plastics made from controversial s	9	-1.744
27	The government and companies should ensure that all plastic	27	-2.029

Z-scores per perspective 3

Factor Scores -- For Factor 3

No.	Statement	No.	Z-SCORES
39	The government should tax virgin fossil-based plastics and n	39	2.275
11	Companies should always design for recyclability and lower o	11	1.840
32	The government should increase plastic recycling targets.	32	1.480
30	The government should set high minimum requirements for recy	30	1.455
15	The government should expand EPR systems to other plastics c	15	1.099
3	The media should communicate the health and environmental be	3	0.947
8	Consumers should be responsible for the pollution of plastic	8	0.923
28	The government should restrict the types of polymers and add	28	0.876
22	The government and companies should ensure that claims about	22	0.840
2	The EU should ban the export of plastic waste outside Europe	2	0.810
5	The government should highly regulate bio-based plastic to p	5	0.787
12	The government should establish financial and legal incentiv	12	0.760
20	Afvalfonds Verpakkingen should increase the waste management	20	0.560
36	The government and companies should highly increase the use	36	0.538
29	The government and companies should ensure that all products	29	0.485
10	The government should mandate the establishment of a deposit	10	0.480
27	The government and companies should ensure that all plastic	27	0.387
14	The government and companies should enforce stronger control	14	0.182
41	The government should establish a single system for waste ma	41	0.174
34	Companies should strive to use less energy as well as use on	34	0.060
7	The government and companies should promote the use of compo	7	-0.017
21	The government should establish a fund focused on innovation	21	-0.019
24	The government should ban non-recyclable single-use plastic	24	-0.027
1	The government and companies should investigate and promote	1	-0.091
13	All stakeholders should educate citizens and create more pub	13	-0.210
40	Companies should publicly disclose data on their use of plas	40	-0.250
25	The government, companies, and civil society organisations s	25	-0.269
18	Regulatory agencies should strengthen and improve the enforc	18	-0.290
26	The government should increase civil society participation a	26	-0.301
9	The government should ban plastics made from controversial s	9	-0.596
37	Companies should keep plastic loops short and minimise trans	37	-0.651
31	The government should provide more recycling bins and contai	31	-1.013
33	The government should place less regulatory constraints for	33	-1.024
6	The government and companies from the Global North should es	6	-1.032
17	Government and companies from the Global North should provid	17	-1.038
4	The government and companies should encourage and highly inc	4	-1.257
38	The government should help people working in unsustainable s	38	-1.259
35	Companies should not sell non-biodegradable single-use plast	35	-1.268
19	Afvalfonds Verpakkingen should include civil society organis	19	-1.271
42	The government should place targets to reduce overall plasti	42	-1.362
16	The government should establish a fair and just societal sys	16	-1.698
23	Municipalities should have more autonomy in the management o	23	-2.019

Z-scores per perspective 4

Factor Scores -- For Factor 4

No.	Statement	No.	Z-SCORES
7	The government and companies should promote the use of compo	7	1.951
39	The government should tax virgin fossil-based plastics and n	39	1.713
4	The government and companies should encourage and highly inc	4	1.572
30	The government should set high minimum requirements for recy	30	1.474
32	The government should increase plastic recycling targets.	32	1.426
33	The government should place less regulatory constraints for	33	1.333
35	Companies should not sell non-biodegradable single-use plast	35	0.954
1	The government and companies should investigate and promote	1	0.949
11	Companies should always design for recyclability and lower o	11	0.905
31	The government should provide more recycling bins and contai	31	0.808
2	The EU should ban the export of plastic waste outside Europe	2	0.715
16	The government should establish a fair and just societal sys	16	0.667
40	Companies should publicly disclose data on their use of plas	40	0.667
12	The government should establish financial and legal incentiv	12	0.569
21	The government should establish a fund focused on innovation	21	0.569
22	The government and companies should ensure that claims about	22	0.380
41	The government should establish a single system for waste ma	41	0.336
13	All stakeholders should educate citizens and create more pub	13	0.238
27	The government and companies should ensure that all plastic	27	0.049
18	Regulatory agencies should strengthen and improve the enforc	18	0.049
19	Afvalfonds Verpakkingen should include civil society organis	19	-0.049
8	Consumers should be responsible for the pollution of plastic	8	-0.097
25	The government, companies, and civil society organisations s	25	-0.146
3	The media should communicate the health and environmental be	3	-0.190
26	The government should increase civil society participation a	26	-0.238
14	The government and companies should enforce stronger control	14	-0.238
9	The government should ban plastics made from controversial s	9	-0.282
20	Afvalfonds Verpakkingen should increase the waste management	20	-0.380
38	The government should help people working in unsustainable s	38	-0.521
17	Government and companies from the Global North should provid	17	-0.715
15	The government should expand EPR systems to other plastics c	15	-0.764
24	The government should ban non-recyclable single-use plastic	24	-0.808
6	The government and companies from the Global North should es	6	-0.856
36	The government and companies should highly increase the use	36	-0.905
29	The government and companies should ensure that all products	29	-1.046
37	Companies should keep plastic loops short and minimise trans	37	-1.095
10	The government should mandate the establishment of a deposit	10	-1.187
34	Companies should strive to use less energy as well as use on	34	-1.236
42	The government should place targets to reduce overall plasti	42	-1.382
23	Municipalities should have more autonomy in the management o	23	-1.523
5	The government should highly regulate bio-based plastic to p	5	-1.761
28	The government should restrict the types of polymers and add	28	-1.903

Distinguishing Statements

Distinguishing Statements for Factor 1

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors							
			1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
36	The government and companies should highly increase the use	36	5	2.10*	-3	-0.97	1	0.54	-3	-0.90
10	The government should mandate the establishment of a deposit	10	5	1.57*	-1	-0.65	1	0.48	-3	-1.19
24	The government should ban non-recyclable single-use plastic	24	3	0.90*	-4	-1.10	0	-0.03	-2	-0.81
17	Government and companies from the Global North should provid	17	3	0.85*	-1	-0.60	-3	-1.04	-2	-0.72
42	The government should place targets to reduce overall plasti	42	2	0.65*	-4	-1.58	-4	-1.36	-4	-1.38
5	The government should highly regulate bio-based plastic to p	5	-1	-0.43*	2	0.59	2	0.79	-5	-1.76
7	The government and companies should promote the use of compo	7	-4	-1.47	-2	-0.66	0	-0.02	5	1.95
3	The media should communicate the health and environmental be	3	-4	-1.53*	4	1.38	3	0.95	0	-0.19
33	The government should place less regulatory constraints for	33	-4	-1.67	-2	-0.79	-2	-1.02	3	1.33
8	Consumers should be responsible for the pollution of plastic	8	-5	-1.83*	2	0.85	3	0.92	0	-0.10
37	Companies should keep plastic loops short and minimise trans	37	-5	-2.10	-1	-0.54	-2	-0.65	-3	-1.09

Distinguishing Statements for Factor 2

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors							
			1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
41	The government should establish a single system for waste ma	41	0	0.20	5	2.02*	0	0.17	1	0.34
25	The government, companies, and civil society organisations s	25	-1	-0.44	3	0.87	-1	-0.27	0	-0.15
39	The government should tax virgin fossil-based plastics and n	39	4	1.33	1	0.49	5	2.27	5	1.71
38	The government should help people working in unsustainable s	38	-3	-0.72	1	0.42	-3	-1.26	-1	-0.52
35	Companies should not sell non-biodegradable single-use plast	35	2	0.81	-1	-0.65	-4	-1.27	3	0.95
7	The government and companies should promote the use of compo	7	-4	-1.47	-2	-0.66	0	-0.02	5	1.95
30	The government should set high minimum requirements for recy	30	3	1.09	-3	-0.94*	4	1.46	4	1.47
9	The government should ban plastics made from controversial s	9	0	-0.09	-5	-1.74*	-2	-0.60	-1	-0.28
27	The government and companies should ensure that all plastic	27	1	0.39	-5	-2.03*	1	0.39	0	0.05

Distinguishing Statements for Factor 3

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors							
			1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
28	The government should restrict the types of polymers and add	28	-2	-0.57	-4	-1.24	3	0.88*	-5	-1.90
20	Afvalfonds Verpakkingen should increase the waste management	20	-1	-0.37	-2	-0.67	2	0.56	-1	-0.38
36	The government and companies should highly increase the use	36	5	2.10	-3	-0.97	1	0.54*	-3	-0.90
29	The government and companies should ensure that all products	29	-3	-1.16	-1	-0.62	1	0.48*	-3	-1.05
10	The government should mandate the establishment of a deposit	10	5	1.57	-1	-0.65	1	0.48*	-3	-1.19
7	The government and companies should promote the use of compo	7	-4	-1.47	-2	-0.66	0	-0.02	5	1.95
24	The government should ban non-recyclable single-use plastic	24	3	0.90	-4	-1.10	0	-0.03	-2	-0.81
35	Companies should not sell non-biodegradable single-use plast	35	2	0.81	-1	-0.65	-4	-1.27	3	0.95
19	Afvalfonds Verpakkingen should include civil society organis	19	0	-0.36	0	0.24	-4	-1.27*	0	-0.05
16	The government should establish a fair and just societal sys	16	0	0.17	2	0.69	-5	-1.70*	2	0.67

Distinguishing Statements for Factor 4

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors							
			1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
7	The government and companies should promote the use of compo	7	-4	-1.47	-2	-0.66	0	-0.02	5	1.95*
4	The government and companies should encourage and highly inc	4	-2	-0.59	-3	-0.81	-3	-1.26	4	1.57*
33	The government should place less regulatory constraints for	33	-4	-1.67	-2	-0.79	-2	-1.02	3	1.33*
1	The government and companies should investigate and promote	1	-1	-0.41	0	-0.37	0	-0.09	3	0.95*
8	Consumers should be responsible for the pollution of plastic	8	-5	-1.83	2	0.85	3	0.92	0	-0.10
3	The media should communicate the health and environmental be	3	-4	-1.53	4	1.38	3	0.95	0	-0.19*
15	The government should expand EPR systems to other plastics c	15	2	0.68	3	1.13	4	1.10	-2	-0.76*
5	The government should highly regulate bio-based plastic to p	5	-1	-0.43	2	0.59	2	0.79	-5	-1.76*