The challenges of Extended Producer Responsibility for textiles in the Netherlands

A backcasting study to explore the challenges faced by stakeholders

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By
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Preface

This thesis marks the culmination of my Master's degree in Industrial Ecology and explores the involving field of Extended Producer Responsibility (EPR) for textiles in the Netherlands. The research allowed me to delve deeply into the complexity of the textile industry and the critical role that producers, policymakers, textile collectors, consumers and other stakeholders play in shaping a circular textile industry.

The journey completing this thesis has been anything but straightforward, with numerous difficulties and valuable learning experiences along the way. I would like to thank my supervisors, Linda & Boriana, for their patience and guidance in helping me throughout this process.
I also want to express my gratitude to my housemate, father and friends who helped me preserve during though moments.

Last but certainty not least, I would like to thank the interviewees who took the time to participate in my research. Our conversations were both enjoyable and inspiring, proving valuable insight into the challenges and complexities of implementing EPR for textiles. This thesis would not have been possible without your valuable contributions.

As a final note, this research has changed my point of view of my own garderobe. To achieve a 100% circular textile industry, it is crucial that we become more aware of our purchasing habits and how we dispose our clothes. Conscious user behavior is key to driving positive change in the textile industry.

Executive Summary

The textile industry, driven by fast fashion, has become one of the most polluting industries, potentially contributing 25% of global carbon emissions by 2050 if trends continue. In response, the Dutch government introduced an Extended Producer Responsibility (EPR) scheme for textiles in July 2023, holding producers accountable for the lifecycle of their products. Similar initiatives exist in France and are expanding across the EU. The Dutch EPR scheme aims to support the circular economy, with 2030 targets including the reuse or recycling of 75% of textile products, 25% reuse, and 33% fiber-to-fiber recycling. The implementation of EPR for textiles and the goal of reaching the 2030 circularity targets pose various challenges for stakeholders in the textile value chain. While previous studies highlight certain challenges of EPR, especially regarding eco-design, there is limited research on EPR's application in the textile sector since it is a newly introduced policy. This research addresses this gap by examining the challenges Dutch stakeholders face in meeting the 2030 EPR targets and exploring actions they can take to overcome these obstacles. Aiming to answer the following research question: *What is the role of the stakeholders to overcome the challenges to reach the Dutch EPR textile targets of 2030?*

This study uses the backcasting framework by Quist (2013) to answer this research question, which starts with a future vision and works backward to identify the necessary actions to achieve that vision. The future vision is based on the Dutch EPR textile targets for 2030. Sub-research questions align with the framework's steps, exploring the current state of EPR for textiles, the future vision, involved stakeholders, challenges they face, and actions needed to overcome these challenges. The research takes a qualitative approach, primarily collecting data through semi-structured interviews with stakeholders, supported by document analysis.

The analysis revealed several structural, cultural-behavioral, and technological challenges for stakeholders in reaching the 2030 EPR targets. Technologically, recycling blended textile fractions was observed as a challenge, requiring both short-term technical innovations and a long-term focus on eco-design. Structural challenges include the risk of losing the sorting and recycling industry from the Netherlands, a need for clearer roles and transparency between partners in the value chain, and a lack of incentives for circular design. Cultural-behavioral challenges involve producers' lack of urgency in using recycled content and low consumer awareness. Stakeholder roles to overcome these challenges include government funding, EU directives on obligation of recycled content, public awareness campaigns and a fair distribution of the EPR fee.

In conclusion, this research provides valuable insights into the perspectives of various stakeholders regarding the challenges and actions required to achieve the Dutch EPR textile targets for 2030. The findings offer a foundation for researchers, practitioners, and policymakers to work towards these targets. It is evident that the 2030 goals are ambitious, and stakeholders are currently facing several challenges. It is important to note that reaching the EPR goals is an iterative process, and the backcasting framework used to plan for these goals may not adapt well to unforeseen changes, potentially

reducing the study's relevance over time. Future research should encompass a broader range of interviews with diverse stakeholders, including consumers and other producers, to gain a more comprehensive understanding of the challenges they face and develop more targeted solutions. Additionally, interviewing international stakeholders, such as the European Commission and foreign suppliers, is recommended to explore their perspectives on meeting the EPR targets. Research could also evaluate the effectiveness of emerging collection systems and further investigate the stakeholder steps identified in the What-Who-How analysis.

Keywords: Extended Producer Responsibility, Circular Economy, Textile waste management, Backcasting, Circular textile industry

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1. Introduction

With a contribution of 7% to the total world exports, the textile industry is the third largest industry in the world, after the automotive and technology industry (Jia et al., 2020). The textile industry is of great importance as it employs over 35 million people globally and a garment serves as a basic human need (Muthu, 2017).

However, the textile industry has shifted in the last decades as one of the most polluting industries in the world. Currently, it is responsible for 3-10 percent of the annual global carbon emissions. Moreover, the producing countries are dealing with poor labour conditions (The World Bank, 2019).

Furthermore, the emergence of fast fashion in the late 20th century has led to structural shifts in the supply chain. In this fast fashion model, garments are manufactured according to constantly changing fashion trends that allow for quick revenue. Due to a competitive market, the consumer price is kept as low as possible which often resulted in a decrease of garment quality and the duration of use (Niinimäki & Hassi, 2011). Between 2000-2015, the garment production doubled, exceeding 100 billion of annually produced pieces of clothes in 2014 (Remy et al. 2016).

The (ultra) fast-fashion model has led to an increase in post-consumer textile disposal in the last two decades. A large portion of post-consumer textiles is downcycled, incinerated or landfilled, while a minimum number of textiles collected are being recycled into new textile products (Köhler et al., 2021). In the Netherlands, it is estimated that 40 clothing items are annually disposed per person (Maldini et al., 2017).

If the textile industry continues with the business as usual, it is expected that it will account for 25% of the global CO_2 emissions by 2050 (Ellen MacArthur Foundation, 2017). Therefore, a transition to a more sustainable and circular textile industry is needed.

The Dutch government has therefore introduced new regulations to enhance the circular textile industry. One of the most important recent regulations is the implementation of an Extended Producer Responsibility (EPR) scheme for textiles as part of their National Circular Economy Program 2023-2030 in July 2023 (Ministerie van Algemene Zaken, 2023). EPR schemes were already implemented in the Netherlands for several product groups including packaging, batteries, auto wracks & tyres, flat glass and electronic waste. The purpose of an EPR is to make producers and importers individually or collectively responsible for their product throughout its life cycle, for the post-use phase. This stimulates the collection and processing of product waste which could enhance reuse and recycling (Backes & Boeve, 2022).

With the implementation of EPR schemes for textile products from 1 July 2023 onwards, textile producers are responsible for their textile products that are placed on the Dutch market after it's being used by their consumers.

The following textiles categories are included in the EPR schemes: Consumer clothing, Work and corporate wear and Bed, table & household linen (Waterstaat, 2023). The infographic from *Stichting UPV Textiel* (2024) in Figure 1.1 visualises what the EPR for textiles entails.

Figure 1: Infographic EPR for textiles (Stichting UPV Textiel, 2024)

The government has defined targets for 2025 and 2030 along with the EPR schemes to substantially reduce the number of virgin textiles. Currently, approximately 35% of the release of textile products on the Dutch market is reused and recycled. This needs to be 50% and 75% in 2025 and 2030 respectively (Waterstaat, 2023). A full overview of the EPR targets set by the government is shown in Figure 2.

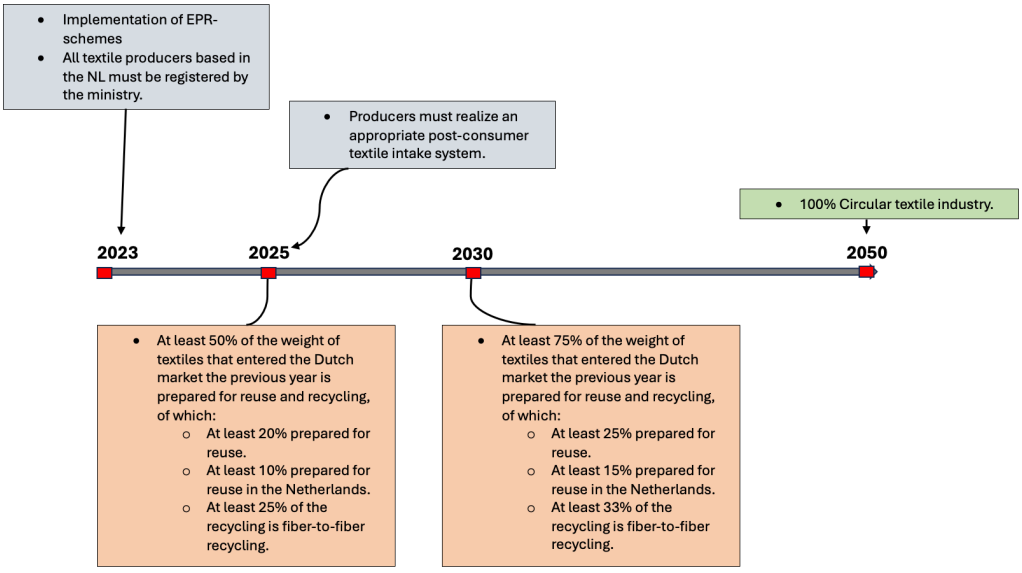

Figure 2: Roadmap of the EPR goals set by the Dutch government (Waterstaat, 2023)

Moreover, from 2024 onwards, textile producers must hand in an annual report to the government with details of their new textiles products that were placed on the market the previous year. The EPR system is currently being set up and will be enforced by the Ministry of Infrastructure and Water management (I&W) from 2025 onwards (Waterstaat, 2023).

When exploring EU-wide policy development, it can be observed that the European Commission is also developing policies for sustainable and circular textiles. For example, on July 18th, 2024, Eco-design for Sustainable Products Regulation (ESPR) came into force in the EU. With this regulation, textile producers in the EU need to focus on eco-design to extend the lifetime of their textile products. (European Union, 2022). Moreover, implementing EPR schemes for all EU member states are also currently developed (European Commission, 2022).
With the implementation of the Dutch EPR system in July 2023 and regulations such as ESPR in the EU, textile producers and other stakeholders in the value chain will face significant challenges. This research project focuses on the challenges of the Dutch EPR for textiles implementation from a perspective of the stakeholders in the Dutch textile value chain.

1.1. Problem Statement

The implementation of the EPR schemes for textiles will have far-reaching consequences for partners in the textile value chain. Therefore, academic research is needed to examine the challenges faced by the stakeholders in the up- and downstream stages to reach the EPR for textiles 2030 goals.
This leads to the following problem statement: *The implementation of the Dutch EPR system and its corresponding textile waste management targets for 2030 could lead to challenges for the stakeholders in the textile chain*.

1.2. Research Question

This research project aims to explore the challenges of the EPR goals of 2025 and 2030 from a stakeholder's perspective. Therefore, the following main research question is compiled: **What is the role of the stakeholders to overcome the challenges to reach the Dutch EPR textile targets of 2030?** To answer this main research question, the study is divided into five sub-research questions:

1. *What is the current state of the Dutch upstream and downstream stages of the EPR for textiles?*
2. *What are the relevant stakeholders of the upstream and downstream stages of the Dutch EPR for textiles?*
3. *What is the future scenario for Dutch EPR for textiles for 2030 from a stakeholder perspective and what are the requirements to reach this future scenario of 2030?*
4. *What are the challenges faced by the stakeholders of the upstream and downstream stages of the Dutch EPR for textiles?*
5. *What are the steps of the stakeholders that need to be taken to reach the EPR textile goals of 2030 set by the Dutch government?*

These sub-research questions will be further explained in section 3.1.

1.3. Societal & Scientific Relevance

This section discusses the relevance of conducting a study on the challenges of EPR for textiles from an academic as well as a societal point of view. Finally, it demonstrates the relevance to the industrial ecology field.

1.3.1.Scientific Relevance

The principles of EPR have been central to most recent policies and laws regarding the end-of-life management of recyclable products. EPR is expected to enhance the circularity of the value chains in several sectors. However, the absence of thorough academic evaluations of EPR achievements makes it difficult to determine whether the policy's impact aligns with circular economy goals (Compagnoni, 2022). Furthermore, since the emergence of EPR as a policy tool for the textile sector is relatively new, limited research is conducted on EPR for textiles. This study aims to examine the challenges of EPR faced by the relevant stakeholders which contributes to the empirical research on EPR and helps to realise a stronger academic comprehensive evaluation of EPR achievements.

Moreover, this study uses a backcasting approach as a theoretical framework, which will be further explained in chapter three. A backcasting approach is useful in providing a clear visualization of the challenges stakeholders are likely to encounter on the journey toward the 2030 vision and in identifying the necessary actions to address these challenges. It was observed from literature that this approach is different from wat most other studies on EPR (for textiles) have done. Therefore, the findings of this study could serve as a new scientific approach for evaluating EPR performance and organisation in relation to circular economy targets.

1.3.2. Societal Relevance

From a societal perspective, conducting scientific research on the challenges from a stakeholder's perspective when implementing EPR schemes and targets for textiles in the Netherlands could give a broader scientific picture on the effect in practice of the Dutch EPR schemes for the textile sector from different perspectives. Furthermore, the explored stakeholder actions to overcome these challenges offer starting points for researchers, practitioners and policymakers to realize the 2030 EPR targets.

1.3.3.Relevance to the Industrial Ecology field

Systems science is an essential part of the Industrial Ecology (IE) field: tackling sustainability challenges by taking a comprehensive and system thinking approach.
This study aligns with these main goals of IE by acknowledging the interdisciplinarity of the textile value chain and addressing future-focused visions and practices. The EPR challenges are explored from technological sides as well as from a social and policy side. Furthermore, it uses a backcasting approach by Quist (2013) to examine future-focused visions and practices on how to overcome the challenges to reach the 2030 vision.

Moreover, EPR is a useful mechanism for implementing circular economy principles within the textile industry. By holding producers accountable for the post-consumer phase of textiles, EPR schemes can drive innovation in product design and end-of-life management (Campell-Johnston et al., 2021). By examining the challenges of the Dutch

EPR system for textiles, it contributes to the circular economy principles that IE seeks to promote (Saavedra et al., 2018).

1.4. Research Outline

A backcasting analysis is used as a theoretical framework for this study. Backcasting is a planning method that starts with defining a desirable future and then works backwards to identify the policies and programs that will connect that specified future to the present. Backcasting frameworks could be used as a guideline in complex situations with several stakeholders where it is unclear how to reach the desired future vision (Geurs and van Wee, 2004). The motivation to use backcasting analysis for this study is that a backcasting framework will help to derive the challenges and stakeholder actions that are needed overcome these challenges and reach the EPR targets using stakeholder participation. Moreover, backcasting has been already widely successfully applied in several studies including research on urban and rural land-use futures (Carlsson-Kanyama et al., 2008; Höjer et al., 2011) and energy backcasting (Anderson et al., 2008, Gomi et al., 2011).

This study applies the backcasting framework of Quist (2013). The motivation to use this framework for this research project is that the framework uses stakeholder involvement, which is necessary to analyse the challenges from a stakeholder perspective. Furthermore, the backcasting framework has a general focus on sustainable visions (Quist, 2013). Another motivation to use the backcasting framework of Quist (2013) is that is has been proven as a successful method in Master theses on several sustainable subjects from other peer TU Delft students including: (Euwema, 2023), (Visman, 2019) & (Vasilikos, 2021).
A deeper elaboration on this backcasting approach, the motivation to use this framework, the corresponding steps and the sub questions that are derived from Quist's (2013) backcasting framework is provided in Chapter 3.

Furthermore, this study makes use of stakeholder analysis based on the actor analysis method by Enserink et al. (2010), desk research and semi-structured interviews. A stakeholder analysis is used to obtain insights on the relevant stakeholders and their interrelations and role in the up- and downstream stages of the EPR for textiles. Desk research is performed to obtain insights from consultancy and governmental reports and relevant case studies. Subsequently, semi-structured interviews with the relevant stakeholders are conducted to derive their perspective on the future vision, potential challenges and stakeholder actions that are needed to meet the EPR targets. A further explanation of the research methods is shown in Chapter 4.

1.5. Thesis Outline

This thesis comprises several chapters. The upcoming chapter provides a literature review of the current literature on EPR for textiles and insights from other relevant EPR studies. Subsequently, the research gap is defined. Chapter 3 gives a deeper explanation of the theoretical framework that is used for this study. In Chapter 4 the research methods are further explained. The subsequent chapter will elaborate on the results and

findings from desk research and the semi-structured interviews. This section starts with the findings of the Strategic problem orientation, followed by the future scenarios and ends with the backcasting analysis. The results are discussed in Chapter 6 followed by a summary of how the research questions were answered and practical implications in Chapter 7.

2. Literature Review

This chapter gives an academic literature review on EPR for textiles and discusses the knowledge gap that was observed.

2.1. Literature Review Approach and Findings

The following sources were used for the literature review: Scopus, Google Scholar and the repository of TU Delft. First, academic literature on EPR textiles was explored. Subsequently, current academic literature on EPR in other sectors was explored to obtain a broad overview of the current academic research on this topic. Table 1 gives an overview of all the relevant literature that was selected, and Table 2 provides an overview of the findings and limitations from the explored literature that are useful for this study.

First, academic literature on EPR in the Dutch textile industry was reviewed. Scopus did not give any results when searching on "Extended Producer Responsibility AND Textile AND Stakeholders AND the Netherlands". Google Scholar gave one relevant result: The research conducted by Backes and Boeve from Utrecht University. They examined the role and responsibilities of municipalities and textile collecting organisations with respect to the producers. The Research was conducted on behalf of the Royal Dutch association for waste and cleaning services (NVRD). They conducted several interviews with producers, local authorities and collecting organisations. Additionally, they explored existing literature. The research gives a first overview on what municipalities and collecting organisations should focus on when implementing the EPR system. However, the research mostly focussed on the legislation part. Furthermore, the research was mainly focussed on a governmental perspective and did not include other relevant stakeholders in the textile chain (Backes & Boeve, 2021).

When exploring academic literature on EPR for textiles in foreign countries, several articles were found. The study by Degenstein et al. (2023) was found on Scopus. They examined the integration of Product Stewardship (synonym for EPR) into the textile industry of New Zealand by focussing on the perspective of the stakeholders. Their research shows some interesting findings on the challenges and drivers that stakeholders are facing when implementing EPR in the textile industry. Financial concerns were identified as the most common barriers for the stakeholders when implementing an EPR system for textiles. This includes costs of transitioning to the use of sustainable fibres, costs of participation of the EPR program and end-of-life solutions for their textile products.

When exploring studies on EPR for textiles from a stakeholder's perspective in foreign countries on Google Scholar, several academic literatures were found. For example, the study by (Kazancoglu et al., 2022) proposed a framework that reveals causal relationships among the circular supply chain barriers in the textile sector by including all the relevant stakeholders. However, the study focussed on circularity in the textile industry in general, not EPR. This also applies to the study conducted by Zoumpalova et al. (2023). They examined the barriers to circularity in the textile industry with a holistic view and potential policy responses in the context of the Czech Republic. Both studies used questionnaires and interviews with stakeholders as their methodology. A lack of

knowledge and awareness, inadequate legislation and financial concerns were identified as the main barriers for the transition towards a circular textile industry. Moreover, implementing EPR was identified as a useful tool to enhance the transition. One of the limitations of EPR that was identified is that the focus would lay more on waste management instead of reducing consumption or reuse and recycling. Their studies give an interesting overview on the barriers and challenges of the transition towards a circular textile industry from a stakeholder perspective, which could be used to analyse the implementation of EPR for textiles.

The reviewed literature showed that EPR systems were introduced in other sectors as well. Therefore, to obtain a broad overview of the current literature, academic studies on implementing EPR in other industry sectors from a stakeholder perspective were explored as well. Vermeulen et al. (2021) analysed in their study the performance of the Dutch EPR system and came up with three pathways to further develop EPR to enhance a circular economy.
Their study on several EPR systems gave interesting insights on the challenges of EPR. For example, they found that most EPR systems did not consider eco-design. Furthermore, they found that current EPR systems focus on waste management instead of circularity.
The study proposed rate differentiation for producers in combination with eco-design. This could be interesting for the textile sector as well.

When exploring academic literature on EPR in other sectors in foreign countries, several results were found. The study by Gupta & Dash (2023) examined EPR for plastic waste management and Leclerc & Badami (2020) studied EPR implementation in the electronics industry in Canada. Both studies derived from their stakeholder interviews that stakeholder involvement and evaluation is key to prevent a lack of clarity on the EPR regulation among the stakeholders.

(Kunz et al., 2018) examined the barriers and drivers of the implementation of EPR in several industries and countries. From their research it was observed that stakeholder surveys and case studies have been already used effectively in EPR research to develop EPR policies. For example, the European Commission used a series of 36 case studies of EPR schemes to identify common principles or rules for circular economy within the EU (Monier et al., 2014). Kunz et al. (2018) identified several strengths and limitations from these case studies and interviews. For example, they found that producers of the Waste from Electrical and Electronic Equipment (WEEE) highlighted the issues that EPR in this sector has failed to provide incentives for product design, since most producers are importers and therefore will not reward producers directly. This could be a challenge for the textile sector as well.

The study of Campell-Johnston et al. (2022) examined the limitations of the Dutch EPR system. Their main outcome was that EPR schemes promote recycling over re-use and other R-strategies. Moreover, producers do not see an incentive to invest in eco-product design, which could hinder the increase of circular products. This was also identified by Kunz et al. (2018), arguing that without effective incentives to encourage eco-design, EPR might end up being merely a mechanism to fund waste management.

The findings from studies on EPR for other sectors and foreign countries could help to find the challenges for the Dutch EPR system for textiles and its corresponding 2030. However, it must be noted that these drivers and challenges may differ per sector and state.

Table 1: Current Academic Literature

Article	Source	Keywords
Backes, C., & Boeve, M. (2022). Uitgebreide producentenverantwoordelijkheid: rol en verantwoordelijkheden gemeenten en inzameling organisaties in relatie tot producenten: Juridische kaders voor de afbakening van verantwoordelijkheden, Utrecht Centre for Water, Oceans and Sustainability Law, Utrecht University. Retrieved from: https://dspace.library.uu.nl/bitstream/handle/1874/420132/Eindrapport_UPV.pdf?sequence=1	Google Scholar	Extended Producer Responsibility AND Textile AND Stakeholders AND the Netherlands
Degenstein, L. M., McQueen, R. H., Krogman, N. T., & McNeill, L. S. (2023). Integrating product stewardship into the clothing and textile industry: perspectives of New Zealand stakeholders. Sustainability, 15(5), 4250.	Scopus	Extended Producer Responsibility AND Textile AND Stakeholders
Gerstmann, B. S. (2020). *Towards circular resource use: the potential of extended producer responsibility for textile circularity in the EU* (Doctoral dissertation, Wien).	Google Scholar	Extended Producer Responsibility AND Textiles
Kazancoglu, I., Kazancoglu, Y., Kahraman, A., Yarimoglu, E., & Soni, G. (2022). Investigating barriers to circular supply chain in the textile industry from Stakeholders' perspective. International Journal of Logistics Research and Applications, 25(4-5), 521-548.	Google Scholar	Extended Producer Responsibility AND Textile AND Stakeholders AND Challenges
ZOUMPALOVA, T., JONÁŠOVÁ, S. K., & MOLDAN, B. (2023). Barriers to the circular economy in the textile industry: a case study of the Czech Republic. In *WASTE* (p. 206).	Google Scholar	Extended Producer Responsibility AND Textile AND Stakeholders AND Challenges
Vermeulen, W., Backes, C., de Munck, M., Campbell-Johnston, K., de Waal, I. M., Rosales Carreon, J., & Boeve, M. (2021). WHITE PAPER on Pathways for Extended Producer Responsibility on the road to a Circular Economy.	Google Scholar	Extended Producer Responsibility AND Stakeholders AND the Netherlands
Tong, X., Wang, T., Li, J., & Wang, X. (2024). Extended producer responsibility to reconstruct the circular value chain. Circular Economy, 100076.	Scopus	Extended Producer Responsibility AND Challenges AND Stakeholders
Gupta, D., & Dash, S. (2023). Challenges of implementing extended producer responsibility for plastic-waste management: lessons from India. Social Responsibility Journal.	Scopus	Extended Producer Responsibility AND Stakeholders AND Challenges
Leclerc, S. H., & Badami, M. G. (2020). Extended producer responsibility for E-waste management: Policy drivers	Google Scholar	Extended Producer Responsibility AND Stakeholders AND Challenges

and challenges. *Journal of Cleaner Production*, *251*, 119657.		
Campbell-Johnston, K., Roos Lindgreen, E., de Waal, I. M., Vermeulen, W., & Dermine-Brullot, S. (2022). Report on the Governance of Extended Producer Responsibility in the Transition to a Circular Economy.	Google Scholar	Extended Producer Responsibility AND Stakeholders
Kunz, N., Mayers, K., & Van Wassenhove, L. N. (2018). Stakeholder views on extended producer responsibility and the circular economy. California Management Review, 60(3), 45-70.	Google Scholar	Extended Producer Responsibility AND Stakeholders AND Challenges
Vink, J. (2020). The role of Extended Producer Responsibility in the transition to a Circular Economy: An institutional analysis of the circularity of EPR.	*TU Delft Repository*	Extended Producer Responsibility AND Stakeholders AND Challenges

Table 2: Overview findings in current literature

Main Topics	**Findings**	**Limitations**
Role and responsibility of stakeholders when implementing Dutch EPR for textiles	• Insights on the current legal frameworks of ERP for textiles between producers and municipalities: Ambiguity between role municipality and producer could occur when implementing EPR for textiles (Backes & Boeve, 2021).	• The study of Backes & Boeve (2021) focussed only on the role and responsibility between municipalities and producers. Challenges of the Dutch EPR system for textiles from other stakeholder perspectives were not examined
Foreign cases of the challenges from stakeholder perspectives of implementing EPR for textiles	• Qualitative study on implementing EPR for textiles in New Zealand. Main findings that could be useful: the region's ability to collect, sort and reuse/recycling is essential to successfully implement EPR. Furthermore, they find that financial concerns appear to be the most common barrier for stakeholders (Degenstein et al., 2023) • A qualitative study for the Czech Republic has derived from stakeholders' interviews that a limitation of EPR for textiles is that the focus of EPR will lay on efficient waste management instead of reducing consumption and reuse/recycling (Zoumpalova et al. 2023). • (Gerstmann, 2020) found that a combined approach of EPR and eco-design appears the most effective option to enhance a circular textile industry based on stakeholder interviews.	• The study by Degenstein et al. (2023) did not consider the perspective of government and waste management stakeholders. Moreover, EPR schemes are not introduced in New Zealand yet. • The study by Zoumpalova et al. (2023) focussed on the challenges of the transition to a circular textile industry in general from stakeholder perspective instead of the challenges of ERP.
Strengths and limitations of Dutch EPR systems in other sectors (on a national level)	• Vermeulen et al. (2021) examined the current organisation of EPR in the Netherlands to promote CE. Found a lack of focus on eco-design as a key	• Strengths and limitations are based on Dutch ERP systems in other sectors such as for packaging and WEEE, these

	limitation for EPR and proposed a rate differentiation of the EPR fee to promote eco-design.	findings could differ for the textile sector.
Foreign cases of strengths and limitations of EPR systems in other sectors	• Stakeholder involvement and evaluation is key to prevent ambiguity on EPR among stakeholders (Gupta & Gash, 2023). • Without effective incentives to encourage eco-design, EPR might end up being merely a mechanism to fund waste management instead of a tool to enhance circularity (Kunz et al., 2018), (Campell & Johnson et al., 2022).	• Strengths and limitations are based on Dutch ERP systems in other sectors such as for packaging and WEEE, these findings could differ for the textile sector.

2.2 Knowledge Gap

From the literature review it can be observed that research on EPR schemes with stakeholder involvement is already conducted in several sectors and countries to analyse its effectiveness, its role in the transition to the circular economy and for developing EPR regulations. Several studies showed that the main barriers of the stakeholders were financial concerns on implementing EPR schemes and the importance of including eco-design regulations.

One study was found on the Dutch EPR for textiles using stakeholder involvement. However, their research was conducted on behalf of the Dutch government, before implementation of the scheme. Moreover, their focus was to examine the role of the municipality in relation to the producers when implementing EPR schemes for textiles instead of focussing on challenges from different stakeholder's perspectives.

Based on the reviewed literature it was observed that there exists a research gap on the challenges from a stakeholder perspective of the implementation of the Dutch EPR schemes for the textile sector and its corresponding textile waste management targets for 2030 mentioned in the introduction.

The upcoming chapter elaborates on the theoretical framework that is used for this research project.

3. Theoretical Framework

This study uses the backcasting framework by Quist (2013) as a supportive theoretical framework. Starting from the reuse and recycling goals of 2030 set by the government, this study looks backwards to derive the challenges from a stakeholder's perspective to help analyse how to realise this desirable future.
This chapter elaborates on the principles of the backcasting method and gives a further explanation of the steps of the framework by Quist (2013) that served as a guideline for this study.

3.1. Backcasting Approach

The concept of backcasting originated in the 1970s and early 1980s, to explore and assess energy futures. Lovins (1976) introduced "backwards looking analysis" as an alternative planning method for managing electricity supply and demand. He argued that it would be beneficial to outline a desirable future(s) and then evaluate how to realise these futures, rather than solely concentrating on probable futures and predictive forecasts. The idea was that, once the strategic objectives were identified for a given future scenario, it would be possible to work back to identify the necessary policy measures to steer the energy sector towards that envisioned future (Quist, 2007). In the early 1980s, Robinson (1982) introduced in his energy study the term "backcasting" to propose soft energy paths toward alternative futures that emphasised energy conservation and decentralised renewable energy technologies. In 1990, Robinson (1990) developed one of the first methodologies for backcasting (Figure 3). His backcasting framework consists of a six-step methodology, starting with defining the future goals, objectives and constraints, for both the defined system and its external context, followed by the formulation of future scenarios, which can be based on criteria set externally to the analysis. The subsequent step is to analyse the outcome of the scenario and to reiterate any problematic aspects, depending on the results of the analysis (Quist, 2007).

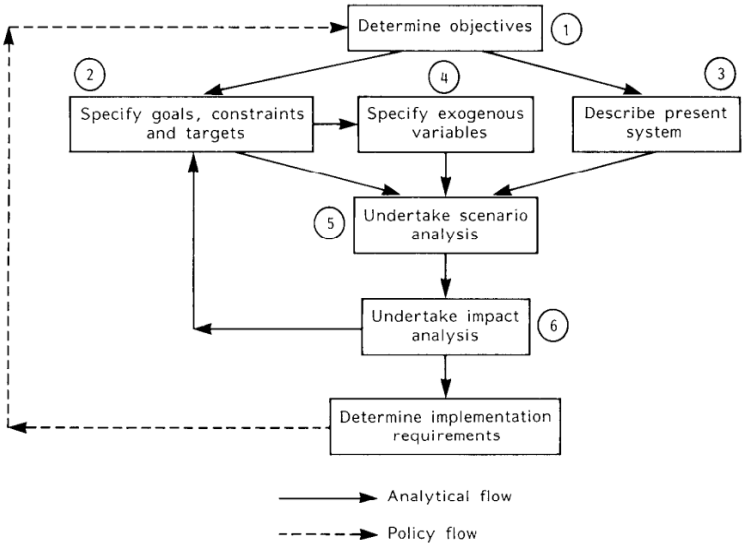

Figure 3: Six-step Backcasting Framework of Robinson (1990)

In the late 1980s, it was observed that the backcasting approach had the potential to be applied to a much broader range of long-term problems, due to its normative nature and problem-solving character. The backcasting method is particularly useful for problems that are complex and persistent, where externalities are at play, there is a need for major change, the dominant trends are part of the problem and the time horizon and scope allow development of radical alternative options (Quist, 2013). Dreborg (1996) argued that sustainability problems contain all these characteristics and are therefore very suitable for the backcasting approach. Over the last decades, several backcasting studies have been performed to evaluate sustainability problems (Quist, 2013).

However, the backcasting approach of Robinson (1990) and similar frameworks developed later in that decade did not include stakeholder participation. Engaging stakeholders throughout the various stages of backcasting can create credibility and accountability, enable the incorporation of perspectives and opinions of stakeholders that might otherwise be overlooked, and encourage support and participation in subsequent phases after the backcasting procedure (Quist, 2007).

This type of backcasting based on stakeholder involvement is also known as participatory backcasting and is particularly useful for developing pathways towards a future scenario that in general have focus on sustainability.

In 2007, Quist (2007) published an example of a participatory backcasting framework. This framework is used as a guideline for this backcasting study. Namely, the framework is already successfully used in several master theses (Euwema, 2023), (Visman, 2019) & (Vassilikos, 2021) and general focus of stakeholder involvement is essential to analyse the challenges of the Dutch EPR system for textiles from different stakeholder perspectives.

The application of the framework for this study is further explained in the upcoming paragraph.

3.2. Backcasting Framework Quist (2007)

The backcasting framework of Quist (2007) follows five steps, which are shown in figure 4. The choice for using Quist's framework for this research project is that the framework is clear and gives detailed sub-steps for the five main steps (Figure 5), making it easier to follow. Additionally, the researcher has prior experience with this framework, which means it requires less time to become familiar with it.
Quist (2007) argues that this framework can be used for backcasting studies with various goals. These goals can range from developing future scenarios and evaluating their environmental benefits to promoting these visions among policymakers or motivating stakeholders to work towards achieving them through a specific action plan.

Furthermore, Quist's framework makes use of the term "socio-technical systems". Which is the belief that technologies are embedded in larger societal frameworks composed of both technological and social elements. These systems include not only people but also organisations, rules and structures (Quist, 2007). The transition towards a circular textile industry consists of technical as well as societal actions. Therefore, a

socio-technical approach is used to explore the role of the stakeholders to reach the 2030 EPR textile targets.

The focus of Quist's framework is his third step: Backcasting analysis. Since, the scope of this research is gathering stakeholder's opinions, identifying the main challenges to reach to the future scenario and exploring the stakeholder actions needed to the envisioned future scenarios.

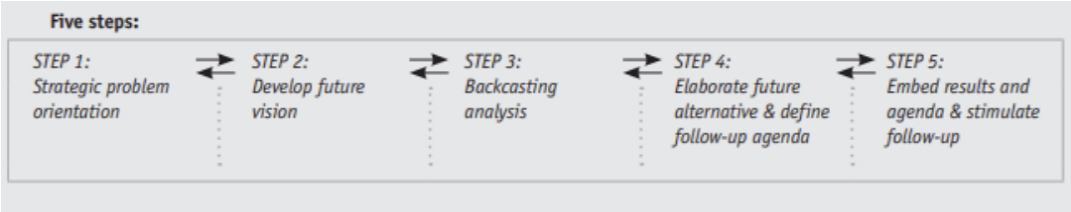

Figure 4: Framework for Participatory Backcasting Analysis (Quist, 2007)

Step 1: Strategic problem orientation
Setting demands and basic assumptions
System and regime analysis
Stakeholder analysis
Problem and trend analysis
Socio-technical mapping
Step 2: Generating future visions
Idea articulation and elaboration
Generation of multiple perspectives
Creative techniques
Step 3: Backcasting analysis
WHAT-WHO-HOW analysis: technological, cultural-behavioral, organizational, and structural-institutional changes
Stakeholder identification: required stakeholders and actions
Drivers and barriers analysis
Step 4: Elaboration and define follow-up agenda
Scenario elaboration (turning vision into quantified scenario)
Scenario sustainability analysis
Generation of follow-agenda
Transition pathway
Step 5: Embed results and stimulate follow-up
Dissemination of results and policy recommendations
Generation of follow-up proposals
Stakeholder meetings

Figure 5: Methods and Tools for the Participatory Backcasting Framework by Quist (2007)

The sub-steps of the Quist's framework shown in Figure 5 can be customised to fit the specific goals and scope of the study (Quist, 2007). The decisions regarding the formulation of the backcasting framework for this study is explained below:

<u>Step 1: Strategic Problem Orientation</u>
In the strategic problem orientation, all the relevant information about the Dutch EPR for textiles is collected, forming the foundation for the subsequent steps of the framework, particularly the backcasting analysis.

First, the current state of the upstream and downstream stages of the Dutch textile value chain is explored using desk research and stakeholder interviews. This will help to obtain an overview of the current situation of the Dutch textile value chain and its major sustainability issues. Furthermore, the current state of the EPR is discussed after the implementation in July 2023 using governmental reports and stakeholder interviews.

Subsequently, a stakeholder analysis is performed to gain insights on the various relevant actors and their interrelations in the EPR. The methodology behind the stakeholder analysis is discussed in Section 4.1. Since the textile industry is a global and complex industry with various stakeholders and interrelations, not all the actors of the upstream and downstream stages of the textile industry can be examined for this research. Therefore, the focus of this research is examining the stakeholders from the Dutch post-use textile value chain, which is the most relevant stage for the EPR schemes. However, a brief overview of other stakeholders that might have a role in the EPR schemes for textiles is given as well. A selection of the most relevant stakeholders is used for the stakeholder interviews. The selection criteria and motivation for the choice of interviewees is elaborated in Section 4.3.3.

Step 2: Develop Future Vision

After completing Step 1, the overall Dutch EPR for textiles will be understood, enabling the start of the planning for the future. The second step of the framework is where the vision for the future will be developed; this means outlining the future scenario for EPR for textiles in 2030 based on different stakeholder perspectives. This will be done considering the future vision of the Government using the EPR decree (Staatsblad, 2023) and the National Circular Economy Program 2023-2030 (Ministerie van Algemene Zaken, 2023). Furthermore, other stakeholder's future visions are gathered from stakeholder interviews.

This study examines the challenges from a stakeholder perspective to reach the 2030 EPR targets proposed in Figure 2. However, the government proposed in their National Circular Economy Program 2023-2030 a future vision for 2050, where a half-point state must be reached in 2030. Therefore, it is assumed that the future vision of the government in 2030 is like the halfway point of 2050.

Furthermore, to fully visualise the future vision of EPR for textiles, it is crucial to understand the EPR requirements for 2030. These requirements are gathered from the official EPR Decree from the government (Staatsblad, 2023), the official website from the EPR collective (Stichting UPV Textiel, 2024) and stakeholder interviews.

Step 3: Backcasting Analysis

Once the problem is defined and several future visions from different stakeholders are developed, the backcasting analysis process is started. As explained in the beginning of this chapter, backcasting starts from a specific future point and works backwards to the present to outline the actions needed to achieve the targets. This analysis will be conducted for the future visions from different stakeholders and the corresponding EPR targets gathered in the previous step.

First, the main challenges that could hinder the future scenario are identified based on desk research and stakeholder interviews. The challenges are divided into three categories, based on Quist's approach:

- *Structural challenges*: this includes organisational challenges and policies that could hinder achieving the future vision, as well as (a lack of) rules and regulations.

- *Cultural-behavioural challenges*: this relates to the social aspects that could hinder achieving the future visions. It involves examining the behavioural and cultural challenges.
- *Technological challenges*: This pertains to (a lack of) certain technologies that could hinder the future vision of 2030.

Subsequently, the necessary actions that stakeholder need to take to overcome these challenges will be identified using the WHAT-WHO-HOW analysis (as illustrated in Figure 5) by working backwards. According to Quist (2007), the purpose of the WHAT-WHO-HOW analysis is to identify the required actions, how they should be implemented, and the stakeholders responsible for their execution. These actions can be technological, institutional, or cultural-behavioural and are categorised like the challenges.

The WHAT-WHO-HOW analysis answers three questions (Quist, 2007):

- *WHAT are the needed actions to reach the future vision?*
- *WHO is involved or needs to be involved in these actions and what should they do?*
- *HOW can these actions be achieved?*

A revised stakeholder map that was provided in Step 1 is used to show what stakeholder actions are needed.
This will ultimately give insights on the challenges and corresponding required actions to reach the future vision for 2030 based on different stakeholder perspectives.

Step 4 Elaborate Future Scenarios and Defining Follow-up Agenda

Step four elaborates on future scenarios and defines the follow-up agenda. As explained before, the scope of this research is on examining the challenges from different stakeholder perspectives and exploring a first attempt in the interventions that are needed to overcome these challenges and to reach the future vision using the WHAT-WHO-HOW analysis in step 3. Therefore, it was decided to leave Step 4 of the backcasting framework for further research.

Step 5: Embedding of Results and Stimulating Follow-up

In the final step of Quist's framework, the results are disseminated to encourage (policy) change. This step is partially realised by sending this research to the interviewees and making the research online available for other stakeholders. The results from this research could give stakeholder information on the required actions needed to overcome certain challenges and to reach the 2030 EPR targets.

3.3. Sub-Research Questions

Table 2 gives a full overview of the sub research questions that are compiled for this research project based on the steps of Quist's (2007) backcasting framework.

Table 3: Research Questions based on backcasting framework for Sustainable visions (Quist, 2007)

	Research Questions	**Corresponding Step of Quist's Backcasting (2007)**
SRQ1	*What is the current state of the Dutch upstream and downstream stages of the EPR for textiles?*	*Step 1: Strategic Problem Orientation*
SRQ2	*What are the relevant stakeholders of the upstream and downstream stages of the Dutch EPR for textiles?*	*Step 1: Strategic Problem Orientation*
SRQ3	*What is the future scenario for Dutch EPR for textiles for 2030 from a stakeholder perspective and what are the requirements to reach this future scenario of 2030?*	*Step 2: Develop Sustainable Vision*
SRQ4	*What are the challenges faced by the stakeholders of the upstream and downstream stages of the Dutch EPR for textiles?*	*Step 3: Backcasting Analysis*
SRQ5	*What are the steps of the stakeholders that need to be taken to overcome these challenges and reach the EPR textile goals set by the Dutch government?*	*Step 3: Backcasting Analysis (What-Who-How analysis)*
Main RQ	What is the role of the stakeholders to overcome the challenges to reach the Dutch EPR textile targets of 2030?	

4. Research Methods

This chapter elaborates on the research methods that are used for this research project to answer the sub research questions in Table 2.

4.1. Research Flow Diagram

Figure 6 shows the research flow diagram of this study. It must be noted that the gathering of the results is an iterative process, therefore this research flow diagram shows the general outline of the steps for this research project. The research methods that are shown in the research flow diagram are explained further in the subsequent sections of this chapter.

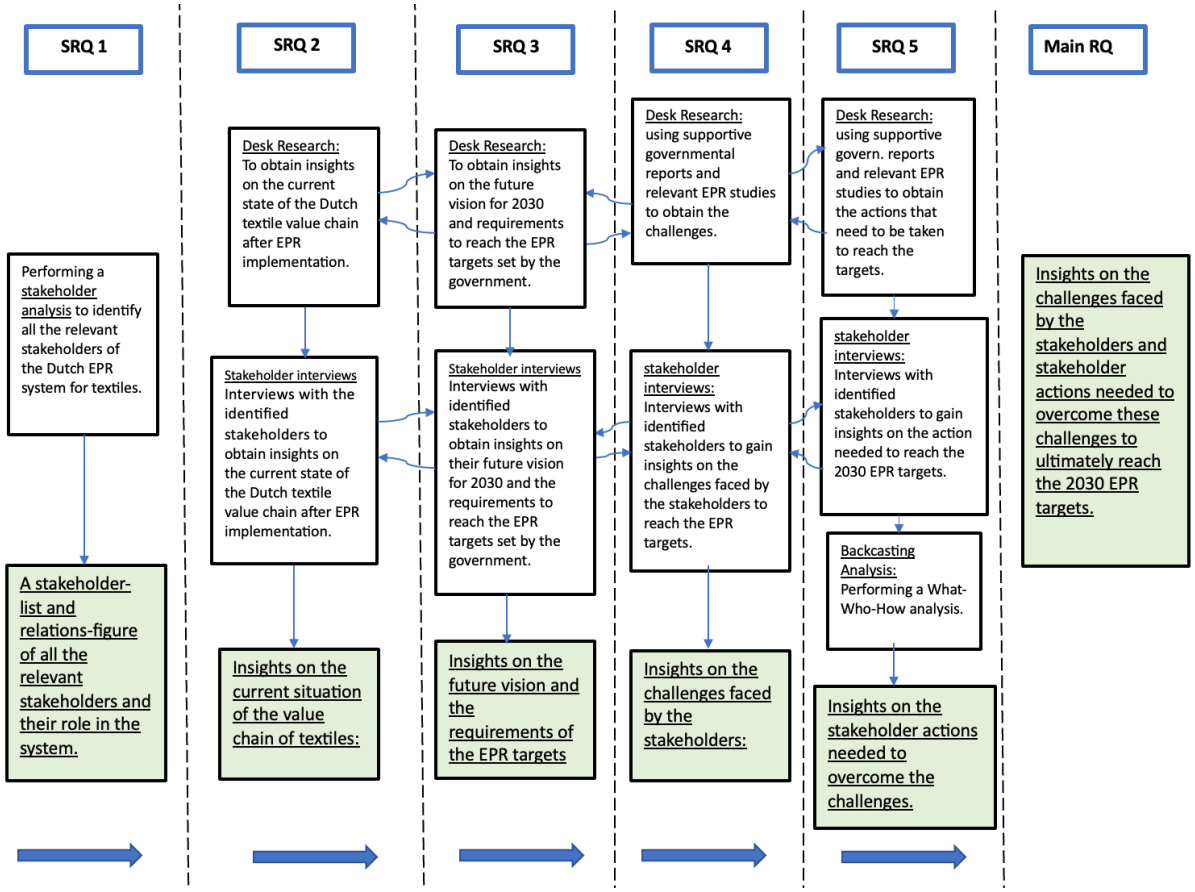

Figure 6: Research Flow Diagram

4.2. Stakeholder Analysis

The stakeholder analysis for sub-research question one is based on the actor analysis method by Hermans in Chapter 4 of the book "*Policy Analysis of Multi-Actor Systems*" (Enserink et al., 2010). First, the actors are identified based on the official website of the decree of EPR for textiles (Staatsblad, 2023) and a consultancy report published by the government (Overheid.nl, 2021). Potential supplementary actors are derived from stakeholder interviews. The actors are classified into four broad categories: *Producers, Post-consumer Textile companies, Policymakers & Authorities* and *"Other" stakeholders*. Their functions and interests are examined and visualised into a table.

As explained before, the textile industry is a complex value chain with various foreign stakeholders in different sectors (e.g.: logistics, manufacturing, retail or destination countries of post-consumer textiles such as Ghana). Each of them plays a role in the transition towards a 100% circular textile industry. However, due to time limits, it is decided that the scope for this research is the Dutch relevant stakeholders that have a function and interest in the Dutch EPR for textiles and its corresponding targets to increase (fibre-to-fibre) recycling and reuse.

A figure is compiled to visualise the formal interrelations between the stakeholders of the current situation. This figure is based on the formal chart from Chapter 4 of "*Policy Analysis of Multi-Actor Systems"* (Enserink et al., 2010). The figure consists of three geographical boundaries: the Netherlands, EU and beyond EU borders. As explained before, in principle this research project focuses on the Dutch stakeholders. However, these geographical dimensions will help to visualise the stakeholder actions needed outside the Netherlands that are needed to overcome the challenges discussed in section 5.3.2.
It is important to note that not all the informal influence relationships have been included. Consequently, non-governmental actors might seem less connected or influential than they are.
Moreover, formal relations between producers that are not members of the collective are not included in this figure to maintain an organised overview. It must be noted that these relations are like the formal relations of the PRO "Stichting UPV Textiel".

4.3. Desk Research

Figure 6 shows that desk research is performed to gain insights on the current state, relevant stakeholders, the future vision & requirements, challenges to reach the EPR targets and necessarily steps to overcome these challenges. These insights are derived from governmental consultancy reports, the official Dutch EPR Collective website (Stichting UPV Textiel, 2024) and other relevant EPR studies as reviewed in Section 2.

4.4. Stakeholder interviews

As can be seen in Figure 6, stakeholder interviews are used in combination with desk research to answer sub-research questions two to five. The interviews are based on a semi-structured interview format. The semi-structured format is chosen to provide enough structure to focus on the relevant topic, while still providing interviewees the freedom to give input from their own experience. Before conducting the interviews, a consent form of the TU Delft is sent to the interviewees which is shown in Appendix A. All the interviews are conducted online via Microsoft Teams. The name of the interviewees is kept anonymous in this research report, but their field of expertise is published.

4.4.1. Structure

The interview protocol is compiled by following the guidelines for semi-structured interviews by Geletta (2013). Geletta (2013) divides a semi-structured interview into three segments. Starting with broad open questions to use the experience of the interviewee without going too deep into theoretical questions. Important points are noted by the interviewer to use for the subsequent segments. This is executed by asking them to tell something about their field of expertise and their connection with the research topic.

In the next segment of the interview, the targets formulated by the Dutch government are shown to the interviewee and their role in reaching these targets is asked. Subsequently, the identified stakeholders and main challenges derived from desk research and other interviews are shown and their point of view is asked. Important notes from segment one is used in this segment to dive deeper into the subject together with questions that have been formulated beforehand.

The last segment is used as a concluding segment. The topics that are not yet clearly answered can be treated and the interviewee will be asked if they want to add something.

The protocol is shown in Appendix B. It is important to consider that this protocol is just a guideline. The interview may differ per participant, depending on the progress of the interview.

4.4.2. Interview analysis

The data of the interviews is obtained by using the transcribing tool of Microsoft Teams and reviewing the transcription. The interviews are conducted in Dutch because all the interviewees are native Dutch speakers, as well as the researcher. The interviews are numbered from C1-C5 and important quotes from the transcriptions are translated into English and used for the results section.

4.4.3. Interviewees

The interviewees are based on the stakeholders derived from the stakeholder analysis. Not all the stakeholders were interviewed due to time constraints. A selection of four stakeholders was made by the researcher (Table 3). The motivation behind the choice for these stakeholders is that these stakeholders appear to be the most important ones, according to the annual expert panels that the Producer Responsibility Organisation (PRO) is organising to reach chain agreements in the (post-consumer) textile sector (Stichting UPV Textiel, 2024). Moreover, these interviewees were also selected based on their openness and availability to an interview. The names of interviewees are anonymised but known by the researcher.

Table 4: Interviewee list

Nr.	Stakeholder	Function of interviewee
C1	Post-consumer Textile Recycling Company	Logistics and R&D employee
C2	Municipality	Contract manager waste & circularity
C3	Post-Consumer Textile Collecting and Processing Organisation	Data and communication employee
C4	Producer (importer)	Corporate responsibility manager
C5	PRO	Account manager & communications officer

5. Results and Findings

5.1. Strategic Problem Orientation

5.1.1. Current State

As mentioned in the introduction, the EPR starts at the point where the textile product is placed on the Dutch market and follows the end-of-life cycle of the garment. Infographic 1.1 shows the various stages of this life cycle. This section gives an overview of the current state of these stages gathered by desk research and interviews with stakeholders. Subsequently, a brief history of EPR and the current situation after implementation in the Dutch textile industry in July 2023 is given to obtain a clear picture of the present state.

5.1.1.1. Current state of the textile chain

The textile industry used to be one of the most significant industries in the Netherlands, with three traditional regional hubs for textile and clothing production: Twente, Leiden and Brabant. However, due to globalisation, the production and manufacturing was outsourced to low-wage countries such as Bangladesh or Vietnam and the Dutch garment industry declined. The global production of textile fibres has almost tripled since 1975 and nowadays, the Textile and Apparel (T&A) value chain is a large and complex chain with numerous actors and stakeholders across different sectors (European Environment Agency, 2019).

The T&A chain can be roughly divided into three stages: the *Pre-Use Phase*, the *Use Phase* and the *Post-Use Phase*, whereas the post-use phase is the most important stage for EPR. Figure 6 shows this linear textile value chain which is still one of the main supply chains in today's textile industry.

The pre-use phase consists of extraction of raw materials, production into yarns and fabrics, finishing process into a garment and distribution. Raw materials are extracted either from natural agricultural resources (e.g., wool, cotton) or crude oil extraction (polyesters) and produced into fibres and spun into yarns. After the production process, the fabrics need finishing (e.g., bleaching, coating, printing, dying, adding accessories) and manufactured into garments (Stengg, 2001). After the production and finishing stage abroad, the textile products are imported and distributed by international and Dutch brand owners in the Dutch market and various retail channels. Additionally, the Netherlands serves as a transit country, with a significant amount of textile products being directly re-exported to foreign markets.

The use-phase is the stage where the textile products are sold and used by its consumers. According to a study by KplusV in 2021, approximately 800 to 900 million garments are sold in the Netherlands each year. Most of these garments are imported from clothing production hubs, such as Bangladesh, India or Vietnam. In the last two decades, the import of garments was doubled from 6.4 to 12.4 billion euros which puts the Netherlands on the fifth largest import EU country (Ministerie van Infrastructuur & Waterstaat, 2021a).

After the use-phase, garments are discarded. According to CBS, approximately 554,000 tonnes of textiles were discarded by households in the Netherlands in 2019. Approximately 15.5% was collected and sorted through thrift stores or clothing containers while 31.4% ended up as residual waste. 58% of these discarded textiles in residual waste was reusable or recyclable (Centraal Bureau voor de Statistiek, 2021). In comparison, in 2012, 255.000 tonnes of textiles were discarded in the Netherlands (Ministerie van Infrastructuur & Waterstaat, 2021b). It can be assumed that this growing trend of textile waste is continuing in the upcoming years due to the (ultra-)fast fashion model mentioned in the introduction.

In the current Dutch textile waste post-use phase system, municipalities are responsible for the infrastructure of the collection of textile waste in household waste. They collect it either on their own or in collaboration with a collection company. The textile waste is collected in underground and aboveground collection containers or through bags collected from homes.
This responsibility of the municipalities remains even with the EPR came into effect. Therefore, producers need to cooperate with municipalities and collection companies to organise their post-consumer textile collection (Staatsblad, 2023).
According to the Dutch Policy Program Circular Textiles 2020-2025, currently only 45% of the post-consumer textiles is separately collected through street containers. Of this, 53% is reused and 33% is recycled. Most of the recycled textiles are downcycled into low-quality cleaning cloths or insulation materials. A study by the Ellen MacArthur Foundation (2017) argued that in 2017, only less than 1% of the Dutch textile waste ends up in new garments.
The remaining 55% of textile waste is disposed of with household waste and incinerated (Ministerie van Algemene Zaken, 2020).

Most of the collected post-consumer textiles by municipalities and collection companies are sold abroad after sorting. Currently, The EU is one of the largest exporters of post-consumer textiles (EEA, 2023). Between 2000 and 2019, the export of post-consumer textiles has increased from approximately 550,000 tonnes to almost 1.7 million tonnes in the EU. The Netherlands plays a significant role in the global complex networks of post-consumer garments. This is mainly because of the Dutch advanced and innovative collection and sorting system, involving approximately 248 companies operating in this sector. In 2018, 84% of the collected post-consumer textiles were sold abroad. Once the post-consumer textiles leave the Netherlands, they enter a complex reverse value chain, moving large quantities across international borders primarily to the Global South (Hagen & Heinen, 2023).

In 2019 the Dutch textile industry employs over 127,000 workers according to a study of Circle Economy (2021), with 94% of these jobs being in retail and distribution. Circle Economy mentioned that only 1% of these positions considered core circular jobs, which are roles within the repair, waste and resource management sectors, such as textile collection and sorting after use (Circle Economy, 2021).

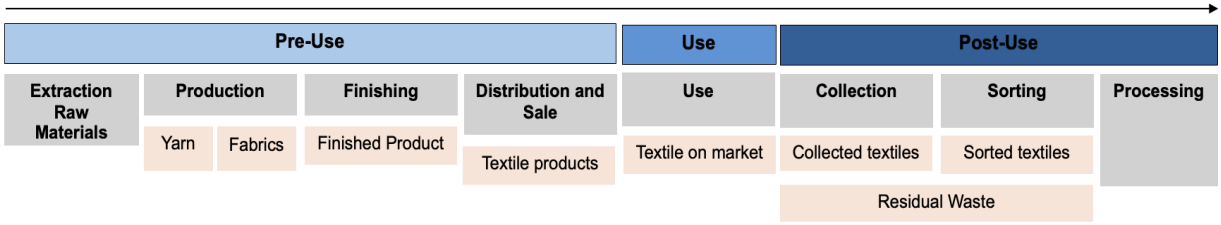

Figure 7: Linear Textile Chain (Based on Ministerie van Algemene Zaken (2022a))

With the National Circular Economy Program 2023-2030, the Dutch government is trying to push towards a circular textile industry. The EPR could serve as a directive to enhance this transition (Ministerie van Algemene Zaken, 2023).
In the upcoming subparagraph, an elaboration on the current state of EPR in the Dutch textile chain after the implementation in July 2023 is given.

5.1.1.2. Current state of EPR for textiles

EPR emerged in the early 1990s to address the growing volume and complexity of waste. The goal was to shift the burden of waste management away from local governments. Essentially, EPR transfers the responsibility for managing the end-of-life phase of a product back to its producers (Campell-Johnston & Vermeulen, 2022).

In 2008, the EU outlined EPR in its European Waste Framework Directive, where member states were obligated to implement EPR for specific products (i.e., batteries, end-of-life vehicles and e-waste) (European Union, 2008). This has resulted in EPR schemes for several product groups. For example, Vermeulen et al. (2021) found that Dutch EPR schemes have been proven to be successful in the car tyres and car wrecks industry already. Passenger car tyres have reached a collection rate of nearly 100% and car wrecks approximately 85%. Moreover, applying EPR with a mix of policy instruments have resulted in a decrease of landfilling in the automotive industry between 2000 and 2019: Down from 9% to 1%.

However, an EPR for textiles was not yet introduced in many member states. Namely, before the Dutch implementation in July 2023, France was the only member state that had an EPR for textiles. They introduced the EPR for textiles in 2007, and the EPR was mainly used for financial support for better collection of textile waste (Hagen, Heinen, 2023).

In the National Circular Economy Program 2023-2030, the government announced the implementation of EPR for textiles in July 2023 (Ministerie van Algemene Zaken, 2023). The government conducted independent research to examine the targets, organisation and implementation of these EPR schemes (Ministerie van Algemene Zaken, 2022). In the beginning of 2023, the decree was published (Staatsblad, 2023) and came into force in July 2023.

In the first six weeks, all textile producers had to report themselves to the ministry to report their name, address and an explanation of their textiles products that are part of the EPR. Furthermore, they must organise their collection system and make sure to meet the EPR targets (Figure 2).

Producers can join a collective or assume their responsibilities individually. This collective system is called *Producer Responsibility Organisations (PROs)*. The producer pays an annual fee to PRO and in exchange the PRO takes the responsibility of the producer and coordinates the collection and recycling processes, under supervision of the national governments. These organisations operate within legal frameworks set by the government (Vermeulen, 2021). Every EPR product group has one or multiple PRO's. For example, the PRO for batteries is "Stichting Open" (Afval Circulair, 2024).

The government can give an "Algemeen Verbindend Verklaring (AVV)" (Universally Applicable Collective Agreement) to a PRO. If a PRO receives an AVV, every producer of this sector is obligated to become a member of this PRO with an AVV. (Overheid, 2023). In June 2024, five product groups received an AVV (batteries and accumulators, end-of-life vehicles, passenger car tyres and packaging and packaging waste) (Campell-Johnston & Vermeulen, 2022).

The Dutch textile sector has three PRO's: Collectief Circulair Textiel, European Recycling Platform (ERP) and Stichting UPV Textiel. *Stichting UPV Textiel* is with 850 (June 2024) members the largest PRO for the textile sector. The organisation was established in 2022 by the sector association for entrepreneurs in non-retail *INretail* and the sector organisation for the Dutch textile- and garment industry *MODINT* (Stichting UPV Textiel, 2024). The members pay an annual fee based on the amount of kilograms of textiles products that have been put on the market that year. According to the Stichting UPV Textiel website, the fee is used to allow separate collection, reuse and recycling, supporting sustainable innovations in the supply chain. The collective organises expert panels with partners in the chain including municipalities, the textile recovery association and the thrift shop collective.
At the time of writing (August 2024), the PRO is trying to get an AVV from the government and is trying to organise how to meet the EPR obligations by making chain agreements. Their goal is to finish this at the end of 2024 (Interview C5, 2024).

From interviews it was observed that therefore no major changes for the stakeholders have taken place since the implementation of EPR in July 2023. For example, the Contract Manager Circularity of a municipality stated that:

"The first 1,5 years after implementation of EPR were used to set up a system and apply for an AVV. That application is currently under review. Agreements still need to be made between municipalities and the PRO. Therefore, not much has changed yet for us as a municipality" (Interview C2, 2024)

A data communication employee of a textile collector organisation and an R&D manager of a post-consumer textile recycling company also confirmed in the conducted interviews that currently not much has changed for them since the implementation and that they are continuing their post-consumer practices. (Interview C1, 2024), (Interview C2, 2024).

This is different for producers. They had to report themselves to the government or need to become a member of a PRO. The corporate responsibility manager of a garment

producer confirmed in the interview that they became a member of Stichting UPV Textiel after the implementation of EPR in 2023:

“Because we are a small company, it is not realistic for us to set up a whole collecting and sorting system. Therefore, we became a member of Stichting UPV Textiel. However, not much has changed for us so far after the implementation of EPR. We were already doing a lot of recycling: For example, recycled fibres in our new collections. Furthermore, we were working on an individual collecting system. Therefore, we will continue our circular practices and await the chain agreements of the PRO” (Interview C4, 2024).

However, it must be noted that this textile producer is classified as a sustainable brand who is already doing a lot of circular projects. The implementation of EPR could have a greater effect on textile producers who were not working on circular practices before.

Now that the current state is discussed, a stakeholder analysis is performed in the upcoming paragraph to obtain the relevant actors of the EPR for textiles and its interrelations for the Strategic Problem Orientation.

5.1.2. Stakeholder Analysis

As explained in Section 4.1, the identified stakeholders are classified into four broad categories. Each stakeholder is explained below, and an overview of the relevant stakeholders and their interests and functions is given in Table 5. Figure 8 shows the formal relations between the identified stakeholders of the current state.

1. **Producers**

The government defines “producers” in their EPR decree as: “a party which first places a new textile product on the market in the Netherlands on a professional basis” (Staatsblad, 2023). The government classifies three different types of producers that fall under EPR schemes: manufacturers, importers and foreign providers. Sellers of second-hand textiles are excluded for EPR schemes (Staatsblad, 2023).

Importer

Most of the garments that are placed on the Dutch market are manufactured abroad. An importer can be a wholesaler selling textiles imported from abroad to retailers. Retailers who directly purchase garments and household textiles from abroad are also considered as importers (Staatsblad, 2023).

Manufacturer

Producers who manufacture textile products in the Netherlands are defined as manufacturers. If they place their textile products on the Dutch market, they must meet the EPR obligations. They could sell their textiles to wholesalers or stores, which then resell the items. Manufacturers may also sell their textile products directly to consumers or businesses (Staatsblad, 2023).

Foreign Provider (Representative)
The last producer group is defined as “foreign providers”. They are based outside the Netherlands (including online sellers) and offer products directly to end-users in the Netherlands. They are required to appoint an authorised representative based in the Netherlands. This representative ensures the “producer” complies with the obligations (Staatsblad, 2023).

Stichting UPV Textiel (PRO)
As explained before, producers can become a member of the PRO. “Stichting UPV Textiel” is the largest PRO for the textile sector. The PRO is an important stakeholder in the value chain. Their function is to organise the EPR obligations on behalf of the members of the collective, by making chain agreements with other partners in the textile chain. Furthermore, the PRO needs to annually report on behalf of the members to Rijkswaterstaat from 2025 onwards. As explained in section 5.1, the PRO is working currently (August 2024) on chain agreements with the stakeholders and trying to receive an AVV from the government (Stichting UPV Textiel, 2024)

2. Other

Consumers/Users
Consumers and users of textile products do play an important role in the EPR for textiles. Namely, their buying and disposal behaviour influence the reuse and recycling rate of textiles. For example, they need to carefully bring their used textiles to the designated points and make sure that the textiles are clean and dry. Moreover, overconsumption is one of the main challenges in the transition towards a healthy and sustainable textile industry (Waterstaat, 2023).

Seller of Second-hand Textiles
A seller of second-hand textiles is excluded from EPR obligations. However, they have a function and interest in the collection of post-consumer textiles and the sale of reusable items. Furthermore, one of the targets for 2030 is that at least 15% of the textiles products that are placed on the market by the producer must be prepared for reuse in the Netherlands. Therefore, it is an important stakeholder for the EPR schemes.

Online second-hand textiles platforms
This stakeholder was identified from the interview of a garment producer:
“Online second-hand textiles platforms such as Vinted are also an important stakeholder to consider. This is a growing market and plays a significant role in the sale of reusable textile items across borders in Europe” (Interview C4, 2024). Like physical second-hand textile stores, online platforms are excluded from EPR schemes. However, these platforms influence the collection of post-consumer textiles and the sale of reusable items.

3. Post-consumer Textiles Organisations

Textile Collectors & Sorters

As explained before, textile collection companies play a significant role in the post-use phase of textiles. Collectors range from charities and non-profit organisations to companies. The collectors are assigned by municipalities and organise most of the collection and sorting systems in the Netherlands. After the collection and sorting process, they sell the post-consumer textiles to other partners. With the EPR decree, producers need to cooperate with these textile collectors on how to take care of their post-consumer textiles.

Textile Recyclers

Textile recycling companies take an important role in the post-use phase. They need to make sure to increase the quality and quantity of the collected post-consumer textiles that are meant for recycling. Textile producers need to become an important purchaser of the textile recycling companies to increase the recycled content in new garments (Interview C1, 2024).

4. Policymakers and Authorities

Municipalities

Municipalities have the duty of care for collecting household waste. Moreover, from 2025 onwards, municipalities are obligated to separate the textile waste from household waste (Staatsblad, 2023). As explained before, most municipalities assign textile collecting organisations to take care of the textile waste. With the implementation of the EPR schemes, producers need to negotiate with municipalities to cover part of their post-consumer textile waste and to make arrangements on fair compensation.

Department of Waterways and Public Works (Rijkswaterstaat)

Rijkswaterstaat serves as a governmental point of contact for the producers. Producers need to annually report their EPR results to Rijkswaterstaat. Rijkswaterstaat reviews the report and communicates the results and progress to the IL&T.

The Human Environment and Transport Inspectorate (IL&T)

The IL&T ensures that the EPR regulations are followed. For example, they monitor textile producers who fail to report or do not provide enough information. The IL&T decides to take further action if rules are not followed (Ministerie van Infrastructuur en Waterstaat, 2024). Therefore, they have an important function as stakeholder in supervising the producer.

Ministry of Infrastructure and Water Management

This stakeholder was identified during the interview with a municipality: “The Ministry of Infrastructure and Water Management is the principal on behalf of the government. They published the EPR decree in July 2023 and assigned Rijkswaterstaat and IL&T to organise the implementation of the EPR schemes.” (Interview C2, 2024).

European Commission

As explained in the introduction, the European Commission is examining the possibilities to implement a universal EPR for every EU member state (European Commission, 2023). Furthermore, the ESPR that came into force in July 2024, will affect the producers as well. The Netherlands has an important role as frontrunner, together with France, since these countries are the only EU member states who have already implemented EPR for textiles. The European Commission has an interest in the functioning of EPR for textiles in the Netherlands to help them by the policy making of a harmonised EPR for every member state.

Table 5: Overview of the relevant stakeholders and their interests and functions

Stakeholder Group	Stakeholder	Interests and Functions
Producer	Importer	• Must comply with the EPR schemes. • Pays fee to PRO based on kg's textiles products that are placed on the market that year (only if member)
	Manufacturer	• Must comply with the EPR schemes. • Pays fee to PRO based on kg's textiles products that are placed on the market that year (only if member)
	Foreign provider: Representative	• Pays fee to PRO based on kg's textiles products that are placed on the market that year (only if member) • The representative is responsible for the obligation of the EPR schemes
Producer	Stichting UPV Textiel (PRO)	• Is working on chain agreements to organise collective collecting & sorting systems on behalf of all the members of the PRO. • Needs to annually report the progress to Rijkswaterstaat on behalf of all the producer members from 2025 onwards. • Needs to monitor producers (members) if they meet the EPR targets
Policymakers and Authorities	Department of Waterways and Public Works (Rijkswaterstaat)	• Producer(s) (collectives) must hand in the annual report to Rijkswaterstaat. • Reports information to the ministry
Policymakers and Authorities	The Human Environment and Transport Inspectorate (IL&T)	• Monitoring Producer(s) (collectives) if they meet the obligations. • Gets informed by Rijkswaterstaat on functioning EPR
Policymakers and Authorities	Municipalities	• Need to separate textile waste from household waste as of 2025. • Making agreements with producers and textile collectors on collection and separation. • Are financially dependent on producers covering part of their textile waste.
Policymakers and	Ministry of Infrastructure and Water	• Acts as the government. Published the

Authorities	Management	EPR decree in July 2023 and assigned Rijkswaterstaat and IL&T to realise the implementation of EPR schemes.
Policymakers and Authorities	European Commission	• Planning to implement EPR for textiles for every EU member state. • Interest in functioning and progress of EPR for textiles in the Netherlands
Other	Consumers/Users of the textile products that are placed on the Dutch market	• Need to bring their used textile products to the designated points. • Buying and consuming textile products
Other	Seller of second-hand textiles	• Excluded from EPR Decree but do have an interest and function in enhancing reuse of textile products of the producer. • Collecting point of post-consumer textiles • Have a function in reuse textile products in the Netherlands
Other	Online second-hand textile items platforms	• Excluded from EPR Decree, but do have an interest and function in enhancing reuse of textile products of the producer
Post-consumer textile organisations	Textile collectors and sorters (e.g., Sympany)	• Collecting and sorting post-consumer textiles and selling it to other partners • Need to realise a high rate of reusable or high-quality recyclable post-consumer textiles
Post-consumer textile organisations	Textile recycling companies (e.g., Frankenhuis)	• Interest in post-consumer textiles. Recycles the post-consumer textiles. • Need to increase recycling quality and quantity (with a focus on fibre-to-fibre recycling) (and sell it to producers)

5.1.2.1. Interrelations of Stakeholders

Figure 8 shows the formal relations between the identified stakeholders of the current state. The relations are based on the actor analysis of 5.1.2.

As explained in section 4.1, this study primarily focuses on domestic stakeholders. However, the geographical boundaries visualised in this figure are used to show the actions needed by the stakeholder to overcome several challenges. This will be discussed in section 5.3.2.

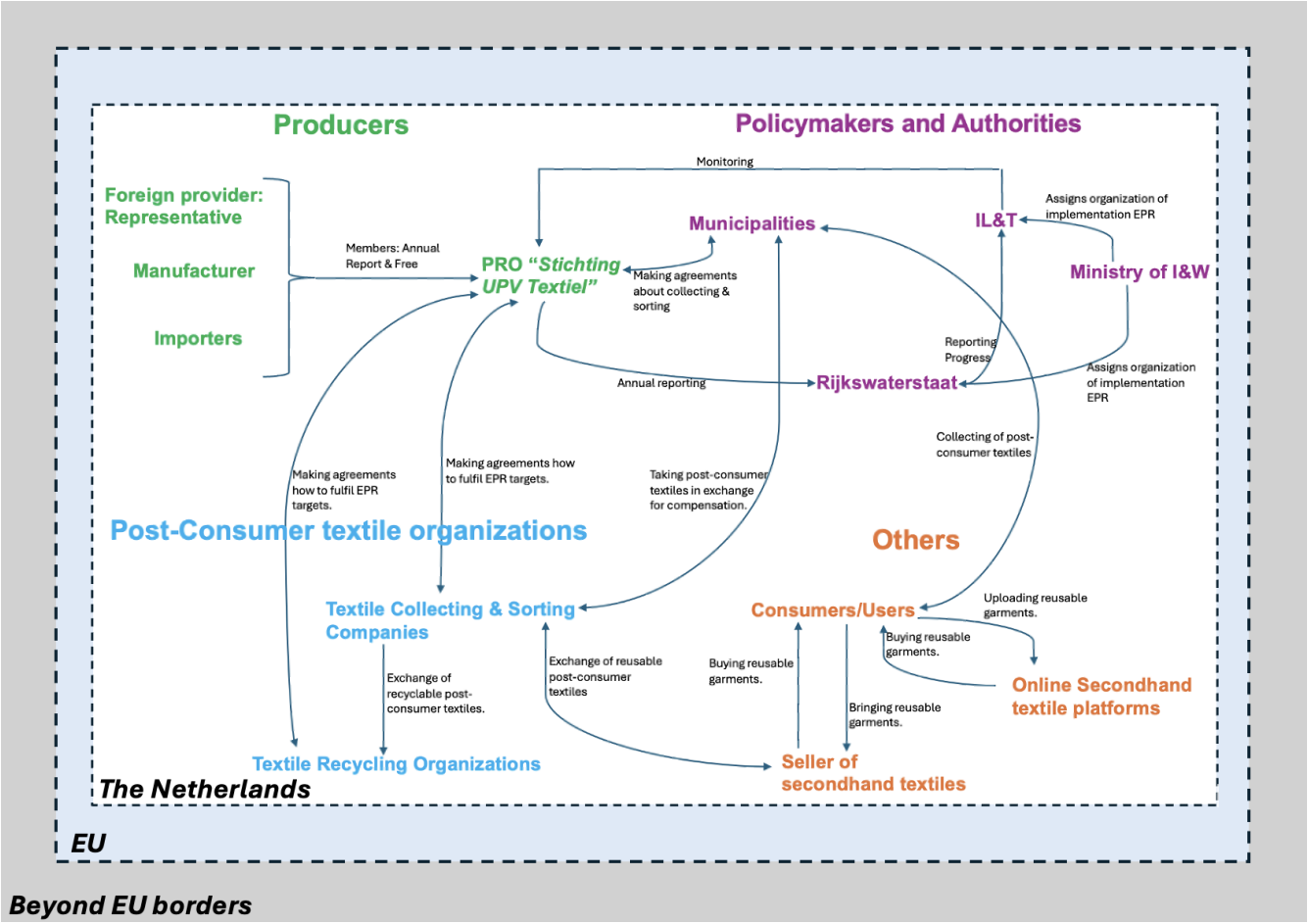

Figure 8: Formal relations between the stakeholders

5.2. Future Visions

This section discusses the findings of the next step of the Quist's backcasting approach (2007): Future Visions. As explained in Chapter 3, the future vision for EPR in 2030 is based on different stakeholder perspectives and its corresponding EPR requirements for 2030. This paragraph starts with the future vision of the government based on desk research which was already briefly explained in the introduction (Figure 2). Subsequently, other stakeholder perspectives are discussed derived from the conducted stakeholder interviews. Finally, an elaboration on the requirements is given in 5.2.3.

5.2.1. Future vision Government

In 2023, the Dutch government proposed a future vision for the Dutch textile industry in their National Circular Economy Program 2023-2030 (Ministerie van Algemene Zaken, 2023). Their vision for 2050 is to have a 100% circular textile industry: Where circular business models will be the norm, with clothing, textiles and fibres being used for extended periods and repurposed in high-value applications. All textile products will incorporate recycled and sustainable materials, ensuring longevity and subsequent recyclability. Moreover, the working conditions throughout the entire textile value chain will be satisfactory, pollution during production will be minimised and businesses will maintain transparency about their processes and products. Consumers will repair their torn clothing to extend its lifetime and will purchase fewer new items. When they do buy new garments, it will be second-hand or sustainable. Textile waste will be minimised as

materials from discarded textiles will be reused in new products (Ministerie van Algemene Zaken, 2023)

This vision needs to be at a half-way point in 2030, according to the government where:

- All textile products sold in the Netherlands will contain 50% sustainable materials, with at least 30% being recycled content and 20% being sustainable textiles.
- After collection, 50% of the resources, materials, and products introduced to the Dutch textile market will be recycled if direct reuse is not possible.
- 15% of the textile products sold in the Netherlands will be reused domestically after collection.

The EPR introduced in 2023 acts as an incentive to meet these targets. According to the government, it encourages the use of sustainable materials and recycled content, as well as the improvement of the quality of clothing in new textile products (Ministerie van Algemene Zaken, 2023). The EPR targets are already explained in the introduction (Figure 2). Figure 2 shows that the producer must prepare their new textile products that are placed on the Dutch market for reuse.

Prepare for reuse means useful application by checking, cleaning or repairing products or components of products that have become waste, so they are made ready to be reused without the need for further pre-treatment. This is mainly executed by textile collectors and sorting companies (Staatsblad, 2023).

The EPR targets are based on a consultancy report executed on behalf of the government. They proposed that a combined reuse and recycling target will give the opportunity to the producer to invest in reuse or recycling. The consultancy report stated that the targets are ambitious, but that it is needed to stimulate change. Moreover, they advised to tighten the targets over time if needed (Ministerie van Algemene Zaken, 2022).

5.2.2. Future vision other stakeholders

This section discusses the future visions from different stakeholder perspectives. An overview of the different perspectives is shown in Table 6. The stakeholders were asked during the interviews how they see their future scenario with EPR in 2030.

As explained in Section 5.1.2, the Municipality has the duty of care for collecting household waste and are obligated to separate textile waste from household waste from 2025 onwards. For this research, a municipality was interviewed. It was observed that this municipality is already working on reaching the proposed EPR targets. For example, in the beginning of 2024, they opened a "Textielhub" where schools (from vocational education to university) build together with local partners on a local circular textile chain: "We want to realise local circular textile chains and involving education so that the youth is prepared for a circular textile future" (Interview C2, 2024). However, the interviewee confirmed that their municipality is one of the frontrunners compared to other municipalities in the Netherlands in combining education with building circular local textile chains. "We are part of the expert group of the royal Dutch association for waste and cleaning services, containing mainly representatives of municipalities. Most of these municipalities are indeed working on circular textiles, but in their own way. For example, four municipalities in Limburg established their own collecting and sorting system for textiles: RD4. However, including education is not used yet. Therefore, we could play an exemplary role in these expert groups" (Interview C2, 2024)

Based on the interview, it can be assumed that this municipality aims for a future with local circular textiles chains and involving education so that the youth are prepared for a circular future.

As mentioned in the stakeholder analysis of section 5.1.2, Textile Collectors & Sorters will play a larger role in the textile chain with the implementation of the EPR schemes. This is also emphasised by an employee of a post-consumer textile collecting organisation, who's organisation collects 15 million kilos of post-consumer textiles on a yearly basis (Interview C3, 2024). "The textile industry used to be focused on producing, using and discarding. We were always involved in the discarding part. With the implementation of the EPR schemes, more attention will be laid on the discarding part: collecting and sorting will be essential". Based on their role in the chain, the employee elaborated on the future vision for EPR: "Currently we collect around 40% of the total textile waste. Which means that within 6 years, we need to collect 35% more and around 10% reuse in the Netherlands according to the EPR targets. Therefore, we aim for a well-established collecting and sorting industry in the Netherlands that has the right applications to cope with these large amounts of post-consumer textiles." (Interview C3, 2024).

In the interview with a post-consumer textile recycling company, the R&D manager emphasised their future vision where producers are obligated to use post-consumer recycled material in new garments and are therefore buying their post-consumer recycled material from local textile recyclers. "Producers don't see the urgence now. But if every producer is obligated to use a minimum of 5% post-consumer material in their new textile products, producers need to recycle their post-consumer materials. We aim for a circular future where producers use a minimum percentage of recycled post-

consumer materials in their new garments from local recyclers instead of using only virgin materials" (Interview C1, 2024).

The Corporate Responsibility Manager (CRM) of a textile producer, a Dutch based sustainable fashion brand, was interviewed as well. As mentioned in 5.1.1.2, this producer is already working on circular practices to meet the EPR targets. They are aiming to continue their circular practices and to play an exemplary role for other producers to create a circular textile industry. Furthermore, the CRM of the textile producer argued the need of creating value for a garment: "I think it is important to make consumers realise that a clothing item should be seen as something valuable rather than a disposable product." (Interview C4, 2024).
PRO Stichting UPV Textiel argued that their future vision is in principle the same as the future scenario of the Government: Being halfway the circular transition of the textile industry in 2030 (Interview C5, 2024).

Table 6: Future visions from different stakeholder perspectives

Stakeholder	***Future vision 2030***	***Source***
Dutch government	"In 2030, we will be at the half-way point in the transition to a 100% circular economy, which means that: • All textile products sold in the Netherlands will contain 50% sustainable materials, with at least 30% being recycled content and 20% being sustainable textiles. • After collection, 50% of the resources, materials, and products introduced to the Dutch textile market will be recycled if direct reuse is not possible. • 15% of the textile products sold in the Netherlands will be reused domestically after collection."	*(Ministerie van Algemene Zaken, 2023)*
Circularity manager of a Municipality	"We want to create a local circular textile chain and involve education so that the youth are prepared for a circular textile future."	(Interview C2, 2024)
Producer (Importer) (Sustainable brand)	"Having a circular textile industry where the consumer sees their clothing item as something valuable rather than a disposable product."	(Interview C4, 2024)
PRO (Stichting UPV Textiel)	"In principle, we are aiming for a more circular textile industry in 2030. Therefore, we agree with the future vision of the Government"	(Interview C5, 2024)
Textile collector/sorter	"Having a well-established collecting and sorting industry in the Netherlands that has appropriate tools to cope with these large amounts of post-consumer textiles."	(Interview C3, 2024)
Post-consumer textile recycling company	A circular textile industry where producers use a minimum percentage of recycled post-consumer materials in their new products instead of using only virgin materials.	(Interview C1, 2024)

5.2.3. Requirements

To reach the future vision, the government proposed a set of requirements for the producers in their EPR decree: The producer is responsible for their textile products that are placed on the market, producers need to report themselves to the ministry or the PRO, the producer has sufficient financial and organisational sources to obligate to the EPR schemes and need to organise and finance a collecting system that is costless available for consumers the whole year. If the producer decides to realise this as a collective, the producer can become a member of the PRO and pays an annual fee to the PRO. Furthermore, the PRO or the producer need to annually report to the ministry how much textile products that have been put on the market in the previous year. Moreover, starting from 2026, they need to annually report how they are obligating the EPR targets (Staatsblad, 2023).

Table 5 gives an overview of the requirements that are proposed to reach the future visions of 2030.

Table 7: Requirements to reach the future vision of 2030.

Proposed by	***Requirements to reach the 2030 EPR targets***	***Who is involved***
Government (Staatsblad 2023)	Producer is responsible for their textile products that are placed on the market. *Applies to: Consumer clothing, Work and corporate wear and Bed, table & household linen.*	Producers
Government (Staatsblad, 2023)	Every textile producer that is defined as "Producer" according to the EPR Decree, need to sign up within 6 weeks at the ministry: name, address, explanation about their textile products that are EPR	Producers
Government (Staatsblad 2023)	In 2030, 75% of the weight of a textile product that a producer places on the Dutch market must be prepared for reuse or recycling.	Producers, Textile-processing companies
Government (Staatsblad, 2023)	The producer has sufficient financial and organisational sources to obligate to the EPR schemes	Producers
Government (Staatsblad, 2023)	Producers need to organise and finance a collecting system that is costless available for the consumer the whole year	Producers, municipalities, textile collectors & processors
Government (Staatsblad, 2023)	Producers (or the PRO) need to annually report to the ministry: • how much textile have been put on the market in the previous year. • Starting in 2026, producers must also report annually whether you are complying with 2030 targets. The ministry checks whether the producer sufficiently fulfilled the obligations.	Ministry, PRO, Producers
PRO (Stichting UPV Textiel, 2024)	Members of the PRO need to pay an annual fee based on the kg's of textiles products placed on the market that year	Producers

Now that the future visions of the stakeholders are discussed and the proposed requirements to reach the 2030 EPR targets are elaborated, a backcasting analysis is performed in the upcoming section to analyse what hinders this future vision from a stakeholder's perspective and what kind of actions are needed to overcome these challenges based on a socio-technical approach.

5.3. Backcasting analysis

As explained in Chapter 3, the backcasting analysis is executed by identifying the main challenges and performing a What-Who-How analysis to explore how to overcome these challenges to reach the future vision of 2030.

5.3.1. Challenges of reaching the EPR 2030 Targets

The main challenges are derived from desk research and stakeholder interviews. The challenges are classified into sub-categories: *Technological, Structural* and *Cultural-Behavioural*. These categories are based on the socio-technical system of Quist's framework which is explained in Chapter 3. It must be noted that some challenges are closely connected to each other, which is further explained in the text. An overview of the main challenges is given in Table 7**.** The challenges are numbered to indicate, in the subsequent What-Who-How analysis, which challenges could be addressed through the proposed actions.

5.3.1.1. Technological Challenges

- Lack of (scaling) technical innovations and knowledge to handle recycling of blended fractions.

This challenge was observed from stakeholder interviews:
The Data communication employee of a post-consumer textile collecting organisation emphasised the complexity of recycling certain collected post-consumer textiles. "Some fractions are not suitable for reuse, but also not fit for recycling. You don't want to ship those to other countries either. This is especially true for blends, which are a mix of different types of materials. There is still a lack of innovations to handle the reuse and recycling of blended textile products'' (Interview C3, 2024).

The CRM of a textile producer also emphasised the problem of blends, but mainly addresses the challenge of scaling these innovations: "Blends are indeed hard to sort, but they are already innovations that can handle these types of blended materials. For example, chemical recycling, where cotton and polyester can be separated. However, the challenge is: how fast can these innovations be scaled to handle the increase of post-consumer materials?" (Interview C4, 2024).

5.3.1.2. Structural Challenges

- No incentive for producers with focus on circular design

As discussed in section 2, several studies emphasised that implementing eco-design is essential to reach the EPR targets: This facilitates easier recycling, reuse and repair (Kunz et al., 2018). However, from desk research it was observed that the current EPR system is not focussing on eco-design. For example, State Secretary Vivianne Heijnen emphasised in a parliamentary letter about Further Development of EPR that existing EPR systems are primarily focussed on the efficiency of waste management rather than on sustainability or circularity (Ministerie van Infrastructuur & Waterstaat, 2023). Hagen & Heinen (2023) stated in their study that EPRs have yielded very limited results in terms of eco-design so far. "The PRO fee falls drastically below what has been calculated as the actual cost of sorting textiles in Europe plus logistics and waste management in destination countries such as Ghana. EPR fees should consider garment composition, sustainability, repairability and recyclability and nut just weight, as is the case with the current declaration rules.".

Vermeulen et al. (2021) showed in their study that this is also a challenge in the Dutch EPR for Waste from Electrical and Electronic Equipment (WEEE): Vermeulen et al. (2021) examined in his study the limitations of the Dutch WEEE EPR system and found that producers do not see a financial return from investing in products that could support the adoption of more circular options in the current EPR system.

Several stakeholders mentioned the absence of incentives for eco-design as a challenge in the stakeholder interviews:
The contract manager of circularity & waste of a municipality also emphasised the lack of stimulation for eco-design: “Eco-design is indeed still not sufficiently encouraged in the current EPR system. Current EPR fee is not based on the actual cost of a product, including damage to people, environment and animals. This is needed to make eco design products more cost-effective and poor-quality textiles more expensive” (Interview C2, 2024)

Moreover, CRM of a garment producer argued that it is still cheaper to use virgin materials than recycled content in new garments for producers. If this is not financially stimulated, it is hard to make the shift for producers (Interview C4, 2024). This is also confirmed by the R&D manager of a post-consumer textile recycling company that was interviewed (Interview C1, 2024).

- <u>Lack of transparency in the (post-consumer) textile value chain</u>

As explained in section 5.1, due to the increased fragmented information systems and complexity of the (post-consumer) textile chain, transparency has become a huge challenge in the textile industry. A transparent textile chain is essential to meet the 2030 EPR targets:

From desk research it was observed that consultancy agency RebelGroup emphasised a lack of transparency in the textile chain as a challenge to meet the 2030 targets in their consultancy report as commissioned by the Government: "Producers must annually demonstrate how they fulfil their producer responsibility and the extent to which they meet the targets. They need to collect data, such as amounts of separately collected textiles and textiles in residual waste, as well as amounts by processing method (reuse, recycling, incineration). This requires greater transparency in the chain, which is a challenge. Necessary data is required from various partners in the (post-consumer) textile chain, both in the Netherlands and abroad to meet the reporting obligations" (Ministerie van Algemene Zaken, 2022).

Observations from stakeholder interviews show that the data manager of a post-consumer textile collecting organisation emphasised that they are noticing a *lack of transparency between partners* in the textile chain as well: “Transparency between stakeholders is a challenge right now. Partners are very protective and sometimes don’t want to give each other any credit. However, collaboration and transparency are crucial for a circular transition; otherwise, it won’t succeed. This is also evident with the EPR collective (PRO): it takes a long time to reach a chain agreement because partners are reluctant to share and fear for their own business. We need to overcome this somehow” (Interview C3, 2024).

However, not every stakeholder considered transparency as a main challenge for them. For example, Contract manager Circularity at a Municipality argued that they are already working on making their textile chain fully transparent and are convinced that this will succeed (Interview C2, 2024). CRM of a textile producer argued that transparency is an industrial challenge: “More transparency in the chain is needed indeed. But that is simply an industry problem. Producers need to address it themselves because it is solvable. They just need to adjust their business model for it” (Interview C4, 2024). However, it must be noted that this garment producer is already trying to work with a fully transparent business model. “We openly share the information of our suppliers and trace them as far back as possible. Usually, we at least know the regions where the materials come from and, in some cases, even the specific companies” (Interview C4, 2024).

- Ambiguity about the role and responsibility between partners in the value chain

From desk research it was observed that there is a challenge in the role between municipalities and producers. For example, the state secretary of I&W argued in a letter to the senate: “Municipalities are responsible to sort textile waste into household waste from 2025 onwards, and producers responsible for their own textile waste. They can decide with municipalities about the use of municipal collecting systems and corresponding compensation. However, this leads to disagreements on responsibility of the quality and compensation, because there is ambiguity about the legislative role between the partners”. Furthermore, the State secretary of I&W emphasised that clarity about the role between partners in the value chain is essential for enforcement of EPR schemes (Ministerie van Infrastructuur & Waterstaat, 2023).
As discussed in section 2, the ambiguity between the role of municipalities and producers for EPR textiles was already noticed by municipalities. As a result, Backes & Boeve (2021) explored the legislative role and responsibilities and emphasised the need for clear policies between the role of municipalities of behalf of the NVRD (Backes & Boeve, 2021).

Stakeholder interviews confirmed this ambiguity in role distinction between the different partners in the chain as a challenge for several stakeholders:
The contract manager of circularity & waste of the municipality that was interviewed confirmed the lack of clarity about the role between municipalities and producers: “We as a municipality have the duty of care to collect household waste. The plan of EPR is to collect post-consumer textiles in retail stores as much as possible. Zeeman and H&M are doing this already. However, most post-consumer textiles are (and will be) collected in containers in public spaces. We noticed that these textiles are of lower quality than the textiles collected in stores. We have the collection obligation for these textiles, but a fair compensation of the producer is needed to compensate for the costs of collection. How do you realise this? That is a big challenge” (Interview C2, 2024).
The data communication employee of a post-consumer textile collecting organisation emphasised the lack of synergy between stakeholders in the textile chain: “When you look at the EPR now, you see that there is too much ambiguity about the roles of the parties involved. There is little synergy between the PRO, the trade associations and the ministry. This is why it takes a long time to reach a chain agreement” (Interview C3, 2024).
Finally, CRM of a garment producer stressed out the risk of pushing the responsibility to

the supplier: “What I am afraid of is that the responsibility will be on the supplier in the supply chain. Namely, most Dutch producers import their garments from production sites outside Europe. These suppliers are the ones that need to use recycled content in the garments of the producer. Therefore, you need to help and compensate them in some way. We shouldn’t push the responsibility further down the supply chain. It is a collective responsibility” (Interview C4, 2024).

- Risk of buying off the producer’s responsibility in PRO

The state secretary of I&W also argued the risk of buying off the responsibility of the PRO in the letter to the senate: In a collectively executed EPR, producers do not physically receive their products back and thus do not directly confront their waste. Instead, they fulfil their responsibility by paying a waste management fee to the PRO. This situation raises questions about how much responsibility producers truly feel in this collective approach and whether producers adopting a (radically) circular design receive adequate recognition” (Staatssecretaris van Infrastructuur & Waterstaat, 2022).

This challenge was also observed in interviews:
“Buying off responsibility already happens through the EPR collective, so it’s about how the PRO will ensure that all parties still act. Otherwise, I think it would be very difficult to achieve the EPR targets” (Interview C4, 2024).
“You want to prevent producers from seeing the PRO as a buying of responsibility, which is happening right now. We need to ensure that we have the right people at the table and show them examples of how it can be done successfully, so that producers can see the possibilities which can lead to a snowball effect” (Interview C3, 2024).

- Risk of disappearance of textile sorting and recycling industry in the Netherlands

The data communication employee of a textile collecting organisation addresses the risk of disappearance of the textile sorting industry in the Netherlands: “This is a real issue we are facing right now. Currently, we see little recycling happening. As a result, we have collected goods in our warehouses that are not being taken, because there is no recycling and producers are not obligated to take them. So, consumers discard their goods, but the sorting process stalls with us. This is happening across Europe. Consequently, sorting organisations will offer their services cheaper on the market, making it unsustainable to maintain their sorting process. Keeping the sorting industry in the Netherlands is not only essential to reach several EPR targets. It will also prevent the textile chain from being more complex and therefore less transparent” (Interview C3, 2024).

This was also observed from desk research, where the national textile recovery association (VHT) argued in an article on their website: “Due to current decreased market prices, it is no longer financially viable to sort discarded textiles in the Netherlands. However, sorting a significant amount in the Netherlands is essential to reach the reuse and recycling targets. Namely, at least 15% precent need to be prepared for reuse in the Netherlands in 2030” (Vereniging Herwinning Textiel, 2024)

5.3.1.3. Cultural-Behavioural Challenges

- Lack of urgency and knowledge producers of using recycled content in new garments

This cultural-behavioural challenge was observed from interviews:
The R&D manager of a post-consumer textile recycling company addressed the lack of urgency of producers as one of their main challenges to reach the EPR targets: "Producers see no urgency of using recycled materials. They prefer virgin materials over recycled materials because of the price and quality. Therefore, we barely have producers taking our recycled post-consumer materials. Our main clients are still the automotive and isolation industry: 80% of our recycled content is going to the automotive and non-woven industry" (Interview C1, 2024).
This is also confirmed by the CRM of a garment producer: "Recycled content is more expensive and of lower quality than virgin materials. Therefore, most of the producers still prefer virgin materials" (Interview C4, 2024).
The PRO Stichting UPV Textiel argued during the interview that it is a combination between lack of knowledge on how to use the recycled content in new garments and lack of urgency of the producers: "A lot of producers are manufacturing their products outside of Europe. The recycled content needs to be shipped to these production sites to manufacture new garments. However, this is associated with a lot of barriers, mainly due to different legislation in other countries. So, besides the urgency, producers mostly don't know how to realise this" (Interview C5, 2024).

- Lack of awareness and knowledge of consumers/users: they need to make sustainable decisions about their buying- and disposal behaviour.

Finally, several stakeholders emphasised in their interviews the lack of awareness of consumers as a challenge to reach the EPR targets:
R&D manager of a post-consumer textile recycling company: "The consumer has also a responsibility. Especially when buying (ultra) fast fashion. The quality of these textile products is low and hard to reuse or recycle. Overconsumption and ultra-fast fashion are also a big challenge to consider" (Interview C1, 2024).

The CRM of a garment producer argued the disposal behaviour of the consumer: "Consumers are reluctant to put much effort into waste separation, you can see that for plastic separating for example. If a piece of clothing ends up in general waste, it becomes unusable and is incinerated. Therefore, raising awareness by the consumer is a significant challenge" (Interview C4, 2024).
The contract manager of circularity & waste of a municipality and the data communication manager of textile collector argued that buying second-hand clothing is still a challenge: "I think the fact that someone else has worn it is for most people still a hurdle that they need to overcome'' (Interview C2, 2024), "Consumers still prefer new over second-hand. Creating awareness by the consumer is a big challenge." (Interview C3, 2024)

PRO Stichting UPV Textiel emphasised the lack of knowledge of the consumer: "We notice that most consumers have a lack of knowledge of the textile chain. Providing accurate and transparent information to them is important to increase their awareness. For example, currently a significant amount of post-consumer textiles is still discarded in

household waste. It is important to inform them that recycling, and reuse is not possible with post-consumer textiles in household waste (Interview C5, 2024).

5.3.1.4. Overview of the identified challenges

Table 8: Overview of the identified challenges

#	Category	Challenges	Desk Research	Interviews
Technological Challenges				
1	Technological	Lack of (scaling) technical innovations and knowledge to handle recycling of blended fractions	-	*C3, C4*
Structural Challenges				
3	Structural	No incentive for producers with focus on circular design	*(Vermeulen et al. 2021), (Kunz et al., 2018), (Ministerie van Infrastructuur en Waterstaat, 2023), (Hagen & Heinen, 2023)*	*C1, C2, C4*
2	Structural	Lack of transparency in the (post-consumer) textile value chain	*(Ministerie van Algemene Zaken, 2022)*	*C1, C3*
4	Structural	Ambiguity about the role and responsibility between partners in the value chain	*(Backes & Boeve, 2021), (Ministerie van Infrastructuur en Waterstaat, 2023)*	*C2, C3, C4*
5	Structural	Risk of buying off the producer's responsibility in PRO	(Staatssecretaris van Infrastructuur en Waterstaat, 2022)	C3, C4
6	Structural	Risk of disappearance of textile sorting and recycling industry in the Netherlands	*(Vereniging Herwinning Textiel, 2024)*	*C3*
Cultural-Behavioural Challenges				
7	Cultural-Behavioural	Lack of urgency and knowledge producers of using recycled content in new garments	-	*C1, C4, C5*
8	Cultural-Behavioural	Lack of awareness and knowledge of consumers/users: they need to make sustainable decisions about their buying- and disposal behaviour	-	*C1, C3, C5*

Now that the main challenges are identified, a What-Who-How analysis is performed in the upcoming paragraph to explore the stakeholder actions that are needed to overcome these identified challenges that hinders the pathway to the 2030 EPR targets.

5.3.2. What-Who-How Analysis

The actions are divided into the same sub-categories as used for the challenges: *Cultural-behavioural, Structural* and *Technological* actions. Each action addresses one or multiple challenges, this is explained in the text. It must be noted that most challenges require several actions to help overcoming them. This What-Who-How analysis explores the key actions that were identified from the stakeholder interviews and desk research to

overcome the derived challenges of Table 8. Most of the actions are supported with a revised stakeholder map of Figure 8 to visualise the required steps from stakeholders needed when executing the action. Two actions are not supported with a stakeholder map: *Enhance cooperation, transparency and clear agreements between partners within the (post-consumer) textile chain* and *Obligation of producers to use recycled content in their garments & revised int. import-export regulations post-consumer textiles*. The reason for this is that these actions require a significant number of stakeholder steps according to the interview results and desk research, which could make the figure unclear. Furthermore, the technological actions are explained simultaneously, since these actions require similar stakeholder steps. A full overview of the What-Who-How analysis is shown in Table 9. Figure 13 visualises the links between the identified challenges and explored actions.

5.3.2.1. Technological actions

- Enhance automatization of sorting industry
- Enhance technical innovations to handle blended fractions.

To help overcome challenge(s): *Risk of disappearance of textile sorting and recycling industry from the Netherlands, Lack of (scaling) technical innovations and knowledge to handle the sorting and recycling of blended fractions*.

What:
One of the changes that is needed according to the Data & Communication employee of a textile collector to overcome *the risk of disappearance of the textile collecting industry in the Netherlands*, is enhancing automatization of the sorting industry. “To manage the growing flow of post-consumer material and to maintain affordable sorted post-consumer textiles prices, automatization of the sorting industry is essential to prevent the disappearance of the textile sorting industry from the Netherlands. Currently, this is done manually, which is expensive and time consuming. Moreover, automatization could also enhance transparency because it will be easier to trace the post-consumer textiles throughout the textile chain” (Interview C3, 2024).

Furthermore, one of the technical challenges that was mentioned was the difficulty in sorting and recycling blended fractions. To overcome this, the Data & Communication employee of a textile collector mentioned the need for technical innovations in the sorting and recycling industry:
"Eco-design should ideally eliminate the need for sorting different types of fractions in the future. However, it may take several decades before eco-design is fully implemented. Therefore, innovation in sorting and recycling will be crucial in the coming years to handle these blended fractions." (Interview C3, 2024).

Who & How:
“To enhance automatization and technical innovation, investments are needed. From companies who are willing to innovate in the automatization of the sorting industry, but also from the government and the PRO. This will help us to develop AI-controlled hyperspectral cameras for example “(Interview C3, 2024). Based on the interview with an employee of a textile collector, it was observed that investments are needed to stimulate

automatization and therefore prevent the disappearance of the textile sorting industry from the Netherlands. Figure 9 shows the stakeholder tasks needed for these actions. The "investors" are placed within the domestic border. However, these external investors could also be foreign organisations.

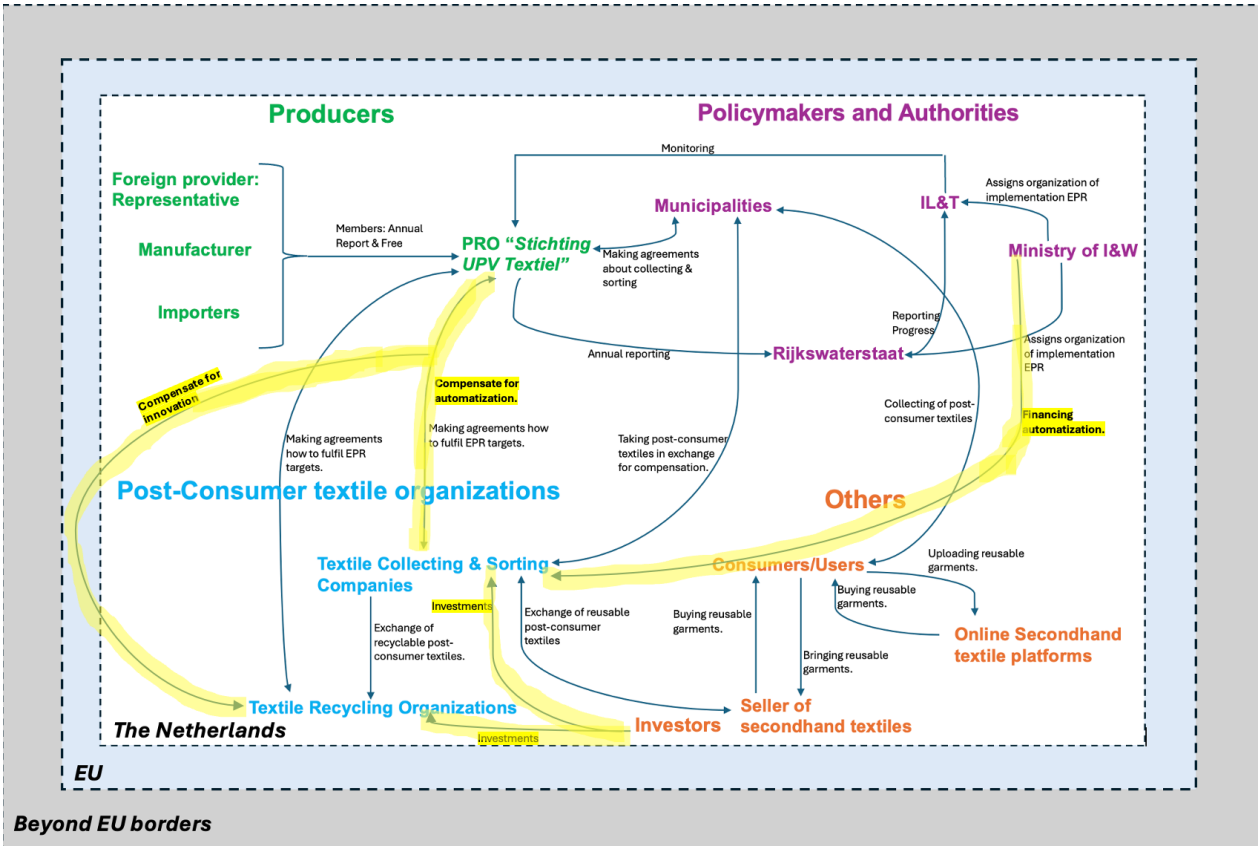

Figure 9: Stakeholder actions to enhance automatization of the sorting industry based on interviews and desk research.

5.3.2.2. Structural actions

- Structural compensation to prevent disappearance of the textile sorting and recycling industry from the Netherlands.

To help overcome challenge(s): *Risk of disappearance of textile sorting and recycling industry from the Netherlands.*

What:
Next to automatization of the sorting industry, the data communication manager of a textile collector and the R&D manager of a post-consumer textile recycling company also emphasised the need for structural compensation for the recycling, sorting and collecting industry to prevent *the risk disappearance of the textile and sorting industry from the Netherlands*, which is crucial to meet the 2030 EPR targets.

Who & How:
To realise this, the interviewees mentioned fair distribution of EPR fee as a key stakeholder task:
R&D manager of a post-consumer textile recycling company: "As a recycler we get subsidies, but this is not enough to have cost coverage of our production and to create

attractive recycled content prices for producers. Therefore, financial compensation from the PRO and government is needed" (Interview C1, 2024).
This is also confirmed by the contract manager of Circularity & Waste of a municipality: "You need to make sure that the collector, municipalities and recyclers don't make extra costs. For example, there are municipalities who organise the collection of textile waste by themselves. I believe that they should be compensated for that. This is not happening right now" (Interview C2, 2024). Based on the interviews, it was observed that at least fair distribution of the PRO could help in compensation post-consumer organisations and could contribute to prevent disappearance from the Netherlands. This is visualised in Figure 10.

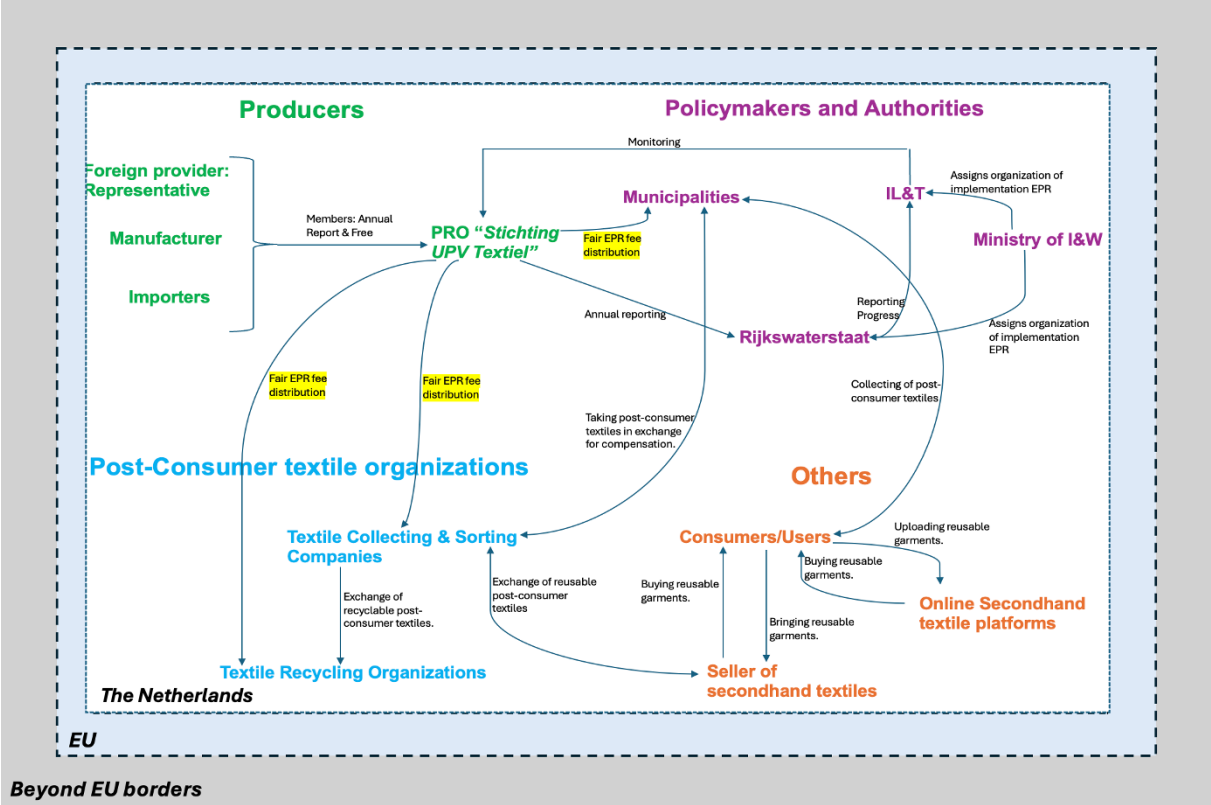

Figure 10: Stakeholder tasks needed to prevent disappearance of the sorting and recycling industry from the Netherlands based on interviews and desk research.

- <u>Enhance cooperation, transparency and clear agreements between partners within the (post-consumer) textile chain.</u>

To help overcome challenge(s): *Is needed for all challenges.*

What:
As derived from desk research and interviews, enhancing transparency and cooperation in the textile chain is essential for almost every challenge for reaching the 2030 EPR targets that is discussed in Section 5.3.2.1. It must be noted that a *lack of transparency* is a textile chain-wide challenge and requires several interconnected changes to overcome this. This study discusses the actions that are needed to enhance transparency and cooperation derived from stakeholder interviews to overcome the discussed challenges to reach the EPR 2030 targets.

One of them is a *lack of consumer awareness*. Transparent information about the textile chain to the consumer is needed to increase awareness. This is explained later in this section. Furthermore, the need for chain partners being cooperative and transparent about their businesses to each other could also help in preventing the *risk of buying off the producer's responsibility* to the PRO. Additionally, the data manager from a textile collector emphasised that cooperation and clear agreements will also help to prevent *ambiguity of the role and responsibility between partners in the (post-consumer) textile chain*: "You need to ensure that there is more synergy between the partners in the textile chain, right now there is a lot of ambiguity, which makes it hard to reach chain agreements for the EPR 2030 targets'' (Interview C3, 2024). Finally, the state secretary of I&W emphasised the importance of enhancing transparency for clear enforcement of the EPR scheme (Ministerie van Algemene Zaken, 2023).

Who & How:
Several stakeholders stressed out their perspectives on how to realise this:
The data manager of a textile collector emphasised the need for an AVV: "The best thing to reach cooperation and clear agreements in the EPR system is an AVV. Then everyone is part of a collective and they say: this is what we are going to do. Right now, there is a lot of uncertainty and ambiguity, causing people to way. Ultimately, if you want to achieve something, you must approach it collectively. So, the main parties need to come to an agreement, and for that an AVV is very important" (Interview C3, 2024)

The contract manager of circularity of the Municipality that was interviewed, and the CRM of a garment producer argued that being transparent as a sustainable frontrunner and therefore serve as a lead by example could also be contributed to enhance cooperation and transparency: "We are participating in the expert-groups of Stichting UPV Textiel, including other municipalities and authorities. We could give a lead by example with our circular practices and give transparent insights to other municipalities how we as a municipality can contribute to the 2030 targets" (Interview C2, 2024). This is also emphasised by the CRM of a garment producer: "We want to be a lead by example and inspire other producers by being transparent about our circular business" (Interview C4, 2024).

The data manager of a textile collector argued that developing digitised tools such as a chain of custody system could help in tracing post-consumer textiles flows that are leaving the Netherlands. "Chain of custody follows and documents materials and products through every step in the value chain as they go through various stages in the supply chain. Such tools could help in providing a transparent overview of the stages of the post-consumer textile chain" (Interview C3, 2024).
Furthermore, several interviewees argued that international regulations are also needed to enhance transparency and clear agreements between partners within the textile chain (Interview C3, C4, C5, 2024). The EU already implemented a Corporate Sustainability Reporting Directive (CSRD), where textile companies need to report their environmental, social and governance (ESG) issues, including supply chain transparency. As a result, textile companies will be more accountable for their practices which could lead to more transparency (European Commission, 2024). Furthermore, a harmonised EPR for all EU member states could also lead to more cooperation and clarity between partners in the

textile chain, which is already explained in section 5.1.
An overview of the stakeholder steps required derived from stakeholder interviews and desk research for this structural change can be found in Table 9.

- Making eco-design the norm

To help overcome challenge(s): *Lack of knowledge to handle blended fractions*, *no incentive for producers with focus on circular design*, *risk of buying off producer's responsibility in PRO*, *Lack of awareness and knowledge among consumer/users*.

What:
Several stakeholders stressed out the importance of making eco-design the norm in the textile sector to meet the 2030 EPR targets. This could for example solve the challenge of recycling and sorting blended materials (Interview C2, 2024), and pushing producers towards using recycled content in their new products instead of virgin materials (Interview C4, 2024).

Furthermore, several studies argued that without focussing on incentives for eco-design, EPR might end up being merely a mechanism to fund waste management instead of reaching circularity targets (Kunz et al., 2018), (Vermeulen et al., 2021).

Who & How:
First, it must be noted that the European Commission introduced an ESPR in July 2024, as explained in the introduction. With this new directive, producers in EU member states need to focus on eco-design criteria, such as improving product durability and reusability. This directive also applies to textile products. The ESPR is a framework legislation, which means that concrete product rules will be decided progressively over time (European Commission, 2022). It can be observed in Figure 11 as a stakeholder task for the EU.

In addition to the directives, the interviewees mentioned several other tasks that are required to make eco-design the norm in the textile industry:

The contract manager circularity of a Municipality that was interviewed argued that a true-pricing model is an essential element in making eco-design the norm: "We need to move towards a true-price model that includes all costs, including damage to people, environment and animals. If these factors are considered, you will see that poor-quality and virgin material textiles become much more expensive. As a result, consumers will buy more eco-design products because they will become more cost-effective. Implementing true pricing needs to be realised via international authorities (Interview C2, 2024).

Hagen & Heinen (2023) stressed out the tariff differentiation of EPR fees: "EPR fees should reflect on sustainability, recyclability and repairability, not just weight. Therefore, PRO's may increase EPR fees to reflect the real cost of textile collection, processing and waste management. This can be realised via eco-modulation". This is also one of the findings of the study from Vermeulen et al. (2021), where Dutch EPR performances were

examined. The eco-modulated fee that is paid by the producer to the PRO is visualised in Figure 11.

Furthermore, the CRM of a garment producer emphasized the importance of involving and compensating foreign suppliers when making eco-design the norm. “Most of the producers have a foreign supplier who manufactures their garments. It is important to compensate this supplier somehow and help them how to realise eco-design, instead of pushing down further the responsibility into the supply chain” (Interview C4, 2024). This is visualised as “eco-design compensation” in figure 11, to show the importance of involving foreign suppliers into the eco-design transition.

Finally, the CRM mentioned that they, as an eco-design frontrunner, could serve as a lead by example for other producers in the expert groups organised by Stichting UPV Textiel (Interview C4, 2024). This is not included in Figure 11, because it will make the figure unclear.

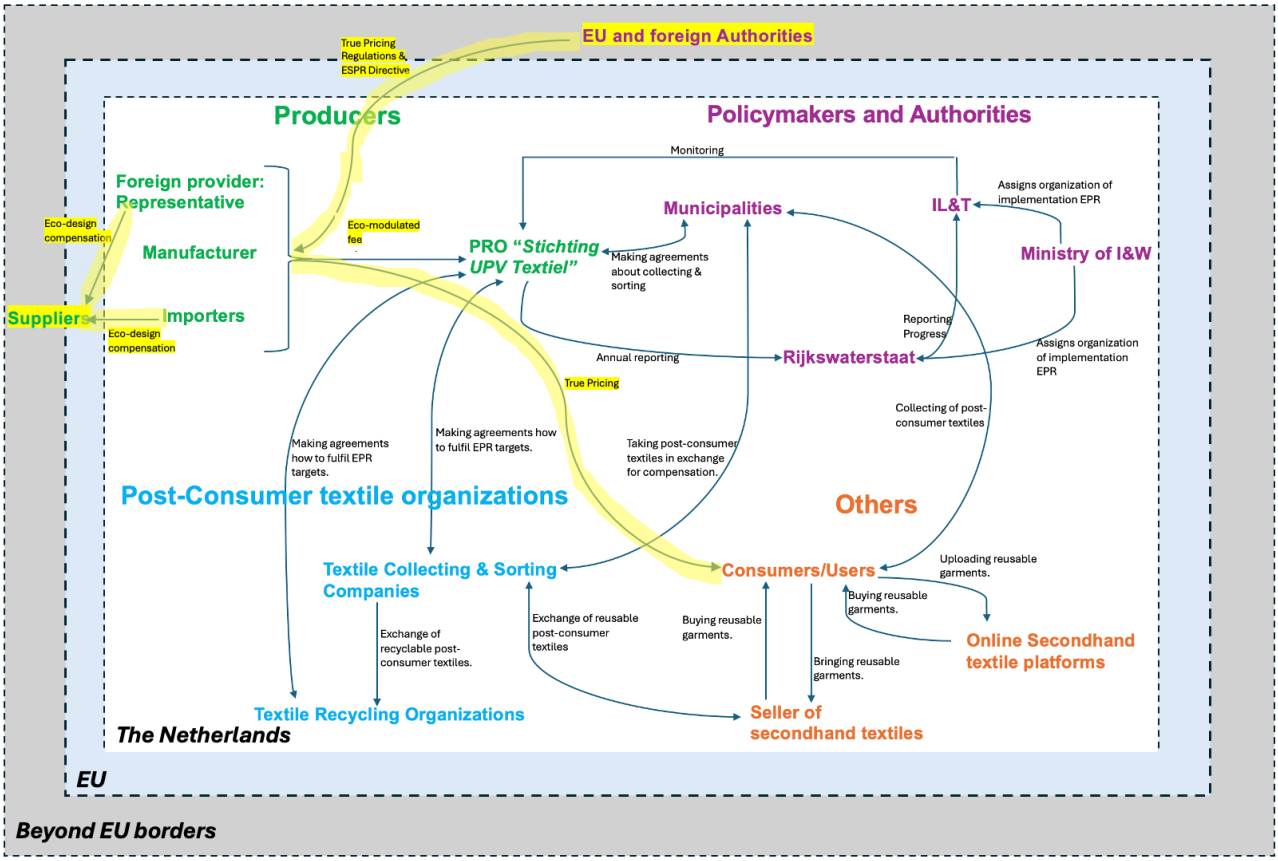

Figure 11: Stakeholder actions required to make eco-design the norm based on interviews and desk research.

- <u>Obligation of producers to use recycled content in their garments & revised int. import-export regulations post-consumer textiles.</u>

To help overcome challenge(s): *Lack of urgency and knowledge of producers using (post-consumer) recycled content in new garment, Making eco-design the norm.*

What:
The R&D manager of a post-consumer textile recycling company emphasised the importance of making the use of recycled content in new garments obligatory for producers to increase the urgency by producers: “There is currently no obligation for producers to take back their recycled content, even though one of the targets for 2030 is a minimum percentage of fibre-to-fibre recycling. As a result, we notice that the urgency is not high enough for the producers. With an obligation, producers are forced to use their recycled content” (Interview C1, 2024).

However, as explained before, Stichting UPV Textiel and the CRM of a garment producer stressed out the need for harmonised international regulations on the import and export of post-consumer textiles to make it easier for producers to incorporate their recycled content into their supply chain. Currently, mainly importers don’t know how to use their recycled content in their supply chain due to different regulations on the transportation of post-consumer textiles (Interview C5, 2024).

Who & How:
To realise this, several stakeholder actions are needed, according to the interviewees:
The R&D manager of a post-consumer textile recycling company argued that the obligation of using recycled content in new garments needs to be regulated via the EU (Interview C1, 2024), which is also confirmed by the Data Manager of the textile collector that was interviewed (Interview C3, 2024).

Furthermore, international import- and export regulations need to be revised:
"The EU import-export regulations are not at all geared towards EPR systems. This needs to be adjusted in a way that does not open the door to dumping clothing in other countries but allows for responsible exporting of post-consumer textiles." (Interview C3, 2024).
“Currently, you cannot export worn jeans as a product to Turkey. They must first be partially destroyed so they are no longer wearable. This is, of course, time-consuming and costly for us. There are many other producers with supply chains outside Europe, so this international regulation really needs to be reconsidered." (Interview C4, 2024).

An overview of the stakeholder actions needed derived from stakeholder interviews and desk research for this structural change can be found in Table 9.

5.3.2.3. Cultural-Behavioural actions

- Increase consumer/user awareness.

To help overcome challenge(s): *Lack of awareness and knowledge among consumer/users*.

What:
One of the cultural-behavioural challenges that was identified is *“lack of awareness and knowledge of consumers/users: they need to make sustainable decisions about their buying behaviour and disposal behaviour”*. Therefore, increasing consumer awareness is essential to let the consumer see the value of its textile product.

Who & How:

Several stakeholder perspectives were observed from interviews on how to increase consumer awareness. However, most of them mentioning the need of transparent communication to the consumer:

The R&D manager of a post-consumer textile recycling company: “We have to make sure that we keep transparent as a textile chain and make sure that we provide transparent information to the consumer, so that the consumer realises what is happening in the textile chain and making them aware of the collecting and sorting opportunities” (Interview C1, 2024).

Stichting UPV Textiel is working on a national campaign to increase consumer awareness: “We are working on a national campaign where we want to give the consumer the right information and transparency about the (post-consumer) value chain of their textile products, so that the consumer makes more sustainable disposal and buying decisions.” (Interview C5, 2024).

The CRM of a garment producer emphasised the need of seeing your textile product as a valuable item: "I think it's important to make the consumer realise that a clothing product should be seen as something valuable again, rather than a disposable item. That means, for example, putting a stop to ultra-fast-fashion clothing brands like Shein." This is visualised as a task for foreign authorities in Figure 12.

As explained in Section 5.2.2., the municipality that was interviewed is trying to increase the awareness via another initiative: by involving the youth via educational institutions, to make them aware and prepare them for the future (Interview C2, 2024). The interviewee emphasized the importance to involve educational institutions to increase the awareness. Based on these findings, a stakeholder figure is drawn (figure 12).

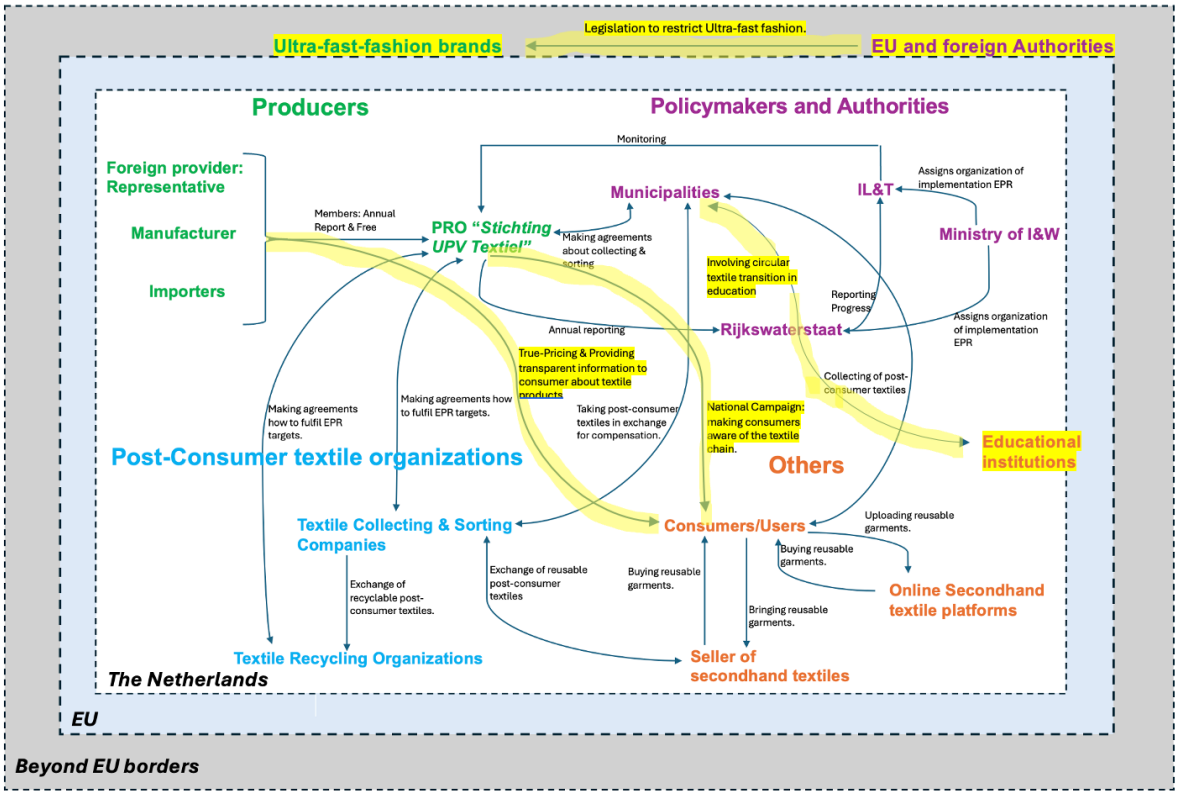

Figure 12: Stakeholder actions needed to increase consumer awareness based on interviews and desk research.

5.3.2.4. Overview of What-Who-How Analysis

Table 9 gives an overview of all the actions that are derived from the stakeholder interviews and desk research to help overcome the identified challenges discussed in Section 5.3.2.1. Figure 13 visualises which action addresses what challenge. It must be noted that *Enhancing cooperation, transparency and clear agreements between partners in the value chain* addresses all challenges. Figure 13 only visualises the key links with the challenges.

Table 9: Overview of What-Who-How analysis

What	Who	How	Sources
Technological Actions			
Enhance automatization of the sorting industry to cope with increasing fractions	Textile sorters and collectors, PROs, investors, government	Financial support of the sorting sector to develop and scale automatization	(Interview C3, 2024)
Enhance technical innovations to handle blended fractions	Textile sorters, collectors and recyclers. PROs, investors, government	Financial support of the sorting and recycling sector to develop and scale technical innovation	(Interview C3 & C4, 2024)
Structural Actions			
Structural compensation to prevent disappearance of the textile sorting and recycling industry from the Netherlands	PROs, Municipalities, Government, Post-Consumer Organisations, Producers	Fair distribution of EPR fee, investments, subsidies	(Interview C1, C2 & C3, 2024)
Enhance cooperation, transparency and clear agreements between partners within the textile chain	All stakeholders of the textile chain	Expert Panels where frontrunners can give a lead by example, AVV for Stichting UPV Textiel, EU regulations on transparency (E.g., CSRD, harmonised EPR for all member states), Chain of custody system to trace post-consumer value chain	(Interview C3 & C5, 2024), (European Commission, 2022)
Making eco-design the norm	Producers, national and international government, PROs	ESPR, Tarif Differentiation for eco-design, true-pricing, Lead by example of sustainable producers	(Interview C2, C3 & C4, 2024), (Hagen & Heinen, 2023), (Vermeulen et al., 2021), (Kunz et al., 2018)
Obligation producers of using recycled content in their garments & revised int. import-export regulations post-consumer textiles	national and international government, Producers	EU regulation for obligation using minimum percentage recycled content for producers, revised import-export regulations to make it possible to transport post-consumer textiles to foreign supply chains	(Interview C1, C3 & C4, 2024), (Hagen & Heinen, 2023)
Cultural-Behavioural Actions			
Increase consumer awareness	Producers, PROs, national and international government	National Campaign PRO, producers provide consumer transparent information, international regulations for restricting ultra-fast fashion	(Interview C3 & C5, 2024)

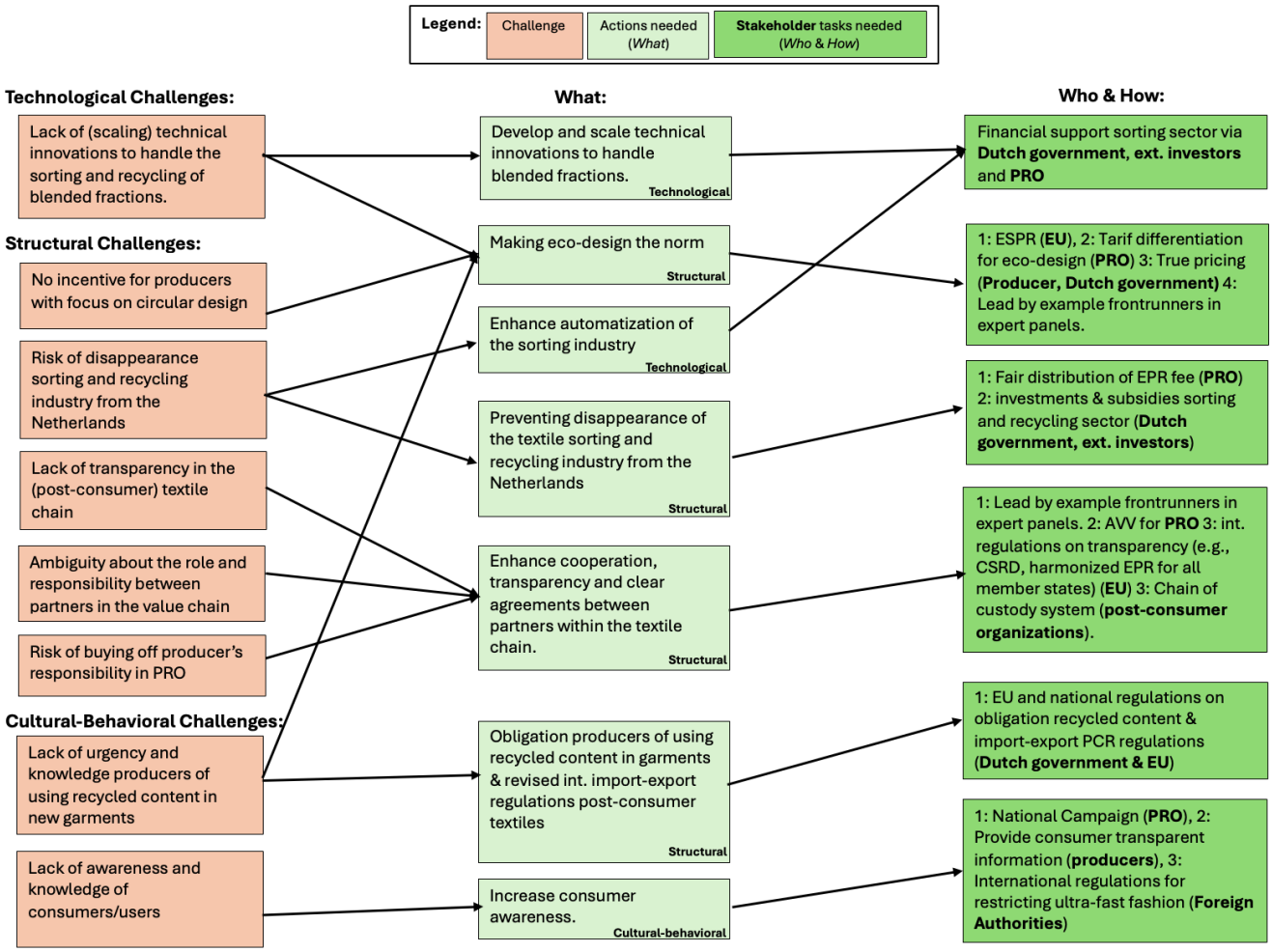

Figure 13: Overview of the derived challenges, associated actions (What) & required stakeholder tasks (Who & How)

6. Discussion

This chapter discusses the findings of this study and puts them into the context of theoretical perspective. Furthermore, it discusses the scientific contribution of this study, the limitations of the findings and concludes with recommendations for further research.

6.1. Interpretation of Results and Scientific Implications

This research aimed to examine the consequences of the implementation of the Dutch EPR system and its corresponding EPR targets for 2030 in the textile sector from different stakeholder perspectives. The primary objective was to examine what challenges several stakeholders are facing to reach the 2030 EPR targets and to explore how to overcome these challenges. The results indicate that there exist indeed several technological, structural and cultural-behavioural challenges that are hindering the 2030 EPR vision. Almost every interviewee pointed out that the 2030 EPR targets proposed by the government are ambitious and hard to reach without overcoming several challenges first.

The lack of eco-design incentives was observed as a challenge to reach the reuse and recycling 2030 EPR targets for several stakeholders during the interviews. This is in line with the literature found on the strengths and limitations of EPR, such as (Vermeulen et al. 2021), (Kunz et al., 2018) and (Campell & Johnston et al., 2022). All these studies found that an EPR scheme functions most of the time more as a tool to fund waste management rather than a tool to enhance circularity if incentives for eco-design are not considered. For example, Campell-Johnston et al. (2022) found that this is a currently existing challenge for EPR in the WEEE sector. The results of this Master research project show that this appears to be a challenge for the Dutch textile sector as well. The explored structural change in the What-Who-How analysis to make eco-design the norm could help to overcome this challenge. The stakeholder actions needed for this structural change are like findings from other EPR studies. For example, PRO Stichting UPV Textiel emphasised that they are working on tariff differentiation for the EPR fee to stimulate eco-design (Interview C5, 2024). This is in line with the study on general functioning of Dutch EPR systems by Vermeulen et al. (2021), who proposed eco-modulation as one of their pathways. Additionally, the results of this master research project show that most textile producers are importers and therefore eco-design incentives will not reward producers directly, which was also one of the findings in a study on EPR for the WEEE sector (Kunz et al., 2018).

Furthermore, one of the EPR targets was to have 15% post-consumer textile reuse in the Netherlands by 2030. What became clear from the backcasting analysis is that without preventing the disappearance of the sorting and collecting industry from the Netherlands, this target will be hard to reach. The What-Who-How analysis showed that at least automatization of the sorting industry, financial compensation and investments is required to prevent this disappearance. However, these findings were based on answers from interviewees, and were not found in literature. Therefore, a deeper analysis is needed to explore the effectiveness of these stakeholders' actions and examine if this could help to overcome the challenge.

Another target for 2030 was that 33% of the collected post-consumer textiles need to be fibre-to-fibre recycled. What became clear from interviews is that there is currently no obligation for textile producers to use their recycled textiles in new garments. The What-Who-How analysis showed that the EU needs to implement regulations to obligate textile producers to use a minimum percentage of their recycled content in new garments.
However, other interviewees mentioned that there is also currently a lack of knowledge by producers how to implement the recycled textiles into their supply chain. It became clear from the results that this has mainly to do with the current strict import- and export-regulations of post-consumer textiles, which makes it difficult for producers to implement this into their supply chain. This is in line with a study on EPR for the WEEE sector, who argued that the complexity of systems, rules and their enforcement between member states and beyond has led to challenges when post-consumer products move internationally (Campell-Johnston et al., 2022).

Finally, the ambiguity of the role and responsibility between partners in the textile chain was also a challenge that was emphasized by several stakeholders for reaching the 2030 EPR targets. From the literature review it became clear that the ambiguity in legislation between textile producers and municipalities was already an observed challenge before the implementation of the Dutch EPR for textiles took place (Backes & Boeve, 2021). The results of this Master research project show that there exists ambiguity and a lack of synergy between more partners in the chain, such as textile sorters, producers and PROs. From the What-Who-How analysis it became clear that, among others, clear chain agreements are required to overcome this challenge. Stichting UPV Textiel emphasised in the interview that they are currently working on this by organising expert groups (Interview C5, 2024).

6.2. Scientific Contribution

This section discusses the scientific contribution of this study. It can be observed that this study has a scientific contribution in developing new methods and filling a gap in literature on the challenges of EPR for textiles.

First, the theoretical framework used for this study is different from what most other studies on EPR (for textiles) have done. Backcasting has not been applied yet for studies on EPR. Quist's (2013) participatory backcasting framework was helpful to clearly visualise what challenges stakeholders will face along the pathway to the 2030 vision, and exploring what actions are needed to overcome these challenges. In addition, step 4 of Quist's framework could be coupled to the results of this study to visualise the short-term and long-term actions that are needed to reach the 2030 EPR targets, which is due to time limits not executed in this study.
Literature review shows that (Vermeulen et al., 2021) was the only related study that examined the organisation of EPR in a future vision context. They developed three pathways in their study for improving EPR in the Netherlands to enhance a circular economy. However, their study was focussed on Dutch EPR systems in general and did not consider the circularity targets of 2030, but a 100% circular economy vision. Therefore, the findings of this study could be used as a new scientific approach to analyse the EPR performance and organisation with respect to the circular economy goals.

Second, as explained in section 1.3, this study tried to contribute to the empirical research on EPR and helped to realise a stronger academic comprehensive evaluation of EPR achievements. By exploring the challenges and stakeholder actions required to overcome these challenges, a broader scientific picture on the effectiveness of EPR for enhancing circularity is given.

6.3. Limitations

This section covers a discussion on the reliability and validity of the methods used in this study.
First, it is important to note that the EPR system for textiles was recently implemented in the Netherlands, and it is one of the first countries that has implemented EPR for textiles. Therefore, limited published scientific research exists on this topic. The primary data for this thesis comes from the conducted interviews and from consultancy and policy reports. These reports are commissioned by governmental parties or other stakeholders and could therefore be biased. This is mentioned in the text. The interview results are therefore central to this study and are subsequently compared with findings from reports and academic studies on EPR in other sectors. It is important to mention that these findings appear to be the main challenges of stakeholders. However, as Stichting UPV Textiel already mentioned, the challenges are strongly interconnected, and more challenges could arise in the upcoming years (Interview C5, 2024)

When reflecting on the interviews, several limitations regarding the validity of the data must be considered. First, due to limited time, five stakeholders were interviewed. Although these stakeholders were identified as the most relevant stakeholders for EPR textiles, not every stakeholder that was derived from the actor analysis was interviewed. For example, this study did not focus on exploring the consumer's perspective, whereas they appear to have an important role in reaching the EPR targets. Although several interviewees mentioned multiple challenges faced by consumers, this limitation inevitably narrows the analysis of certain challenges. Interviews with consumers could be helpful to confirm these challenges, such as the lack of consumer awareness.
Another limitation of the interviews is that some participants mentioned their willingness to collaborate but had limited time for an interview, leading to shorter interviews. As a result, the information collected from these participants may be less detailed. Finally, the geographical scope of this research was the Netherlands. However, several stakeholders mentioned steps needed from foreign stakeholders to overcome challenges. These steps were visualised in the stakeholder figures, but not further examined yet.
When reflecting on the theoretical backcasting framework, it is important to note that, reaching the 2030 EPR goals is an iterative process. Actions may not happen as planned or unforeseen circumstances could occur which may lead to emerging challenges. Therefore, the government emphasized in their directive that the EPR scheme will be evaluated after five years of implementation (Staatsblad, 2023). However, backcasting analysis relies on a static, stepwise process and does not account for emergent behaviours of stakeholders, unforeseen circumstances or dynamic feedback. As a result, the findings of this study could fail to remain relevant in the future as conditions change and emerging challenges could occur.
The upcoming paragraph discusses the suggestions for further research.

6.4. Recommendations for further research

First, it is recommended that future research include a wider range of interviews with diverse stakeholders. For example, it would be interesting to interview multiple textile producers to compare their perspectives, as well as other key stakeholders like consumers and second-hand store operators. Expanding the scope of interviews will provide a more comprehensive understanding of the challenges faced by the stakeholders and could lead to more targeted and effective recommendations for change to overcome these challenges.

Second, this study has considered foreign stakeholder actions, but did not conduct interviews with foreign actors to examine their perspective to reach the future vision. For further research, it would be interesting to conduct interviews with foreign actors such as the European Commission, textile fabrics, foreign sorters or foreign dyeing companies to obtain their perspective on the challenges faced to reach the EPR targets for the Dutch textile industry. Especially because the implementation of EPR for all EU member states is under construct (European Commission, 2022).

Third, this study explored a first attempt on the stakeholder steps needed to overcome the identified challenges by performing a What-Who-How analysis. Future research could explore the effectiveness and organisation of these steps (e.g., implementing a true-pricing model or eco-modulation). Moreover, this study mentioned several collecting systems (e.g., a take-back system). Especially in-store collecting is a recent trend and limited scientific research is conducted yet on the effectiveness. It would be interesting to examine the challenges of these emerging collecting systems to create a more comprehensive view on the challenges to reach the 2030 future vision.

Finally, it must be noted that the transition pathway was out of scope for this research. Further research could use the findings of this study to utilise step 5 of Quist's framework (2007): develop transition pathways, which could give insights on the long-term and short-term steps to reach the 2030 EPR targets.

7. Conclusions & Practical implications

This chapter discusses how the study has answered the main research question and sub-research questions. Subsequently, the practical implications of this study are discussed.

7.1. Conclusion

This study has investigated the challenges to reach the 2030 Dutch ERP for textile targets from different stakeholder perspectives in the Dutch textile chain. Furthermore, stakeholder actions were explored on how to overcome these challenges. It attempted to answer the following research question: *What is the role of the stakeholders to overcome the challenges to reach the Dutch EPR textile targets of 2030?* To come to an answer, a backcasting analysis approach from Quist (2007) was used as a theoretical framework. The steps of the backcasting framework were used to formulate the sub-questions. A qualitative approach was used to gather data via desk research and semi-structured interviews with stakeholders in the textile chain. Stakeholders were identified and analysed via the actor analysis method of Enserink et al. (2010). From the findings, each sub-research was answered to finally obtain an answer to the main research question.

The first sub question: *What is the current state of the Dutch upstream and downstream stages of the Dutch EPR for textiles?* Was answered by conducting desk research and asking questions in stakeholder interviews on the current state of the Dutch EPR system. It was observed that the T&A chain can be divided into three stages: *Pre-Use Phase*, the *Use Phase* and the *Post-Use Phase*, whereas the post-use phase is the most important stage for EPR. In the current Dutch post-use phase system, municipalities are responsible for the infrastructure of the collection of textile waste in household waste. They collect it either on their own or in collaboration with a collection company. The responsibility of the municipalities remains even with the EPR came into effect. Therefore, producers need to cooperate with municipalities and collection companies to organise their post-consumer textile collection. Most of the collected post-consumer textiles by municipalities and collection companies are sold abroad after sorting. Once they leave the Netherlands, they enter a complex reverse value chain, moving large quantities across international borders. EPR could serve as a directive to make the post-use phase more sustainable and therefore the textile industry more circular. Dutch EPR schemes have been proven to be successful in the car tyres and car wrecks industry already. For example, applying EPR with a mix of policy instruments have resulted in a decrease of landfilling in the automotive industry between 2000 and 2019: Down from 9% to 1%. The Dutch government implemented the EPR scheme for textiles in July 2023. From interviews it was observed that no major changes for the stakeholders have taken place since the implementation. The main reason for this is that the organisation of the EPR system is still under construction at the time the interviews were conducted.

The second sub question: *What are the relevant stakeholders of the upstream and downstream stages of the Dutch EPR for textiles?* This question was answered by performing an actor analysis. The following key national stakeholders were found **Producers**, which can be classified into: **Importer** (imports their garments from foreign

suppliers and sells them on the Dutch market), **Manufacturer** (manufactures textile products in the Netherlands) and **foreign providers** (are based outside the Netherlands and offer products directly to end-users in the Netherlands). Foreign providers need to assign an authorised representative, which ensures that the "producer" complies with the EPR obligations.
Producers can become a member of a **Producer Responsibility Organisations (PROs)**, which is an important stakeholder of EPR for textiles. The largest PRO is Stichting UPV Textiel, with 850 members (June 2024). Their function is to organise the EPR obligations on behalf of the members of the collective, by making chain agreements with other partners in the textile chain. Furthermore, the PRO needs to annually report on behalf of the members to Rijkswaterstaat from 2025 onwards.
Furthermore, **Textile recyclers** and **Textile sorters & collectors** play an essential role in reaching the EPR targets as well, since one of the targets is that a minimum of 15% of the textile products that are placed on the Dutch market need to be prepared for reuse in the Netherlands. Therefore, producers need to cooperate with these organisations to handle collection, sorting and recycling.
Other important stakeholders are the **Consumers**, **Sellers of (online) second-hand textiles** (important collection point of post-consumer textiles), **Municipalities, Rijkswaterstaat**, **The IL&T** (monitors textile producers if they meet the EPR targets) and the **Ministry of I&W** (published the EPR decree in July 2023).

The third sub question, *what is the future scenario for Dutch EPR for textiles for 2030 from a stakeholder perspective and what are the requirements to reach this future scenario of 2030?* Was answered by asking during the stakeholder interviews their future vision of 2030 for EPR textiles. The future vision of the government was derived from desk research. Their future scenario is that in 2030, the circular transition for the textile industry is at its half-way point, with: 1: All textile products sold in the Netherlands will contain 50% sustainable materials, with at least 30% being recycled content and 20% being sustainable textiles. 2: After collection, 50% of the resources, materials, and products introduced to the Dutch textile market will be recycled if direct reuse is not possible. 3: 15% of the textile products sold in the Netherlands will be reused domestically after collection. The government proposed several requirements to realise this: The producers is responsible for their textile products that are placed on the market, the producer has sufficient financial and organisational sources to obligate to the EPR schemes, producers need to sign up to the ministry within six week after implementation of the scheme, producers need to organise and finance a collecting system that is costless available for the consumer the whole year and they need to annually report to the ministry how much textiles have been put on the Dutch market.
The future vision of the government was shown during the stakeholder interviews and their future vision perspective was asked. Most of the stakeholders support the future vision of the government. The interviewee of the municipality that was interviewed argued that they want to create a local circular textile chain and involve education so that the youth are prepared for a circular textile future. The CRM of a garment producer aspires to a circular textile industry where the consumer sees their clothing item as something valuable rather than a disposable product. The textile collector organisation that was interviewed aspires to a well-established collecting and sorting industry in the Netherlands that has appropriate tools to cope with increasing amounts of post-

consumer textiles. Finally, the interviewee of a post-consumer textile recycling company emphasised their vision for 2030 where producers use a minimum percentage of recycled post-consumer materials in their new products instead of using only virgin materials.

The fourth sub question, *what are the challenges faced by the stakeholders of the upstream and downstream stages of the Dutch EPR for textiles?* Gave answers on which challenges stakeholder face to reach the 2030 EPR targets derived from stakeholder interviews and desk research. The challenges were divided into three sub-categories: *Structural, Technological* and *Cultural-Behavioural*.
Identified structural challenges were:

- No incentive for producers with focus on circular design
- Lack of transparency in the (post-consumer) textile value chain
- Ambiguity about the role and responsibility between partners in the value chain
- Risk of buying off the producer's responsibility in PRO
- Risk of disappearance of textile sorting and recycling industry in the Netherlands.

The observed cultural-behavioural challenges were:

- Lack of urgency and knowledge producers of using recycled content in new garments
- Lack of awareness and knowledge of consumers/users: they need to make sustainable decisions about their buying behaviour and disposal behaviour.

Finally, one technological challenge was observed:

- Lack of technical innovations and knowledge to handle sorting and recycling of blended fractions.

The fifth and last sub question: *What are the steps of the stakeholders that need to be taken to overcome these challenges to reach the EPR textile goals of 2030 set by the Dutch government?* Gave insights on the stakeholder actions that are needed to overcome these challenges. A What-Who-How analysis from Quist's (2007) backcasting framework was performed to explore these actions. It was observed that to prevent the risk of disappearance of the textile sorting and recycling industry in the Netherlands, automatization of the sorting industry is needed. Furthermore, fair distribution of the EPR fee to the post-consumer organisations and sufficient financial compensation to prevent exceeding costs is needed as well.
A second structural change that was observed was that enhancing transparency and cooperation between partners is essential to prevent ambiguity of the role between stakeholders and to avoid buying off responsibility of producers that are members of a PRO. This can be enhanced via an AVV, EU regulations on transparency (such as the CSRD), harmonised EPR textiles for all EU member states, digitised tools to trace post-consumer value chain (such as a chain of custody) and organising annual expert panels with frontrunners that can give a lead by example.
In making eco-design the norm, preparing for reuse and recycling becomes easier for sorters and recyclers. This can be for example realised by international regulations such as ESPR, eco-modulated EPR fee and true pricing.
Furthermore, to increase the urgency and knowledge of producers using recycled content in their materials, an EU regulation of using a minimum percentage of recycled content is

needed. However, it was observed that this needs to be combined with revised regulations on the import and export of post-consumer textiles, so that importers can transport their collected post-consumer textiles to their supply chain.
Finally, it was observed that increasing consumer awareness is important as well for reaching the 2030 EPR targets. To make them aware of their disposal and buying behaviour, this could enhance collecting, recycling and reuse. It was observed that Stichting UPV Textiel is organising national campaigns to increase consumer awareness by providing transparent information of the textile chain.
These sub questions together have formed an answer to the main research question that was formulated for this study: *What is the role of the stakeholders to overcome the challenges to reach the Dutch EPR textile targets of 2030?* The study showed different stakeholder perspectives on the challenges faced by reaching the 2030 EPR textiles targets and explored how to overcome them. Whereas the textile recycler that was interviewed stressed out the lack of urgency by producers to use their recycled content and the risk of disappearance of the recycling industry as their main challenges. To overcome this, it was observed that financial compensation from the PRO and government and EU regulations on using a minimum percentage of post-consumer material in new garments is required.
The textile collector that was interviewed also emphasised the need for fair distribution of EPR fee and subsidies to prevent disappearance of the collecting & sorting industry.
The producer that was interviewed argued that they are facing challenges with the export of the collected post-consumer textiles into their supply chain outside Europe. It was observed that revised export and import regulations are needed via the EU to make it possible to export post-consumer textiles to their supply chains.
Finally, the lack of incentives for circular design was a challenge that was observed from desk research as well as from several interviewees that could hinder reaching the 2030 EPR targets. Implementing eco-modulated EPR fees by the PRO and making regulations on true pricing of textile products could improve this. Moreover, the ESPR directive is already a step towards making eco-design the norm.

7.2. Practical Implications

When looking at the practical implications of this study, it can be observed that the findings of this study could serve several practical implications. First, the explored stakeholder actions contain several (international) policy actions. These actions could be used as an inspiration for policy makers to develop a transition pathway to the 2030 (or 2050) future vision. Furthermore, the identified challenges and the actions explored in the What-Who-How analysis could give stakeholders useful insights and could encourage them to take targeted measures to overcome these challenges to ultimately reach the 2030 future vision.

List of Abbreviations

EPR = Extended Producer Responsibility

ESPR = Eco-design for Sustainable Products Regulation

EU = European Union

ILT = Inspectie Leefomgeving & Transport

I&W = Infrastructure and Water Management

NVRD = Koninklijke Nederlandse Vereniging voor afval- & reinigingsdiensten (Royal Dutch Association For waste & cleaning services)

PCR = Post-Consumer Recycled

PRO = Producer Responsibility Organisation

PVO = Producentenverantwoordelijkheid Organisatie

T&A = Textile and Apparel

UPV = Uitgebreide Producenten Verantwoordelijkheid

VHT = Vereniging Herwinning Textiel (Dutch Association for Textile Recovery)

WEEE = Waste from Electrical and Electronic Equipment

References

Backes, C., Boeve, M., & Sammie van der Heijden. (2022). *Uitgebreide producentenverantwoordelijkheid: rol en verantwoordelijkheden gemeenten en inzameling organisaties in relatie tot producenten*. Retrieved from: https://dspace.library.uu.nl/bitstream/handle/1874/420132/Eindrapport_UPV.pdf?sequence=1

Batterijen en accu's. (2024). Afval Circulair. Retrieved from: https://www.afvalcirculair.nl/producentenverantwoordelijkheid/batterijen-accu'/

Campbell-Johnston, K., Pruijsen, J., Vermeulen, W. J., & Dermine, S. (2022). Report on the Governance of Extended Producer Responsibility in the Transition to a Circular Economy. In *Zenodo (CERN European Organization For Nuclear Research)*. https://doi.org/10.5281/zenodo.6597508

Carlsson-Kanyama, A., Dreborg, K. H., Moll, H. C., & Padovan, D. (2008). Participative backcasting: A tool for involving stakeholders in local sustainability planning. *Futures*, *40*(1), 34-46.

Centraal Bureau voor de Statistiek. (2021). Steeds meer textiel in Nederland. *Centraal Bureau Voor de Statistiek*. Retrieved from: https://www.cbs.nl/nl-nl/nieuws/2021/05/steeds-meer-textiel-in-nederland

Circle Economy (2021). Putting textiles to work: The employment potential of circular clothing in the Netherlands. Retrieved from: https://assets.websitefiles.com/5d26d80e8836af2d12ed1269/60d484479ef55512ac50d615_20210624%20- %20CJI%20Tex%20skills%20-%20paper%20-%20297x210mm.pdf

Compagnoni, M. (2022). Is Extended Producer Responsibility living up to expectations? A systematic literature review focusing on electronic waste. *Journal of Cleaner Production*, *367*, 133101.

Corey, G. R., & Lovins, A. (1979). Soft Energy Paths: Toward a Durable Peace. *Land Economics*, *55*(3), 417. https://doi.org/10.2307/3145916

Degenstein, L. M., McQueen, R. H., Krogman, N. T., & McNeill, L. S. (2023). Integrating Product Stewardship into the Clothing and Textile Industry: Perspectives of New Zealand Stakeholders. *Sustainability*, *15*(5), 4250. https://doi.org/10.3390/su15054250

Dreborg, K. H. (1996). Essence of backcasting. *Futures*, *28*(9), 813–828. https://doi.org/10.1016/s0016-3287(96)00044-4

Enserink, B., Hermans, L., Kwakkel, J., Thissen, W., Koppenjan, J., & Bots, P. (2010). Actor Analysis. *Policy analysis of multi-actor systems*, 79-108.

European Commision (2024) *Corporate sustainability reporting*. Finance. Retrieved from: https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-

reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en#legislation

European Commission. (2023). European Commission - European Commission. Retrieved from: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3635

European Commission. (2022, March 30). Communication From the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions: EU Strategy for Sustainable and Circular Textiles (Nr. 141). Retrieved from https://eurlex.europa.eu/resource.html?uri=cellar:9d2e47d1-b0f3-11ec-83e1- 01aa75ed71a1.0001.02/DOC_1&format=PDF.

European Environment Agency. (2019). *Textiles in Europe's circular economy*. Retrieved from https://www.eea.europa.eu/publications/textiles-in-europes-circular-economy

European Union. (2008). *Directive - 2008/98 - EN - Waste framework directive - EUR-Lex*. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098

European Union. (2022). EUR-LEX - 52022DC0140 - EN - EUR-LEX. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0140&qid=1649112555090

Eeuwema, T. (2023). *Modal shift from air to rail | TU Delft Repository*. TU Delft Repository. https://repository.tudelft.nl/record/uuid:7547020b-1e7b-4363-ba9d-c85e1628be99

Gerstmann, B. S. (2020). *Towards circular resource use: the potential of extended producer responsibility for textile circularity in the EU*. https://doi.org/10.34726/hss.2020.80650

Gomi, K., Ochi, Y., & Matsuoka, Y. (2011). A systematic quantitative backcasting on low-carbon society policy in the case of Kyoto city. *Technological Forecasting and Social Change*, *78*(5), 852-871.

Gupt, Y., & Sahay, S. (2015). Review of extended producer responsibility: A case study approach. *Waste Management & Research*, *33*(7), 595–611. https://doi.org/10.1177/0734242x15592275

Gupta, D., & Dash, S. (2023). Challenges of implementing extended producer responsibility for plastic-waste management: lessons from India. *Social Responsibility Journal*, *19*(9), 1595–1612. https://doi.org/10.1108/srj-08-2022-0326

Hagen, K., & Heinen, V. (2023). Destinations of Dutch Used Textiles: Uses and risks after export. In *Destinations Of Dutch Used Textiles* (pp. 3–4). Retrieved from: https://circulareconomy.europa.eu/platform/sites/default/files/2024-03/Destination%20of%20Dutch%20used%20textiles_0.pdf

Informatie UPV textiel – Stichting UPV Textiel. (2024) Retrieved from: https://www.stichtingupvtextiel.nl/en/upvtextiel/

Jia, F., Yin, S., Chen, L., & Chen, X. (2020). The circular economy in the textile and apparel industry: A systematic literature review. *Journal Of Cleaner Production*, *259*, 120728. https://doi.org/10.1016/j.jclepro.2020.120728

Kazancoglu, I., Kazancoglu, Y., Kahraman, A., Yarimoglu, E., & Soni, G. (2020). Investigating barriers to circular supply chain in the textile industry from Stakeholders' perspective. *International Journal Of Logistics*, *25*(4–5), 521–548. https://doi.org/10.1080/13675567.2020.1846694

Köhler, A., Watson, D., Trzepacz, S., Löw, C., Liu, R., Danneck, J., ... & Faraca, G. (2021). *Circular economy perspectives in the EU textile sector*. Luxembourg: Publications Office of the European Union.

Kunz, N., Mayers, K., & Van Wassenhove, L. N. (2018). Stakeholder Views on Extended Producer Responsibility and the Circular Economy. *California Management Review*, *60*(3), 45–70. https://doi.org/10.1177/0008125617752694

Leclerc, S. H., & Badami, M. G. (2020). Extended producer responsibility for E-waste management: Policy drivers and challenges. *Journal Of Cleaner Production*, *251*, 119657. https://doi.org/10.1016/j.jclepro.2019.119657

MacArthur, E. (2017). Beyond plastic waste. *Science*, *358*(6365), 843. https://doi.org/10.1126/science.aao6749

Maldini, I., Duncker, L., Bregman, L., Piltz, G., Duscha, L., Cunningham, G., Vooges, M., Grevinga, T., Tap, R., & Van Balgooi, F. (2017). Measuring the Dutch clothing mountain : Data for sustainability oriented studies and actions in the apparel sector. *PublishingLab*.

Mander, S. L., Bows, A., Anderson, K. L., Shackley, S., Agnolucci, P., & Ekins, P. (2008). The Tyndall decarbonisation scenarios—Part I: Development of a backcasting methodology with stakeholder participation. *Energy Policy*, *36*(10), 3754-3763.

Ministerie van Algemene Zaken. (2020, 16 juli). *Policy programme for circular textile 2020-2025*. Parliamentary Document | Government.nl. Retrieved from: https://www.government.nl/documents/parliamentary-documents/2020/04/14/policy-programme-for-circular-textile-2020-2025

Ministerie van Algemene Zaken. (2022, 19 januari). *Naar een UPV voor textiel*. Rapport | Rijksoverheid.nl. Retrieved from: https://www.rijksoverheid.nl/documenten/rapporten/2021/05/20/bijlage-5-eindrapportage-upv-textiel-rebel-group

Ministerie van Algemene Zaken. (2023, 3 november). *National Circular Economy Programme 2023-2030*. Report | Government.nl. Retrieved from: https://www.government.nl/documents/reports/2023/09/27/national-circular-economy-programme-2023-2030

Ministerie van Infrastructuur en Waterstaat. (2021a, oktober 18). *Fast fashion onderzoek*. Rapport | Rijksoverheid.nl. Retrieved from:

https://www.rijksoverheid.nl/documenten/rapporten/2020/04/14/onderzoek-fast-fashion

Ministerie van Infrastructuur en Waterstaat. (2021b, oktober 18). *Massabalans textiel 2018*. Rapport | Rijksoverheid.nl. Retrieved from: https://www.rijksoverheid.nl/documenten/rapporten/2020/04/14/rapport-massabalans-textiel-2018-2020

Ministerie van Infrastructuur en Waterstaat. (2023, 17 oktober). *Kamerbrief over doorontwikkeling UPV*. Kamerstuk | Rijksoverheid.nl. Retrieved from: https://www.rijksoverheid.nl/documenten/kamerstukken/2023/10/16/doorontwikkeling-uitgebreide-producentenverantwoordelijkheid-upv

Ministerie van Infrastructuur en Waterstaat. (2024a, januari 4). *Voortgangsrapportage circulair textiel 2023*. Rapport | Rijksoverheid.nl. Retrieved from: https://www.rijksoverheid.nl/documenten/rapporten/2023/06/26/bijlage-5-voortgangsrapportage-circulair-textiel-2023

Ministerie van Infrastructuur en Waterstaat. (2024b, april 25). *Uitgebreide producentenverantwoordelijkheid*. Inspectie Leefomgeving en Transport (ILT). Retrieved from: https://www.ilent.nl/onderwerpen/producentenverantwoordelijkheid

Monier, V., Porsch, L., Hestin, M., Cavé, J., Laureysens, I., Watkins, E., & Reisinger, H. (2014). Development of Guidance on Extended Producer Responsibility (EPR).

Niinimäki, K., & Hassi, L. (2011). Emerging design strategies in sustainable production and consumption of textiles and clothing. *Journal Of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2011.04.020

OECD. (2016). Extended producer responsibility. In *OECD eBooks*. https://doi.org/10.1787/9789264256385-en

Overheid.nl | Consultatie Invoering uitgebreide producentenverantwoordelijkheid textiel. (2021). Retrieved from: https://www.internetconsultatie.nl/upv_textiel

Quist, J. (2007). *Backcasting for a Sustainable Future: The Impact After 10 Years*. Retrieved from: http://repository.tudelft.nl/islandora/object/uuid:bd642b6a-17c7-4284-8be7-10be10dc336c/datastream/OBJ/download

Quist, J. (2013). Backcasting and Scenarios for Sustainable Technology Development. In *Springer eBooks* (pp. 749–771). https://doi.org/10.1007/978-1-4020-8939-8_52

Remy, N., Speelman, E., & Swartz, S. (2016). *Style that's sustainable: A new fast-fashion formula*. McKinsey Global Institute.

Riemens, J., Lemieux, A., Lamouri, S., & Garnier, L. (2021). A Delphi-Régnier Study Addressing the Challenges of Textile Recycling in Europe for the Fashion and Apparel Industry. *Sustainability*, *13*(21), 11700. https://doi.org/10.3390/su132111700

Robinson, J. B. (1990). Futures under glass. *Futures*, *22*(8), 820–842. https://doi.org/10.1016/0016-3287(90)90018-d

Saavedra, Y. M., Iritani, D. R., Pavan, A. L., & Ometto, A. R. (2018). Theoretical contribution of industrial ecology to circular economy. Journal of Cleaner Production, 170, 1514–1522. https: //doi.org/10.1016/J.JCLEPRO.2017.09.260

Staatsblad 2023, 132 | Overheid.nl > Officiële bekendmakingen. (2023a, april 21). Retrieved from: https://zoek.officielebekendmakingen.nl/stb-2023-132.html

Staatsblad 2023, 132 | Overheid.nl > Officiële bekendmakingen. (2023b, april 21). Retrieved from: https://zoek.officielebekendmakingen.nl/stb-2023-132.html

STAATSSECRETARIS VAN INFRASTRUCTUUR EN WATERSTAAT. (2022). In *Tweede Kamer: Vol. 32 852* (Report Nr. 187; pp. 1–2). Retrieved from: https://www.eerstekamer.nl/behandeling/20220421/brief_regering_beleid_uitgebreide/document3/f=/vlshkkrbxnzl.pdf

Stengg, W. (2001). The textile and clothing industry in the EU. *Enterprise papers*, *2*(4).

Sympany - Stof tot Grondstof. (2024, 10 april). Sympany. Retrieved from: https://www.sympany.nl/

UPV textiel. (2024). Afval Circulair. Retrieved from: https://www.afvalcirculair.nl/producentenverantwoordelijkheid/textiel/

Van Wee, B., & Geurs, K. (2004). Backcasting as a Tool for Sustainable Transport Policy Making. *Deleted Journal*. https://doi.org/10.18757/ejtir.2004.4.1.4256

Vassilikos, E. (2021). *Towards a Sustainable Energy Future for the Cyclades Islands | TU Delft Repository*. . Retrieved from: TU Delft Repository. https://repository.tudelft.nl/record/uuid:9431b209-34a8-4ae0-ade1-f6ea1856b9d6

Vereniging Herwinning Textiel. (2024, 19 maart). Vereniging Herwinning Textiel. Retrieved from: https://www.textielrecycling.nl/nieuws/berichten/textiel-recycling-sector-in-crisis.html

Vermeulen, W. J. V., Backes, C. W., De Munck, M. C. J., Campbell-Johnston, K., De Waal, I. M., Rosales Carreon, J., Boeve, M. N., & Utrecht University – Circular Economy and Society Hub. (2021). Transitiepaden voor uitgebreide producentenverantwoordelijkheid op weg naar een circulaire economie. In *Utrecht University* [Report]. https://www.uu.nl/sites/default/files/White-paper-over-Transitiepaden-voor-uitgebreide-producentenverantwoordelijkheid-op-weg-naar-een-circulaire-economie.pdf

Vermeulen, W. J., & Campbell-Johnston, K. (2024). Extended producer responsibility. *Handbook of Recycling*, 587-600

Vink, J. (2020). The role of Extended Producer Responsibility in the transition to a Circular Economy: An institutional analysis of the circularity of EPR. *TU Delft*. Retrieved from: https://repository.tudelft.nl/islandora/object/uuid%3A49b274b6-7048-4c85-b03d-3d0a219162ee

Visman. (2019). *B. Visman | TU Delft Repository*. Retrieved from: TU Delft Repository. https://repository.tudelft.nl/person/Person_01bac254-c820-4f1c-a9f2-191621e48f19

World Bank Group. (2022). *How Much Do Our Wardrobes Cost to the Environment?* World Bank.Retrieved from: https://www.worldbank.org/en/news/feature/2019/09/23/costo-moda-medio-ambiente

ZOUMPALOVA, T., JONÁŠOVÁ, S. K., & MOLDAN, B. (2023). *Barriers to the circular economy in the textile industry*: a case study of the Czech Republic. In *WASTE* (p. 206).

Appendices

Appendix A Informed Consent Form Interviewees

Interview informed Consent Form

Research project title: The Barriers and Challenges of EPR schemes for textiles from a stakeholder's perspective (a Backcasting Analysis)
Research investigator: Jacob Wierts
Research supervisor: Dr. Linda M. Kamp

You are being invited to participate in a research study titled "The Barriers and Challenges of EPR schemes for textiles from a stakeholder's perspective". This study is being done by Jacob Wierts from the TU Delft & Leiden University Industrial Ecology Joint Degree Master Programme.

The purpose of this research study is to understand the main challenges and barriers from a stakeholder's perspective of Extended Producer Responsibility (EPR) schemes for textiles in the Netherlands and to formulate pathways on how to reach these EPR targets. The interview will be used to obtain insights on the current state, potential requirements and what hinders the implementation of EPR schemes for textiles. The interview forms part of a published Master's Thesis, and will take you approximately 45 minutes to complete.

This consent form is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Would you therefore read the accompanying information sheet and then sign this form to certify that you approve the following:

1. The interview will be recorded, and a transcript will be produced.
2. You will be sent the transcript and given the opportunity to correct any factual errors.
3. The transcript of the interview will be analyzed by Jacob Wierts as research investigator.
4. Access to the interview transcript will be limited to Jacob Wierts and academic colleagues and researchers with whom she might collaborate as part of the research process.
5. Any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify you is not revealed.

As with any online activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by taking the following measures:

1. Gathering as little personal information as possible and only strictly necessary from participants. Identified necessary data: name, email address, gender (implicitly assumed from interviews, not explicitly asked), occupation and area of expertise, involvement in current/previous projects regarding the studied field, audio, and video recording of interviews for transcription/analysis.
2. You will be given the option of not having video recorded (only audio) during interviews.
3. All interviews will be conducted online through a secure platform (Microsoft Teams) and using a private internet network to avoid cyber-security threats.
4. All data collected will be kept on a private, password protected drive only accessible by researchers mentioned below.
5. You will be anonymized in the published work, only your area of expertise will be mentioned, and all participants will be referred to as they/them (e.g., "Participant 1 is a high-level executive at a sustainable energy company" and "Participant 1 stated that they identify the following barriers for technological uptake").

6. Actual recordings of interviews will be promptly deleted as soon as the research is concluded (expected date is August 2024).

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any questions and to opt out of including data gathered during your interview before August 1st, 2024.

By signing this form, I agree that:

1. I am voluntarily taking part in this project. I understand that I don't have to take part, and I can stop the interview at any time.
2. The transcribed interview or extracts from it may be used as described above.
3. I have read the Information sheet.
4. I don't expect to receive any benefit or payment for my participation.
5. I can request a copy of the transcript of my interview and may make edits I feel necessary to ensure the effectiveness of any agreement made about confidentiality.
6. I have been able to ask any questions I might have, and I understand that I am free to contact the researcher with any questions I may have in the future.

_____

Printed Name

_____ _____

Participants Signature Date

_____ _____

Researchers Signature Date

Should you have any questions or need to contact us, you can do so using the following details:
Jacob Wierts
J.Wierts@student.tudelft.nl
Corresponding Research

Appendix B Interview Protocol (Dutch)

Nogmaals hartelijk bedankt dat u wilt deelnemen aan dit interview. Het onderwerp van dit interview gaat over de uitdagingen van de uitgebreide producentenverantwoordelijkheid (afk. UPV) voor textiel bekeken vanuit verschillende perspectieven van stakeholders. Uw deelname aan dit interview is vrijwillig, dus u kunt op elk moment aangeven dat u een vraag niet wilt beantwoorden of wilt stoppen met het interview. Uw naam wordt geanonimiseerd, en alleen uw expertisegebied wordt gepubliceerd.
Dit gesprek wordt opgenomen met transcriptie. Gaat u hiermee akkoord? Dan ga ik nu de opname starten.

VRAGEN:

1. Kunt u iets vertellen over uw werk/expertisegebied?
2. In juli 2023 is de UPV wet voor textiel ingevoerd. Hoe beïnvloedt deze nieuwe wet op dit moment uw werk/bedrijf?

2025:

- *50% van in handel gebrachte textielproducten wordt voorbereid voor hergebruik of gerecycled (waarvan 20% voorbereid voor hergebruik, 10% hergebruik in NL en 25% van het gerecyclede deel is vezel-tot-vezel)*

2030:

- *75% van in handel gebrachte textielproducten wordt voorbereid voor hergebruik of gerecycled (waarvan 25% voorbereid voor hergebruik, 15% hergebruik in NL en 33% van het gerecyclede deel is vezel-tot vezel)*

3. Hierboven staan de bijbehorende doelstellingen voor 2025 en 2030. Hoe ziet u uw rol als stakeholder in het behalen van deze doelstellingen?
4. Wat zou volgens u het ideale toekomstscenario voor 2030 zijn, kijkend naar deze wet en bijbehorende doelstellingen?
5. Hieronder is een lijst te zien van de actoren in de keten die een rol spelen bij het behalen van deze UPV doelstellingen. Zijn er partners in de keten die u hier in deze lijst mist?

Stakeholders
Producenten (importeur, fabrikant & buitenlandse aanbieder)
Gemeenten
Textielinzamelaars & Sorteerders
Textiel-recycling organisaties
De Consument/Gebruiker
Rijkswaterstaat & Inspectie Leefomgeving en Transport
Tweedehands (kleding)winkels
Online tweedehands kleding platforms
Producentenverantwoordelijkheid Organisatie (Stichting UPV Textiel)

6. Hieronder staan een aantal uitdagingen voor de UPV textiel die op basis van deskresearch naar voren zijn gekomen. Welke van deze uitdagingen zijn volgens u het meest belangrijk? Kunt u hier iets over vertellen?

Uitdagingen
Weinig Transparantie en **samenwerking** (tussen actoren) in **Textielketen**
Eco-design wordt **niet tot weinig gestimuleerd**
Onduidelijkheid over de **rol** en verantwoordelijkheid **tussen actoren in de keten**
Bewustwording bij de **consument/gebruiker**: duurzame keuzes in koopgedrag en weggooigedrag
Risico op **afkopen** van **verantwoordelijkheid** van **producenten** die lid zijn van een **collectief**
Door dalende marktprijzen is het niet langer financieel haalbaar om textiel te sorteren in Nederland. Gevolg: risico op **verdwijning van sorteer- en recyclingindustrie uit Nederland**.

7. Zijn er nog andere uitdagingen die niet in deze lijst staan, maar die volgens u belangrijk zijn en die het behalen van de doelstellingen kunnen belemmeren?

8. Welke verandering is er nodig om de door u genoemde uitdaging(en) te kunnen verhelpen? En welke stakeholder(s) speelt/spelen daarbij een belangrijke rol?

9. Dit waren de vragen voor het interview. Heeft u nog iets toe te voegen?

Hartelijk bedankt voor uw deelname. Mag ik nog contact opnemen met u naderhand als ik nog enige verheldering van uw antwoorden wil?

Daarnaast krijgt u de resultaten van het onderzoek toegestuurd via de mail.