Sustainable Production and Consumption 54 (2025) 452–465

Contents lists available at ScienceDirect

Sustainable Production and Consumption

journal homepage: www.elsevier.com/locate/spc

An empirical exploration of the unintended effects of circular economy policies in the European Union: The case of textiles☆

Martyna Solis [a,b,*], Leonidas Milios [b], Davide Tonini [b], Steffen Foss Hansen [a], Charlotte Scheutz [a], Dries Huygens [b]

[a] Department of Environmental and Resource Engineering, Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark
[b] Joint Research Centre of the European Commission, Calle Inca Garcilaso, 41092 Seville, Spain

ARTICLE INFO

Editor: Prof. Idiano D'Adamo

Keywords:
Ex-ante impact assessment
Policy design
Policy development
micro- and macro-level modelling
Stakeholder engagement
Textile waste

ABSTRACT

With the need for further research on methods to estimate unintended effects, specifically in the context of circular economy, and the European Union's textile policy in the making, it is necessary to understand and account for any potential unintended effects ex-ante. This study explores the unintended effects of past and hypothetical future textile policies in order to categorise them empirically and to evaluate scientific tools for improving ex-ante impact assessments. The study combines interviews with policy development experts, a stakeholder survey and a thematic analysis of the findings, which confirm that an evident gap exists between the acknowledged importance of unintended effects and the tools used to address them. Second-order effects, defined as indirect and unintended effects prompted by changes in a socio-technical system (e.g., policy implementation and its direct effects) prove to be as equally relevant as first-order effects or direct effects. The categorisation of these effects showed that most of them were related to alterations to legal requirements influencing import-export and value chain dynamics, the exploitation of loopholes in legislation and fraud, as well as price alterations affecting household consumption patterns and business strategies. The experts' suggestions for addressing better the unintended effects of policies in ex-ante impact assessments confirm the importance of reinforcing or expanding the use of scientific tools during policy processes, i.e. stakeholder engagement, combined micro- and macro-economic modelling, extended consideration of the European Union's resilience and the inclusion of a behavioural and social component. It was highlighted that unintended effects are not always negative, and even when so, they do not necessarily have to discredit a policy altogether. This study contributes to informed decision-making on future circular economy policy in the European Union.

1. Introduction

Given the rapid environmental degradation linked to resource exploitation – also known as the 'triple planetary crisis' (UNEP, 2024), there is an urgent need to accelerate the circular economy transition by employing targeted policy interventions. Especially, the introduction of appropriate, mandatory policies is considered essential (Calisto Friant et al., 2021; Carattini et al., 2022; Roberts and Geels, 2019). Multiple policy responses can adequately contribute to addressing the 'multi-aspect' nature of such triple planetary crisis problem at hand (Bennear and Stavins, 2007). However, their impacts are dependent on direct effects – or "forward" influences – as well as feedback loops (Rogge and Reichardt, 2016; Edmondson et al., 2019; Zepa and Hoffmann, 2023).

A main concern in policymaking relates to the unintended effects of policy measures. Often, direct effects (the so-called first-order effects) in the incumbent socio-technical system, will prompt indirect and unintended (or second-order) effects (European Commission, 2023a). An example of a first-order effect could be a local reduction in the landfilling of certain industrial waste types following a landfill ban, or the availability of green loans at lower interest rates for sustainable business practices. Policy mixes can create various first and second-order effects, thereby stimulating hard-to-predict interactions in the socio-technical system and unintended effects (Edmondson et al., 2019). For example, companies engaging in the recycling of post-industrial waste or dumping their waste in response to a landfilling ban, or companies making use of new financial incentives. The unintended effects of re-spending saved

☆ This article is part of a special issue entitled: Circular Economy 2024 published in Sustainable Production and Consumption.

* Corresponding author at: Department of Environmental and Resource Engineering, Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark.
E-mail address: msol@dtu.dk (M. Solis).

https://doi.org/10.1016/j.spc.2025.01.021
Received 28 October 2024; Received in revised form 29 January 2025; Accepted 31 January 2025
Available online 1 February 2025

income or gained revenue, or changed consumer behaviour following circular economy actions, are considered unresolved issues in the literature (Castro et al., 2022; Lowe et al., 2024; Zink and Geyer, 2017). While the existing literature addresses mitigation of unintended effects via different policy approaches and connects unintended effects with specific policy measures (Section 2.2), the scientific evidence is insufficient to draw any definite conclusions. Therefore, a deeper understanding of unintended effects is required to identify the factors that influence the pace and direction of socio-technical changes towards a circular economy regime, which is currently missing in the literature.

Scientific tools for policy assessments increasingly play an essential part in supporting the evidence-based policy development process (Hertin et al., 2009; Mickwitz, 2003). This involves support during the evaluation of existing policies as well as ex-ante impact assessments that support the revision of existing policies and new initiatives. Looking at recent impact assessments of European Union's waste and circular economy policies, the methods used predominantly were life cycle assessment and life cycle costing. Nonetheless, De Laurentiis et al. (2024), Niero et al. (2021) and Tukker (2024) claim that these tools are insufficient to address unintended effects from circular economy policy initiatives due to technical challenges (Section 2.1). While existing literature points out some potential solutions, they have not yet been proven effective if incorporated into an impact assessment (Section 2.1). Hence, a challenge remains, and new insights are needed to understand how unintended effects can be better accounted for in an ex-ante impact assessment.

Textiles are an appropriate case to explore this as it is a sector of particular interest when investigating circular economy policies. The European Union's Green Deal, and particularly the Circular Economy Action Plan have highlighted textiles as one of the key product value chains for intervention (European Commission, 2020). The textile challenge is evident due to the sub-optimal management of textile waste aligned with limited re-use and recycling capacities, and it is thus high on the European Union's agenda (Gözet et al., 2021; Solis et al., 2024a; Solis et al., 2024b). Addressing the textile challenge is also relevant in the context of the United Nation's Sustainable Development Goal 12 on ensuring sustainable consumption and production patterns (United Nations, 2024). With excessive production and consumption driven by fast fashion, and a short time frame, targeted policy supporting the transition to a sustainable textile sector will play an important role in meeting the goal. With several national initiatives (Section 2.3) but no EU dedicated policy in force (as of 2024), textiles are one of the last key product value chains to address in terms of policymaking, which makes a suitable case for exploring the unintended effects of policies upfront.

Building on the identified knowledge gaps, the research objectives of this study are to (i) explore empirically and better classify the unintended effects of selected circular economy measures, focusing on the case of textiles, and (ii) provide insights on aspects that should be addressed by future ex-ante impact assessment tools to better address unintended effects of policies. The research focus is mainly directed at second-order (unintended) effects, as these have been underrepresented in the scientific literature and their drivers and impacts for circular economy policies remain largely unexplored. This study aims to contribute to informed decision-making on future circular economy and waste management policies in Europe. The target audience are impact assessment practitioners and policymakers who seek to improve the preparedness for second-order policy effects.

Following this introduction, Section 2 outlines the background literature relevant to this study. Section 3 presents the methodology used to collect and analyse empirical data. Section 4 presents the results, which are discussed in the same section, and finally, we provide conclusions in Section 5 of the paper.

2. Literature review

This section provides the necessary background on current approaches and challenges in addressing unintended effects of policies ex-ante. The review was expanded to provide the textile policymaking context.

2.1. Addressing the unintended effects of policies

To address potential unintended effects that might derive from the implementation of a specific policy (or policy mix), several scientific tools and assessment methods have been developed as an essential part of the policy development process throughout the policy cycle (Hertin et al., 2009; Mickwitz, 2003). These tools can provide support during the evaluation of existing policies after their implementation (ex-post), as well as support the revision of existing policies and the design of new initiatives (ex-ante). In the EU, impact assessments follow a standard format with several steps, and the methods used are determined by the Better Regulation guidelines and toolbox (Collova, 2015; European Commission, 2023a). In simplified terms, these steps include defining the problem and required action, setting policy objectives, elaborating different options to achieve them, analysing the subsidiarity (European Commission, 2008b) and proportionality (European Commission, 2016) of European Union's action and analysing the economic, social and environmental impacts of each option quantitatively and/or qualitatively. Based on the results, the preferred option is identified. Impact assessment usually also includes monitoring arrangements (the methods for policy monitoring after implementation) and indicators to assess whether the action taken corresponds to its intended effects.

All policy proposals from the European Commission must undergo an ex-ante impact assessment, which feeds into the technical basis for a policy decision-making process and aims to provide an analysis of the foreseeable effects of a proposed policy intervention (Collova, 2015). The Better Regulation guidelines refer not only to policy process tools (e.g., oral and written feedback collection mechanisms from experts, public consultations and multi-criterion decision analysis), but also to scientific tools and models. For instance, life cycle assessment, life cycle costing, risk assessment, computable general equilibrium (CGE) and input-output models are referred to.

Given that the life cycle assessment has been mentioned as one of the leading scientific principles in European Union's policy development (European Commission, 2023a), in many recent impact assessments of European Union's waste and circular economy policies, life cycle assessments and life cycle costings have been the predominantly used methods (De Laurentiis et al., 2024). Life cycle assessments and life cycle costings alone, however, are not suitable for addressing the unintended effects of policies, as these may be related to macroeconomic effects and other indirect changes in consumption patterns (De Laurentiis et al., 2024; Niero et al., 2021; Tukker, 2024). The technical limitations of life cycle assessments and life cycle costings, for instance, are their inability to account for macroeconomic effects, lack of integrated dynamic features and lack of consideration of socio-technical dynamics across life cycle phases. On the other hand, tools that are traditionally used for quantifying macroeconomic effects (e.g., Input-Output models) are reportedly not suitable for modelling the effects of “multi-aspect,” complex problems (also known as “wicked” problems), such as the circular economy transition (Sala et al., 2015; Tukker, 2024). This is due to technical challenges, e.g., too high a level of aggregation (they often consider sectors and not specific products or materials) or lack of consideration of distributional effects. The existing scientific literature proposes some solutions to these challenges, such as integrating bottom-up life cycle assessments and top-down (e.g., input-output) models to consider missing macroeconomic effects and associated social dimensions in the impact assessment (Aguilar Hernandez et al., 2023; Font Vivanco et al., 2022; Tukker, 2024). Maeder and Fröhling (2024) proposed a framework for circular economy policy instruments based on recycled content standards. The study includes qualitative categorisation of systemic effects on economy, sector, product and material levels. However, it lacks practical recommendations on incorporating

consideration of the unintended effects in the ex-ante impact assessments. Another example is complementing life cycle assessments with Practice Theory and Actor-Network Theory, which could help improve understanding of the unintended effects of circular economy policies and provide guidance on how behavioural issues could be addressed (Niero et al., 2021; Sonnberger and Gross, 2018). While these approaches seem promising, to our best knowledge, all of them are theoretical and have not yet been applied effectively in policy impact assessments. Since the application of these methods is currently immature, it is unclear whether they can indeed contribute to addressing better the unintended effects of policies in ex-ante impact assessments. Consequently, given that many Green Deal policy interventions are on the way, there is a clear need for insights on a simpler, hands-on approach, which would help impact assessment practitioners and policymakers tackle the challenge of addressing the unintended effects of policies as soon as possible.

2.2. Policymaking for accelerated circular economy transition

While policy measures can play a key role in sustainability transitions, their actual impacts are largely dependent on "forward" effects and feedback loops (Edmondson et al., 2019; Rogge and Reichardt, 2016; Zepa and Hoffmann, 2023). Rogge and Reichardt (2016) indicate that policy elements (e.g., choice of policy instrument or level of ambition) and the policy process (e.g., the consultation strategy) together shape policy characteristics, namely consistency, coherence, congruence, comprehensiveness and credibility. Edmondson et al. (2019) complement this by pointing out the importance of "feedback influences" that result from socio-political, fiscal and administrative mechanisms, which determine "on-the-ground" second-order unintended effects. These feedback influences are stakeholders' responses after a specific policy implementation and their adaptation to new system settings. This approach is deemed to be also relevant for a better understanding of "multi-level governance" settings in which friction points can disrupt a vertical policy mix, including inconsistencies in transition strategies and tools across various levels of governance (Zepa and Hoffmann, 2023).

For a circular economy transition, public policy is considered a crucial enabler (Alberich et al., 2023; Hartley et al., 2023; Taghipour et al., 2022). The current literature defines different policy approaches for mitigating unintended effects and accelerating circular economy transition (Font Vivanco et al., 2016; Hartley et al., 2023; Puglia et al., 2024). Appropriate policy design and policy mixing, to target all product's life cycle stages, are found to be crucial in effectively moderating unintended effects (Font Vivanco et al., 2016; Milios, 2018). While the existing literature links unintended effects with specific types of policies, such as deposit return schemes for single-use plastic bottles (Rhein and Sträter, 2021), landfill tax (Fletcher et al., 2018) or tax on household waste (Briguglio, 2021), the scientific evidence is insufficient to make any definite parallels. Before the decision on implementation, every policy needs to be investigated individually by considering its application and scope of influence, as well as a constituent part of a policy mix that will inevitably interact with other policies (both existing and supplementary).

2.3. Textile policy context

In the context of textiles, examples of implementing different policy types can be observed across Europe through various targeted mandatory and voluntary interventions in force at national level. France, for instance, recently introduced a tax on ultra-fast-fashion articles to target excessive consumption. The tax is currently set on the item's price at 5 EUR and is expected to increase up to 10 EUR by 2030, with a ceiling of 50 % of the item's price (Moussa, 2024; St. Martin, 2024). In addition, France has proposed plans to ban publicity for fast-fashion companies and their products from 2025, with financial penalties enforcing this law (Louis, 2024). Moreover, to curb the overproduction practices in textiles manufacturing and retail sectors, France has introduced mandatory reporting of unsold and discarded products on large companies and a ban on the destruction of unsold or returned textiles (Puglia et al., 2024; Roberts et al., 2023). France, Hungary and the Netherlands have also adopted Extended Producer Responsibility schemes for textiles (Ellen MacArthur Foundation, 2024), whilst Sweden has introduced tax relief on the repair of clothing, shoes, leather goods and household linen (Almén et al., 2021; Puglia et al., 2024). The tax on repairs was set to 12 % compared to the normal tax rate of 25 % (Sveriges Riksdag, 2023). In Denmark, the Ministry of Environment and some fashion and textile companies have come to a voluntary sectoral agreement on targets for participating companies, e.g., at least 40 % recycled content by 2030 (Copenhagen Fashion Week, 2022). In a similar spirit, the Finnish textile and fashion industry made a voluntary commitment to become carbon-neutral by 2035 (Suomen Tekstiili and Muoti, 2022). To the best of our knowledge, there are no existing studies on unintended effects linked to policies on textiles.

At the European Union level, so far, the only adopted targeted textile policy measure, mandated by the Waste Framework Directive, is a separate collection requirement starting from 2025 (European Commission, 2023a). In relation to this scheme, the European recycling industry has called for accelerated policymaking to ensure the required sorting and recycling capacities are in place before the separate collection deadline (EuRIC, 2023). To address challenges inherent in the end-of-life phase, the European Union has investigated different policy options listed in the European Union's Strategy for sustainable and circular textiles (European Commission, 2022) and proposed a targeted amendment to the Waste Framework Directive, with a focus on textiles waste (European Commission, 2023b). While the European Union's textile policy is in the making, it is nevertheless important to increase understanding of the unintended effects of policies, which could apply to the specific case of textile waste.

3. Methodology

To address the research objectives of this study, namely, to classify the unintended effects of selected circular economy measures and to provide insights on aspects that should be addressed by the future ex-ante impact assessment tools to better address unintended effects of policies, a qualitative mixed-method exploratory approach was followed, utilising semi-structured interviews and surveys. The exploratory approach of the study was deemed particularly appropriate due to the scarcity of relevant empirical data (Stebbins, 2001) on the unintended effects of circular economy policies implemented on material streams in the existing literature. Ultimately, the exploratory approach aimed at increasing initial understanding of the research subject and creating the foundations for potential theoretical explanations and/or practical solutions (Bryman, 2016; Swedberg, 2020).

The research unfolded in three successive steps, as illustrated in Fig. 1. First, the input from policy development experts was sought by conducting semi-structured interviews. The interviews were preceded by a short preparatory survey to elicit contextual information for assisting the development of the interview guide and setting the scope of the discussion. Second, the input of relevant stakeholders was sought through an online survey, making sure to include a wide and varied sample of interested parties from the (public) policymaking domain, private business and industry, and civil society representatives expressing the views of the wider public sphere. In this way, a diverse but well-balanced sample was sought in order to provide the opportunity for the researchers to navigate through the different contexts and the plurality of realities that these stakeholders represent, therefore effectively addressing potential special interest interpretation biases (Jacobsson and Åkerström, 2013). Finally, a qualitative data analysis was performed following the conceptual framework drawn up in this study. Based on the outcome, the intended and unintended effects of

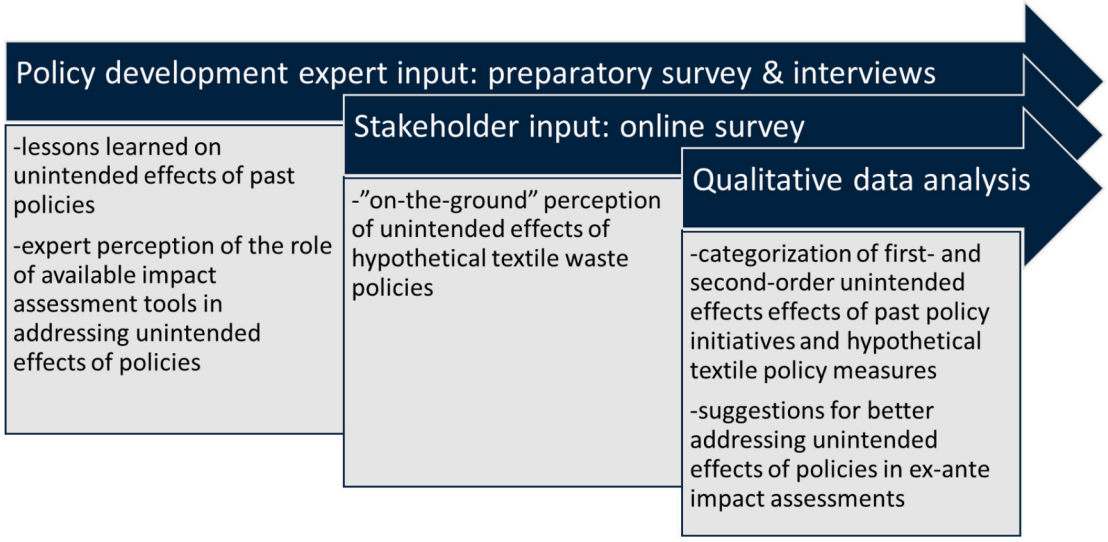

Fig. 1. Graphical representation of methods used in the study, and specific outcomes for each step.

circular economy policies were interpreted, discussed and linked to the tools that might be suitable to address them more efficiently in the future.

Although the main objective of the study is to uncover and better categorise the unintended effects of circular economy policy measures, with a view to supporting policy development and ex-ante impact assessments, it was deemed necessary to provide a more nuanced contextual environment to extract targeted and context-dependent input from the surveyed stakeholders. General input about circular economy policies and tools could be unspecific enough so that no useful knowledge would be extracted from the stakeholder survey, so this study focused on hypothetical policies in the textiles material management domain, thus providing a case-specific context. Case-specific studies produce context-dependent knowledge and therefore are key to understanding and learning about a phenomenon, because they are conducted in close proximity to real-life situations and can provide a more 'nuanced view of reality' (Flyvbjerg, 2006). Although the results of case-specific studies cannot be readily generalised, as there is the underlying assumption that general knowledge is more valuable than context-dependent knowledge, Flyvbjerg (2006) counter-argues that 'predictive theories and universals cannot be found in the study of human affairs. Concrete, context-dependent knowledge is, therefore, more valuable than the search for predictive theories and universals'. To this end, the textiles-specific context in this study is motivated by the evident challenge of the unsustainable textiles system in the EU, with sub-optimal management of textile waste and limited re-use and recycling capacities which places it is high on the European Union's policy agenda (European Commission, 2023a; European Environment Agency, 2019; Gözet et al., 2021). With no dedicated policy in force (as of 2024), textiles are one of the key product value chains to address alongside policymaking, which makes a suitable case for exploring upfront the unintended effects of policies.

3.1. Expert preparatory survey and interviews

Policy development expert input was collected through interviews performed in June 2024. The interviews were preceded by a short survey (see section S1.3 in the supplementary information (SI)) filled in June 2024 as well, which served as preparation material and inputs for the discussion part of the interview. The interviews were semi-structured, providing a well-planned structure of predetermined questions as a basis, but also allowing the freedom to wander into other relevant topics deriving from the questions, which in turn could enable deeper understanding. This approach could potentially lead to additional interesting information that may otherwise be overlooked (Bryman, 2016).

The selection of participants was a challenging and critical aspect of the research and the quality of the interview outcomes. For this study, specific expert profiles were selected by following a non-random judgement approach (Marshall, 1996) and involved screening based on topical expertise as well as professional affiliation, resulting in eleven selected experts. This was done to ensure that the viewpoints of crucial policy development actors in the European Union were included, namely European institutions (represented by 4 out of 11 interviewees) and industrial organisations (represented by one interviewee), as well as academia (represented by 3 interviewees) and research bodies (represented by 3 interviewees) (see section S1.5 in SI for details). The selected interviewees brought a wealth of experience of working directly or indirectly with ex-ante impact assessments, policy monitoring, impact assessment tools as well as researching topics relevant to this study. All names of the interviewees and organisations were anonymised. Each interview lasted between 30 and 45 min and was conducted online, recorded and transcribed via video conference software. The interviews were conducted in a flexible fashion so that the interviewees had the possibility to elaborate on topics directly related to their expertise.

The interview questions were shared with interviewees in advance, together with the short survey, and concerned capturing unintended effects in ex-ante impact assessments, lessons learned from past policies as well as supplementary thoughts on the topic (see section S1.4 in the SI). The aim of the interviews was to uncover lessons learned regarding the unintended effects of past policies as well as feedback on which tools and research techniques should be better employed to understand the unintended effects of policies at the ex-ante impact assessment stage.

The past policies selected for the purpose of concretisation and comparability of the discussion were (i) Packaging and Packaging Waste Directive (European Commission, 2020), (ii) Single-Use Plastics Directive (European Commission, 2019), (iii) Waste Framework Directive (European Commission, 2008a), (iv) Landfill Directive (European Commission, 2018) and (v) Waste Shipment Regulation (European Commission, 2024b). The choice of past policies was dictated by their relevance in the circular economy and waste management contexts, as well as the fact that these initiatives were flagship measures listed under the European Union's Circular Economy Actions Plans from 2015 and 2020. The categories of specific tools and research techniques that we asked about were taken from the EU's Better Regulation toolbox (European Commission, 2023a) and included (i) micro-level modelling

tools, (ii) macro-economic modelling tools, (iii) scenario analysis, (iv) monitoring and evaluation and learning from past policies and (v) stakeholder engagement. The interviewees had the chance to add and discuss other tools, if relevant.

3.2. Stakeholder survey

An online survey was selected as a method to collect stakeholder inputs focused on potential unintended effects of hypothetical textile waste policies. It was emphasised to the stakeholders that these policies were exploratory and not part of ongoing policy processes or considerations. The policy measures (Table 1) were selected to cover all categories in terms of different administrative ("command-and-control"), economic and informative policy instruments (Vedung, 1998; Wurzel et al., 2013). Also, they represented common instruments to promote separate collection and waste management practices aligned to the waste hierarchy (prevention, preparation for re-use, recycling, recovery and landfilling as a last resort). For instance, a tax on low-cost clothing items was adopted by the French government to tackle unsustainable waste management (see section 2.2). Only mandatory policy measures were considered in the scope of this study to uncover potential unintended effects, as voluntary measures cannot be considered equally universal or binding, and thus they do not result in accurately observable effects across the whole economy. In addition, unintended effects may be less expressed when a policy is voluntary. Stakeholders were requested to categorise unintended impacts of circular economy policies into different sustainability dimensions covering environmental, social and economic impacts. For concretisation and comparability, the categories were predefined based on the Better Regulation toolbox and guidelines (see section S1.2 in SI for details), along with the ability to add other categories, if relevant (European Commission Secretariat-General, 2024). Stakeholders were requested to comment on multiple-choice questions so their input could be further analysed.

A stakeholder sample of 214 individuals representing 157 non-governmental organisations (business and civil society) was contacted in May 2024 by email to voluntarily express their interest in contributing to this study, executed under the remit of the Technical University of Denmark. The criteria for the selection of the stakeholders were: (i) at least one organisation from each EU-27 Member State and (ii) at least one representative organisation from each stage of the textile value chain, and at least one from academia or research body. Out of the 214 contacted individuals, 73 expressed their interest in participating in the study and were asked to fill in the survey in May and June 2024 (see section S2.1 in the SI for details).

Table 1
Outline of selected hypothetical policies on textile waste included in the study. Only mandatory policy measures were considered.

Hypothetical textile waste policy	Instrument	Intended effects
Tax on low-cost clothing items	Economic	To limit environmental impacts of ultra-fast fashion and address textile waste prevention
Information provision and label with instructions on sorting in a separate waste container	Informative	To increase awareness among consumers and ultimately increase separate textile waste collection rates
Deposit-refund scheme for textiles or other take-back schemes	Economic, Administrative	To increase textile collection rates
Subsidy or tax incentive for recycling infrastructure	Economic	To boost textile waste closed-loop recycling
Ban on landfilling of textile waste	Administrative	To limit environmental impacts of textile waste landfilling

3.3. Qualitative data analysis

As our goal was to answer the overarching research question in the study rather than analyse each individual part of the input, we used thematic analysis for processing the results from the interviews and survey to identify common themes and patterns in the qualitative data (Braun and Clarke, 2023). This method was deemed more suitable than, for example, content analysis ("the scientific study of content of communication"), as it allows for 'developing and interpreting patterns of meaning across qualitative data' (Braun and Clarke, 2023; Prasad, 2008). Thematic analysis also allows for examining across the perspectives of different research participants, thereby highlighting similarities and differences and generating unanticipated insights, as well as for condensing the key features of a large dataset by enabling the researcher to take a well-structured approach to handling data and producing clear and organised research findings (King, 2014). Consequently, stakeholder input that was found to be less relevant or beyond the scope of the study was excluded from the analysis.

To conduct a rigorous and trustworthy thematic analysis that would fulfil the criteria of credibility, transferability, dependability and confirmability (Lincoln and Guba, 1985), we loosely followed the six-step data analysis approach outlined by Nowell et al. (2017). The analysis was performed in June and July 2024. First, all data from the interviews and survey was meticulously compiled in Excel files, following the structures of the interview guide and the survey. The research team was given access to the files to familiarise themselves with the data and to get a grasp of the extent and content of the input (step 1). Second, two researchers from the team independently processed the data (step 2) and compiled preliminary themes (step 3). In this step, the frequency and relevance of data were defined, allowing for further theme categorisation, provided that the inputs were relevant to the subject of study and significant in terms of frequency and stakeholder coverage. Third, two additional researchers from the team were brought in to review and assist in defining the emerging themes, thus complementing the work done independently in the previous steps and accordingly triangulating the data analysis (step 4). Lastly, the results of the thematic analysis were presented and discussed within the research team to seek consensus on the emerging themes (step 5) and to produce the final themes (step 6) that would ultimately be used for analysis and discussion in line with the stated objectives of the study. Although thematic analysis is presented herein as a linear six-step method, in practice its implementation was a dynamic iterative process that involved several back-and-forth iterations between the consecutive steps (mostly steps 3–5) to conclude on the definitive list of identified themes that most accurately reflect the data generated from the interviews and survey (Creswell, 2014). Finally, we developed a custom conceptual framework to facilitate the analysis of the findings according to the identified themes in relation to the policy development process and the interrelations of policies, the socio-technical context of their implementation and the evaluation potential of their intended and unintended effects. We based our conceptual framework on previous work by Rogge and Reichardt (2016) and Edmondson et al. (2019).

4. Results and discussion

In this section, a custom framework developed in this study and the results of the thematic analysis are presented with an aim to address the overarching objectives of this study, while the detailed results of interviews and surveys are available in the SI (section S2). The results from the thematic analysis are discussed and complemented with additional reflections based on the existing literature.

4.1. Conceptual framework for categorisation of unintended effects of policies

Our analysis categorised unintended policy effects per nature of the

effect, using the terminology as outlined in Fig. 2, based on "forward influences", "first-order effects", "feedback influences" and "second-order effects". In general, four potential feedback influence categories were identified based on the interviews and survey responses (Fig. 2): (i) alterations to legal requirements influencing import-export and value chain dynamics, (ii) exploitation of loopholes in legislation and fraud, (iii) price alterations affecting household consumption patterns and business strategies and, to a lesser extent, (iv) socio-political, fiscal and administrative responses. The characteristics of the forward and feedback influences were then considered the drivers shaping the first-order and second-order impacts. Unintended effects raised in the interviews and survey were classified into these different categories based on Rogge and Reichardt (2016) for first-order effects and our own definitions for relevant themes of similar second-order effects. Taking their drivers as a point of departure, potential scientific and policy process tools were then proposed based on the scientific literature.

The authors of this study refrained from assessing the value, relevance or effect magnitude of the information provided from policy development experts and stakeholders. No scientific or universal criteria are available to make such a judgement, and dissenting views may occur depending on perspective and the perceived value and relevance of policy impacts. Hence, any assessment would entail a subjective evaluation. Rather, we aimed at classifying the information based on objective criteria set out in the scientific literature and defined grouping criteria to gain insights on drivers and solutions to understand better and possibly account for unintended effects from policy measures ex-ante.

The policy development experts flagged an approximately equal amount of (negative) unintended policy effects relating to "first-order effects" (52 %) (Table 2) and "second-order effects" (48 %) (Table 3). The identified first-order unintended effects from this group were perceived as mostly the consequence of a lack of comprehensiveness in the policy design phase. Stakeholders representing the textile industry, consumer organisations, waste management organisations and NGOs dominantly highlighted second-order effects (Table 3). An important reason for this outcome is that first-order effects are less likely to be flagged for hypothetical policy measures that have not yet been implemented, meaning that the lack of comprehensiveness and coherence with other pieces of legislation is hard to identify in the absence of detail on their exact elements.

4.2. First-order versus second-order effects

Most of the first-order effects identified in the study (Table 2) could be classified as being the result of a lack of comprehensiveness of the policy measure, referring to how effectively it addresses market, system and institutional failures, including any barriers and bottlenecks (Rogge and Reichardt, 2016). In fact, undesirable first-order effects often represented incomplete achievements of the policy objective. From the policy development expert input, it is noted that the full achievement of the entire desired first-order effect is challenging and mostly not even realistically aspired when establishing a new policy, for instance due to many political and institutional system boundary conditions that apply in the policy process (Zepa and Hoffmann, 2023). These may include the mandate to act in the field or to use certain policy instruments and the need to ensure coherence with policies that are already in force. According to the policy development experts, European companies may encounter, for instance, additional challenges due to national transposition, such as when a Member State enforces laws with varying requirements and standards across different countries. Supranational, national and local governments may also have different ambitions for sustainability transitions that cause friction points, or institutional barriers at the local level may contradict policy instruments at the state level – a notion backed up by Zepa and Hoffmann (2023). A supporting example from past policies could be, for instance, that in 2023 only five European Union's Member States had incorporated key provisions of the Packaging and Packaging Waste Directive into national legislation by the deadline, thereby causing internal market distortions and an unlevel playing field for firms operating in different European Union's Member States (European Court of Auditors, 2024). Another factor contributing to the occurrence of unintended effects of policies, identified during the interviews, was that resources available for policy development support may often be limited, potentially leading to the compromised quality of policy designs and ex-ante impact assessments. This could in turn exacerbate the occurrence of unintended effects due to poor policy design, the unclear articulation of policy mechanisms or goals or the inappropriate use of evidence, in line with observations made by Oliver et al. (2019). However, the occurrence of undesirable first-order effects does not imply that the policy is not useful at all – as highlighted by one of the policy development experts: 'Just because there are unintended effects of a policy, it does not mean that the policy is not valid. Even if one gets 85% of the intended effect instead of 100%, it is still better than 0%'.

4.3. Second-order effects and their drivers

Second-order effects (Table 3) were flagged almost to the same

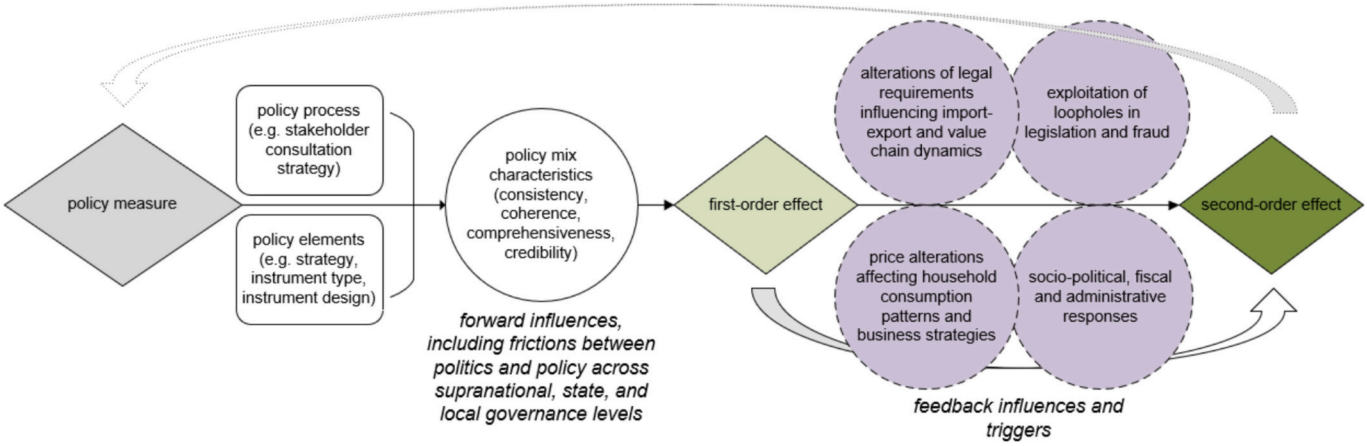

Fig. 2. Overview of the framework used in the study adapted from Edmondson et al. (2019) and Rogge and Reichardt (2016). Forward (white circles) and feedback (purple circles) influences serve as drivers for first- (light green rhombus) and second-order (dark green rhombus) effects, respectively, following the implementation of a policy measure (grey rhombus). Based on the findings of this study, we have categorised the feedback influences and triggers relevant for circular economy policies (purple circles). In the long-term, the combined first- and second-order effect may result in a revised legal framework to account for observed unintended effects.

Table 2
Categorisation of first-order effects flagged by policy development experts and stakeholders for different past policy initiatives and hypothetical textile policy measures. Note that the descriptions of first-order effects are direct inputs from the interviews and survey and constitute raw data of analysis, not including interpretations by the authors of this study.

Policy initiative	Policy objective	Description of first-order effect	Type of unintended effect	Forward influence deficiency category	Respondent type
Packaging and packaging waste Directive	Reducing the environmental impact of packaging	Focus of policy solely on packaging, the challenge of plastics in products is beyond the scope of the policy and remains unresolved	Environmental	Comprehensiveness	Policy development expert
Single Use Plastics Directive	Use of recycled content due to their environmental benefits vis à vis primary plastics	No possible check or transparency regarding the recycled nature of imported materials	Environmental, economic	Comprehensiveness	Policy development expert
Waste Framework Directive	Promote the management of waste according to the waste management hierarchy	Less ambitious outcome than assumed, reductions in landfilling often achieved through more incineration and reductions in incineration and landfilling through more recycling instead of prioritising prevention being the top priority in the waste hierarchy	Environmental	Comprehensiveness	Policy development expert (ex-post of implemented measure)
Waste Framework Directive	Promote the management of waste according to the waste management hierarchy	Following a waste hierarchy is not always correct. Higher targets than the actual potential encourage pushing for a specific treatment method, which may not be the most beneficial option from the lifecycle perspective (e.g., pushing for more re-use of products, which could be recycled with lower environmental impact)	Environmental	Comprehensiveness	Policy development expert (ex-post of implemented measure)
Waste Framework Directive	Promote sustainable management to minimise adverse health and environmental impacts	Risk of misusing some articles in the Directive, e.g., on by-products or and-of-waste, due to possibility of free interpretation. For example, Member States have a possibility to adjust definitions to their own advantage and boost the domestic industry	Environmental	Comprehensiveness	Policy development expert (ex-post of implemented measure)
Waste Framework Directive	Promote separate collection	Setting high collection targets, without available sorting and recycling capacities to match them, may lead to the disposal of separately collected waste	Environmental	Comprehensiveness	Policy development expert (ex-post of implemented measure)
Waste Framework Directive	Promote sustainable management to minimise adverse health and environmental impacts	End-of-Waste criteria, apart from facilitating the free circulation of high-quality secondary raw materials within the EU, facilitate leaks of high-quality secondary raw materials outside of the EU	Environmental	Comprehensiveness	Policy development expert (ex-post of implemented measure)
Landfill Directive	Promote sustainable waste management	Lack of sufficient monitoring leads to a lack of implementing rules, with unintended effects on human health and the environment	Environmental	Comprehensiveness	Policy development expert (ex-post of implemented measure)
Tax on low-cost clothing items	Internalise production externalities	If the tax is too low – risk of unchanged consumer behaviour, risk of competition issues and market distortions favouring big players who could potentially internalise the tax and recuperate losses by keeping low-cost prices unchanged	Environmental, economic	Comprehensiveness	Stakeholder (ex-ante of hypothetical measure)
Information provision - waste management instructions	Inform and incentivise citizens to engage in separate waste collection	Risk of inefficiency if the infrastructure for separate collection is not in place	Environmental	Comprehensiveness	Stakeholder (ex-ante of hypothetical measure)
Establishment of deposit-refund scheme	Increase the separate collection of textile waste, diverting from mixed municipal waste	Risk of market fragmentation and antagonism due to competition for the acquisition of end-of-life textiles for re-use (social actors) and recycling (municipal/public actors). If the deposit rate is too low, the risk of return success being low	Environmental	Comprehensiveness	Stakeholder (ex-ante of hypothetical measure)
Establishment of deposit-refund scheme	Increase the separate collection of textile waste, diverting from mixed municipal waste	Risk of inefficiency due to loophole for products bought through e-commerce from entities not bound by European Union's legislation	Environmental	Comprehensiveness	Stakeholder (ex-ante of hypothetical measure)
Financial incentive for recycling infrastructure	Promote fibre-to-fibre recycling of textiles that are not prepared for re-use	Risk of overestimating required recycling capacity and prioritising recycling over re-use, thus deviating from the waste hierarchy and leading to a sub-optimal environmental and social benefits	Environmental, economic, social	Comprehensiveness	Stakeholder (ex-ante of hypothetical measure)
Financial incentive for recycling infrastructure	Promote fibre-to-fibre recycling of textiles that are not prepared for re-use	Risk of market distortion and market concentration if a subsidy were to create mega-plants that would collect and process large quantities, thus deepening regional inequalities	Environmental	Comprehensiveness	Stakeholder (ex-ante of hypothetical measure)

(*continued on next page*)

Table 2 (*continued*)

Policy initiative	Policy objective	Description of first-order effect	Type of unintended effect	Forward influence deficiency category	Respondent type
Financial incentive for recycling infrastructure	Promote fibre-to-fibre recycling of textiles that are not prepared for re-use	Unless the demand for recycled fibres was increased in parallel to increased recycling, there is a risk of downcycling or disposal of recyclate that is not in demand	Environmental	Comprehensiveness	Stakeholder (ex-ante of hypothetical measure)
Packaging and packaging waste Directive	Reduce the environmental impact of packaging	Focus of legislation on recycling rather than re-use and extending packaging's lifecycle	Environmental	Comprehensiveness, coherence	Policy development expert
Packaging and packaging waste Directive	Reduce the environmental impact of packaging	Disruption to recycling sector's know-how and investments because of mandatory re-use targets and re-use prioritisation over recycling	Economic	Credibility	Policy development expert
Landfill Directive	Promote sustainable waste management	Fixing the quantitative target (in this case <10 %) once and forever may not be justified, and so a certain degree of flexibility should be allowed	Environmental	Credibility	Policy development expert (ex-post of implemented measure)

extent as first-order effects, indicating their overall relevance for transitioning towards a more circular economy. The following sections delve deeply into the results and discussions related to each feedback influence category (Fig. 2).

4.3.1. Alterations to legal requirements influencing import-export and value chain dynamics

Based on the stakeholders' input, alterations to legal requirements influencing import-export and value chain dynamics are deemed to be of a particular concern, i.e., due to the revised focus on economic competitiveness and open strategic autonomy in the EU. From the insights provided in the survey, it was indicated that the legislation affecting waste status and imposing minimum shares of recycled content has implications on import-export of products. This, in turn, can influence material availability in the European Union and affect businesses operating in other parts of the world. Imported materials may have different sourcing and production requirements and conditions, whereas waste treatment obligations may be more lenient in countries receiving (waste) materials exported from the EU. Several stakeholders and policy development experts indicated that waste exports could be a potential threat to the integrity of recycled content obligations and lead to the loss of critical recycling capacity in the European Union, as recyclers potentially could not compete with cheaper imports of recycled material from outside of the EU, in line with findings from previous studies (Maeder and Fröhling, 2024; Söderholm and Ekvall, 2019). Limiting certain "outside" waste treatment options (e.g., landfilling) and recycling obligations in the European Union were seen by some respondents as possible causes of increased waste exports for treatment outside of the territory, which would allow for circumventing European Union's obligations. This, in turn, was seen to be likely associated with leakage of valuable secondary raw materials outside the European Union and potential negative environmental effects in export destinations.

4.3.2. Exploitation of loopholes in legislation and fraud

Second-order effects resulting from the possible exploitation of loopholes in legislation or potential fraud, which go against the initial objective of a policy measure were found to be equally problematic. This could be because real-life environmental regulations may involuntarily include design elements that create "loopholes," which can then have a significant distortionary effect on companies' competitiveness and technical change (Konishi and Managi, 2020). From the findings of this study, upon implementation of a new policy measure, affected stakeholders may want to redesign existing practices and evaluate alternative technical and financial options for compliance. According to the stakeholders and policy development experts, product attributes outside of the direct scope of the new requirements of the policy could be manipulated to minimise technical and economic adaptations to ensure compliance. For instance, an example was brought up for packaging, whereby packaging producers could prioritise the most cost-effective rather than the most environmentally beneficial packaging option to ensure they meet legal standards, albeit, in turn, this could have a negative impact on, for example, packaging recyclability.

4.3.3. Price alterations affecting household consumption patterns and business strategies

Price and income changes have a lasting effect on consumer priorities, which need to be factored in when planning long-term business strategies and redefining business success in a more circular future economy (EY, 2023; Horrell, 2023). On one hand, price alterations can have a positive effect in the form of consumerism moderation, but on the other hand, from the stakeholders' input, it can also exacerbate social injustice. For instance, it may impose an unfair financial burden on low-income households (Sassi et al., 2018). When purchasing power is negatively affected, it can have a direct negative effect on the sense of safety and overall quality of life (Kim and Huruta, 2021). It was shown that even if consumers are willing to engage in sustainable fashion practices and support recycled clothing, there can be a mismatch between willingness to pay and ability to pay, particularly when considering luxury brands which are often the most desired (Papamichael et al., 2023, 2024). Consumers were found to be willing to pay more for circular, long-lasting garments which indicates that there is a market for circular premium among conscious consumers (Papamichael et al., 2024; Tamlander, 2024). As circular business models within the luxury fashion sector are relatively unexplored, this presents an opportunity for brands to innovate and enhance its perception among consumers (Gasulla Tortajada et al., 2024). However, there is a strong need for clear communication from companies, media, sales personnel on the exact meaning of circular economy to support consumers in circular fashion choices (Jimenez-Fernandez et al., 2023). The benefits of circular economy were shown to connect to an ethical belief in achieving collective or individual improvements. Focusing on both of those two levels could ensure achieving not only environmental but also social well-being (Jimenez-Fernandez et al., 2023). Lastly, from the stakeholder input, there is a risk of shifting current business models and unsustainable production practices to other locations without solving the issue, thus causing a price-and-speed squeeze (Härri et al., 2022).

4.3.4. Socio-political, fiscal and administrative responses

This category is very relevant in the context of capturing the unintended effects of policies, particularly from a longer-term perspective. Even if a policy can be successful from an environmental perspective, the stakeholders pointed to the need for an increased consideration of possible social reactions. In the past, this has been flagged as an important element of a successful circular economy transition (Calisto Friant et al., 2021). The risk of limiting consumer convenience, and of increased bureaucracy, could affect public acceptance (Euractiv, 2014;

Table 3
Categorisation of second-order effects flagged by policy development experts and stakeholders for different past policy initiatives and hypothetical textile policy measures. Note that the descriptions of second-order effects are direct inputs from the interviews and survey and constitute raw data for analysis, not including interpretation by the authors of this study.

Policy objective	Description of second-order effect	Type of unintended effect	Feedback influence category	Respondent type
Reducing the environmental impact of packaging	Waste exports outside of the EU, instead of increased recycling within the EU, to reach recycling targets	Environmental	Alterations to legal requirements influencing import-export and value chain dynamics, exploitation of loopholes in legislation and fraud	Policy development expert (ex-post of implemented measure)
Desincentivising sub-optimal waste management options	Risk of waste exports. Risk of inefficiency if waste is landfilled in third countries	Environmental	Legal requirements influencing import-export and value chain dynamics, exploitation of loopholes in legislation and fraud	Stakeholder (ex-ante of hypothetical measure)
Use of recycled content due to environmental benefits vis à vis primary plastics	Import of recycled plastics from outside of the European Union (e.g., China) to meet recycled content targets (instead of sourcing it from the EU). Risk of bankruptcy to the European (plastics) recycling industry.	Economic	Alterations to legal requirements influencing import-export and value chain dynamics	Policy development expert (ex-post of implemented measure)
Enable only exports of waste to non-OECD countries when a third country can demonstrate sustainable waste management	Maintaining waste in the European Union to a higher extent could enhance recycling opportunities, especially for those materials that require specialised handling	Economic	Alterations to legal requirements influencing import-export and value chain dynamics	Policy development expert (ex-post of implemented measure)
Use of recycled content due to their environmental benefits vis-a-vis primary plastics	High-purity recycled plastics often used as a source for recycled content in polyester textiles, shifting away from food-grade-quality recycled plastics from packaging	Environmental, economic	Alterations to legal requirements influencing import-export and value chain dynamics	Policy development expert (ex-post of implemented measure)
Promote sustainable management to minimise adverse health and environmental impacts, reduce administrative barriers for waste that has reached End-of-Waste status	Risk with bringing more materials into the product status that they will more easily leave the EU	Economic	Alterations to legal requirements influencing import-export and value chain dynamics	Policy development expert (ex-post of implemented measure)
Enable only exports of waste to non-OECD countries when a third country can demonstrate sustainable waste management	Stopping waste exports could result in unemployment in waste-receiving countries, which is an issue in the context of plastic waste and will likely be an issue in the context of textile waste	Social	Alterations to legal requirements influencing import-export and value chain dynamics	Policy development expert (ex-post of implemented measure)
Increase separate collection of textile waste, diverting from mixed municipal waste	Risk of brand-owned take-back schemes depriving social enterprises and charities from a clear stream of textiles to re-use and re-sell	Economic	Alterations to legal requirements influencing import-export and value chain dynamics	External stakeholder (ex-ante of hypothetical measure)
Reduce the environmental impact of packaging	Development of high-tech, lightweight packaging (e.g., multilayered packaging) to accommodate the recycled content requirement, which in turn makes packaging more difficult to recycle	Environmental	Exploitation of loopholes in legislation and fraud	Policy development expert (ex-post of implemented measure)
Implement a “polluter pays” principle	Extended Producer Responsibility fees used differently than intended if, e.g., an Extended Producer Responsibility scheme is implemented as a state-owned monopoly and is therefore unregulated. Extended Producer Responsibility fee passed on to consumers and not paid by producers as intended	Environmental	Exploitation of loopholes in legislation and fraud	Policy development expert (ex-post of implemented measure)
Promote sustainable management to minimise adverse health and environmental impacts, reduce administrative barriers for waste that has reached End-of-Waste status	The more intermediate phases there are between waste generation and End-of-Waste, the easier it is to cheat and send waste to illegal destinations	Environmetnal, social	Exploitation of loopholes in legislation and fraud	Policy development expert (ex-post of implemented measure)
Internalise production externalities	Risk of illegal markets and fraud, for clothing circumventing official retail channels	Environmental, economic	Exploitation of loopholes in legislation and fraud	Stakeholder (ex-ante of hypothetical measure)
Desincentivising sub-optimal waste management options	Risk of illegal dumping	Environmental	Exploitation of loopholes in legislation and fraud	Stakeholder (ex-ante of hypothetical measure)
Internalise production externalities	Risk of increasing the final price of the clothing article with a potential negative impact on the purchasing power of disadvantaged/deprived social groups, thereby exacerbating social/ environmental justice issues	Socio-economic	Price alterations affecting household consumption patterns and business strategies	Stakeholder (ex-ante of hypothetical measure)
Internalise production externalities	If the market for low-cost items becomes unprofitable in Europe, the risk is that the brands will seek new markets with lower purchasing power and increase their sales there. This would likely have a negative effect on local textile providers and the supply of affordable second-hand clothing from Europe. This would carry a risk of a solid re-use market shrinking and being substituted by new low-cost low-quality items	Environmental, economic	Price alterations affecting household consumption patterns and business strategies	Stakeholder (ex-ante of hypothetical measure)

(*continued on next page*)

Table 3 (*continued*)

Policy objective	Description of second-order effect	Type of unintended effect	Feedback influence category	Respondent type
	increasing the environmental footprint of the textile sector globally			
Internalise production externalities	Risk of manufacturers seeking to further reduce production costs, which would place additional pressure on producing countries to reduce them even further and lead to adverse social and environmental effects. In the worst case, there could be a total relocation of production to countries with even lower salaries and environmental standards, leaving the previous locations in poverty through unemployment. The social implications of the textile value chain would be strongly (if not stronger than environmental) affected	Social	Price alterations affecting household consumption patterns and business strategies	Stakeholder (ex-ante of hypothetical measure)
Promote fibre-to-fibre recycling of textiles that are not prepared for re-use	Risk of negative economic and environmental unintended effects on third countries that are currently receiving second-hand clothing	Socio-economic	Price alterations affecting household consumption patterns and business-strategies	Stakeholder (ex-ante of hypothetical measure)
Avoiding plastic littering	Lids attached to plastic bottles by law – the level of detail in European Union's regulation can be used to undermine the seriousness of European Union's policy, e.g., during national elections	Environmental	Socio-political, fiscal and administrative responses	Policy development expert (ex-post of implemented measure)

Rodríguez-Pose and Dijkstra, 2021), which links directly to policy compliance, or a lack thereof (Grelle and Hofmann, 2024). On a business level, stakeholders touched upon the possible investment uncertainties resulting from policy implementation with a potential risk of affecting European Union's competitiveness and know-how. Second-order effects could be related to the cohesion-competitiveness issue, i.e., the imbalance between objectives and financial resources in different Member States, and possible difficulties with policy compliance as a result (Mancha-Navarro and Garrido-Yserte, 2008). In line with recently outlined priorities set for the EU's economic growth and prosperity, efforts should be directed towards 'working hard to maintain our leadership globally and to make sure we have control over our own future' (European Commission, 2024a, 2024b).

4.4. Insights on better addressing unintended second-order effects

Policy development experts were asked in the preparatory survey (see section S1.3 in the SI) which tools or research techniques should be better employed in ex-ante impact assessments to understand the potential unintended effects of policies. The experts mainly pointed at *monitoring, evaluation and learning from past policies* (ranked most relevant by 36 % experts), *stakeholder engagement* and *micro-level modelling* (ranked most relevant by 27 % experts in each case), see Fig. S5 in the SI. Furthermore, many experts pointed at *micro-level modelling* (life cycle assessment, life cycle costing, societal life cycle modelling) as an important type of tool to be better employed in future impact assessments, as illustrated in Fig. S5 in the SI. However, a technical limitation of this type of tool is precisely its inability to capture macroeconomic effects (De Laurentiis et al., 2024; Niero et al., 2021; Tukker, 2024). From this finding, we understand that while micro-level modelling tools are not suitable for quantifying the unintended effects of circular economy policies (Niero et al., 2021), more appropriate methods are being developed (see section 2.1), and they seem to be the best available alternative.

While solid guidelines and comprehensive toolboxes are already available (European Commission, 2023a), this study confirms the importance of reinforcing or expanding the use of certain tools during policy processes: (i) increased stakeholder engagement to better capture techno-scientific information, (ii) combined micro- and macro-economic modelling, (iii) extended consideration of European Union's resilience (and effect on third countries) and (iv) the inclusion of behavioural and social insights. It is important to emphasise that the suggestions presented herein may be non-exhaustive and are solely based on the results of this study. These insights could nevertheless be relevant for fine-tuning existing guidance for policymaking in certain circular economy policy development settings.

4.4.1. Increased stakeholder engagement to better capture techno-scientific information

While stakeholders are already consulted at different stages of the policymaking process (e.g., inception, draft proposals, adoption) at the national and supranational level (European Commission, 2023a), the results of this study suggest a need for further stakeholder engagement. This, according to policy development experts, is essential for mapping all potential unintended effects before the modelling phase to be able to quantify their potential effects on the wider economy with tools that are available today – and before more appropriate tools are proven effective. This finding is in line with the outcome from a previous study by (Oliver et al., 2019) which demonstrated that unintended effects of policies could be partially mitigated through the better use of evidence, better involvement of stakeholders in policy design and evaluation. Enhancing a participatory, transparent, consensus-based approach to develop, establish and update environmental norms and performance standards in circular economy policies could assist in detecting and addressing upfront loopholes in legislation. Collaboration between industry and regulatory bodies can be an effective approach to overcoming technical compliance challenges for industry (FasterCapital, 2024). Furthermore, a continuous dialogue with parties, with a view to building a sense of engagement and ownership during consensus development, could help regulators gain a better technical understanding of "on-the-ground" implications of policy implementation. This could include, for instance, the use of tools and methodologies for data-gathering, information exchange mechanisms, stakeholder feedback and commenting, as well as transparency. These would then allow all parties to take an active role during data collection, processing and verification. For example, in this regard, to overcome the challenge of technical bias and limited consideration of unintended effects in current assessments, policy experts suggested including relevant stakeholders in the initial stage of an ex-ante impact assessment, before the start of the modelling phase, to map all possible unintended effects, thereby ensuring that all relevant perspectives are considered. The mapped effects could then be included in the models to quantify their magnitude. The main challenge in this regard relates to required additional resources and time requirements, which are substantially greater if this initial mapping and stakeholder

involvement are added to the ex-ante impact assessments. Furthermore, monitoring and auditing compliance with new legislation is also an effective instrument to detect and address loopholes in legislation, but we will not dive deeper into procedures focusing on scientific tools, as this is beyond the scope of this study.

4.4.2. Combined micro- and macro-economic modelling

As initially described in section 2.1, macro-economic modelling could be well-suited to quantifying socio-economic unintended effects on economic sectors on the macro-scale or even the unintended effects previously mapped by stakeholders. Such models can integrate bottom-up modelling results (e.g., life cycle assessment and costing), which cannot capture the macro-economic scale (Tukker, 2024). However, the integration of life cycle assessments with macro-economic models is not yet established common practice in the field. Macro-economic models need input-output tables, which often have an insufficient level of disaggregation to address the detailed mass flows changes incurred by circular economy policies, i.e., they generally do not have the granularity level of specific products, waste or materials. Moreover, waste is often considered an aggregated sector, without making any distinction between individual secondary materials. This downside is likely the reason why many experts, when asked in the preparatory survey (see section S1.3 in the SI) about which tools or research techniques would be better employed to understand the potential unintended effects of policies in ex-ante impact assessments, pointed at *micro-level modelling* (see Fig. S5 in the SI). However, their main limitation is precisely their inability to capture macro-economic effects (De Laurentiis et al., 2024; Niero et al., 2021; Tukker, 2024). Macro-economic models (e.g., E3MI, GEMI3, Fidelio), on the other hand, include all economic sectors (and relations amid) and work with price elasticities, striving to include first-order (e.g., substitution effects following a shock on a selected economic activity) and second-order effects (e.g., changes in consumer expenditure following a shock). Therefore, they could be suitable for estimating macro-economic effects, but this is heavily dependent on the quality of input-output-tables disaggregation performed. For example, Exiobase v3 is an improvement compared to previous Input-Output datasets, as it contains a disaggregation into 163 industries and 200 products, thereby allowing for selected material-level analysis (Stadler et al., 2021).

4.4.3. Scenario modelling and extended consideration of European Union's resilience

In relation to the insufficient preparation of the European Union for unforeseen events in the past (e.g., war in Ukraine or the COVID-19 pandemic), some policy experts suggested the need for increased consideration of Europe's resilience in ex-ante impact assessments. To address this point, the experts proposed to include bolder scenarios in the assessments, even if they are currently deemed unrealistic, e.g., a ban on short-haul flights, societal lockdown, Europe at war, etc. Lastly, they highlighted the challenge of focusing on the effects of European Union's policies exclusively within the European Union and a reduced consideration of their effects in third countries. These findings are in line with research by Steenmans and Lesniewska (2023) which pointed out that policy development would benefit from a wide evidence base covering both the Global South and marginalized communities in the Global North.

4.4.4. Inclusion of behavioural and social insights

To complement the findings from this study, it is important not to forget that second-order effects involve, by definition, a behavioural component. Hallsworth (2023) suggests that viewing policies through a behavioural science lens can aid in evaluating current actions and comprehending their potential unintended effects, as well as helping to mould system features that establish the conditions for broad behavioural changes to take place. Studies that have assessed waste management actions by consumers have already identified different influencing factors, including internal (e.g., environmental values, beliefs and attitudes) and external (e.g., laws and regulation, social norms, financial incentives) motivators (Iyer and Kashyap, 2007). Cristóbal García et al. (2022) suggested, for instance, that a mix of policy interventions – such as regulations, economic incentives and communication – is likely necessary to ensure citizens sort their waste correctly. Bączyk et al. (2024) highlighted that circular consumption does not necessarily have to be sustainable and that it can challenge circular economy's no-waste-growth promise. To address this, circular business models supported by policies aiming at demand moderation are suggested (Bączyk et al., 2024). Both the outcomes of behavioural studies and including a behavioural science lens can surely assist in supporting policy development and better predicting the responses of citizens and firms to newly established policies.

4.5. Limitations

The exploratory nature of this research may be a limitation in terms of providing conclusive evidence to directly inform policy development process. To overcome this limitation, two complementary approaches have been applied in this research, based on ex-post and ex-ante evaluation. It is noted that a full analysis of specific textile waste policies proposed by the European Commission was not possible due to the timing (ongoing development) and data scarcity for evaluation. In addition, the geographical scope was limited to the European Union policy context, which makes the findings of the study European Union specific and cannot be directly translated to other geographical contexts. On the other hand, the findings may be partially applicable to societies with similar consumption patterns and economic profile. The results of the study are likely sensitive to the composition of the stakeholder sample or number of stakeholders who participated in the study. This could be another limitation as some relevant input may have been missed from either stakeholders who were invited but did not express their interest in participating in the study or stakeholders who were not identified during the sample composition process.

5. Conclusions

Our study confirms that an evident gap exists between the acknowledged importance of unintended effects and the tools/processes used to address them. From the insights provided by policy development experts and relevant stakeholders, the relevance of second-order effects was deemed as equally high as first-order effects. The categorisation of these effects showed that most of them were related to three feedback influence categories, namely alterations to legal requirements influencing import-export and value chain dynamics, the exploitation of loopholes in legislation and fraud, as well as price alterations affecting household consumption patterns and business strategies. While the last category (socio-political, fiscal and administrative responses) was reflected to a lesser extent, it was argued that it should not be underestimated in the context of capturing the unintended effects of circular economy policies, as public acceptance is directly linked to policy compliance or a lack thereof. To address second-order effects, the policy development experts suggested: (i) increasing stakeholder engagement before the start of the ex-ante impact assessment modelling, (ii) combining micro- and macro-modelling tools to address and mitigate the technical limitations of each and effectively quantify the impacts of proposed policy on the wider economy, (iii) extending consideration of the European Union's resilience by adding bolder scenarios to the ex-ante impact assessment and investigating the effects of European Union's policy on third countries and, finally, (iv) including the behavioural and social components with the ex-ante impact assessment to increase understanding of potential social responses, which is currently done but to a limited extent. Lastly, it was highlighted that unintended effects are not always negative, and even when so, they do not necessarily have to discredit a policy altogether. Even if the starting ambition with a given policy is achieved only partially, this can be more beneficial

than no action. Future research could focus on bridging the gap between suggestions for capturing second-order effects and how to practically include these insights in future ex-ante impact assessments. In addition, future analyses could focus on actual textile policies proposed by the European Commission when the necessary information is available. While this study is exploratory in nature and derived suggestions may be non-exhaustive, it nevertheless provides relevant insights for fine-tuning existing guidance for policymaking in certain circular economy policy development settings. It sheds light on unintended effects of circular economy policies, and this is very timely as many policies are currently under development in the EU. Ultimately, it contributes to more effective circular economy policymaking and, hence, supporting the action to meet the United Nation's Sustainable Development Goal 12.

CRediT authorship contribution statement

Martyna Solis: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **Leonidas Milios:** Writing – review & editing, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **Davide Tonini:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Steffen Foss Hansen:** Writing – review & editing, Validation, Supervision, Conceptualization. **Charlotte Scheutz:** Writing – review & editing, Supervision, Conceptualization. **Dries Huygens:** Writing – review & editing, Validation, Supervision, Methodology, Formal analysis, Conceptualization.

Disclaimer

The views expressed in this article are the sole responsibility of the authors and in no way represent the views of the European Commission and its services.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to thank all stakeholders and experts who have taken the time and participated in the study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.spc.2025.01.021.

References

Aguilar Hernandez, G.A., Taherzadeh, O., Tukker, A., 2023. Lessons from micro-and macro-modelling linkages: example of linking LCA/DMFA and CGE model for developing circular economy scenarios. https://scholarlypublications.universiteitleiden.nl/handle/1887/3590029.

Alberich, J.P., Pansera, M., Hartley, S., 2023. Understanding the EU's circular economy policies through futures of circularity. J. Clean. Prod. 385. https://doi.org/10.1016/j.jclepro.2022.135723.

Almén, J., Dalhammar, C., Milios, L., & Richter, J. L. (2021). Repair in the circular economy: towards a National Swedish Strategy. *In 20th European roundtable on sustainable consumption and production*, 21–41. doi:https://doi.org/10.3217/978-3-85125-842-4-15.

Bączyk, M., Tunn, V., Worrell, E., Corona, B., 2024. Consumer behavior in circular business models: unveiling conservation and rebound effects. Sustain. Prod. Consum. https://doi.org/10.1016/j.spc.2024.10.022.

Bennear, L.S., Stavins, R.N., 2007. Second-best theory and the use of multiple policy instruments. Environ. Resour. Econ. 37, 111–129. https://doi.org/10.1007/s10640-007-9110-y.

Braun, V., Clarke, V., 2023. Thematic analysis. In: Encyclopedia of Quality of Life and Well-Being Research. Springer International Publishing, pp. 7187–7193. https://doi.org/10.1007/978-3-031-17299-1.

Briguglio, M., 2021. Taxing household waste: intended and unintended consequences. J. Clean. Prod. 304. https://doi.org/10.1016/j.jclepro.2021.127034.

Bryman, A., 2016. Social Research Methods. Oxford University Press.

Calisto Friant, M., Vermeulen, W.J.V., Salomone, R., 2021. Analysing European Union circular economy policies: words versus actions. Sustainable Production and Consumption 27, 337–353. https://doi.org/10.1016/j.spc.2020.11.001.

Carattini, S., Hertwich, E., Melkadze, G., Shrader, J.G., 2022. Mandatory disclosure is key to address climate risks. Science 378 (6618), 352–354. https://doi.org/10.1126/science.add0206.

Castro, C. G., Trevisan, A. H., Pigosso, D. C. A., & Mascarenhas, J. (2022). The rebound effect of circular economy: definitions, mechanisms and a research agenda. In *journal of cleaner production* (Vol. 345). Elsevier ltd. doi:https://doi.org/10.1016/j.jclepro.2022.131136.

Collova, C. (2015). How does ex-ante Impact Assessment work in the EU? https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2015)528809.

Copenhagen Fashion Week, 2022, August 8. New sectoral agreement for a more circular Danish textile industry. https://copenhagenfashionweek.com/article/new-sectoral-agreement-to-ensure-a-greener-danish-textile-industry.

Creswell, J.W., 2014. Research Design: Qualitative, Quantitative and Mixed Methods Approaches. Sage publications.

Cristóbal García, J., Pierri, E., Antonopoulos, I., Bruns, H., Foster, G., Gaudillat, P., 2022. Separate collection of municipal waste: citizens' involvement and behavioural aspects. https://doi.org/10.2760/77931.

De Laurentiis, V., Caldeira, C., Sala, S., Tonini, D., 2024a. Life cycle thinking for the assessment of waste and circular economy policy: status and perspectives from the EU example. Waste Manag. 179, 205–215. https://doi.org/10.1016/j.wasman.2024.02.037.

Edmondson, D.L., Kern, F., Rogge, K.S., 2019. The co-evolution of policy mixes and socio-technical systems: towards a conceptual framework of policy mix feedback in sustainability transitions. Res. Policy 48 (10). https://doi.org/10.1016/j.respol.2018.03.010.

Ellen MacArthur Foundation, 2024. Pushing the boundaries of EPR policy for textiles. https://www.ellenmacarthurfoundation.org/epr-policy-for-textiles.

Euractiv. (2014, December 16). After 'Hoovergate', EU torn over power-saving rules. https://www.euractiv.com/section/energy/news/after-hoovergate-eu-torn-over-power-saving-rules/.

EuRIC. (2023). No full revision of the Waste Framework Directive without a corresponding impact assessment and stakeholder involvement. https://euric.org/resource-hub/press-releases-statements/no-full-revision-of-the-waste-framework-directive-without-a-corresponding-impact-assessment-and-stakeholder-involvement.

European Commission, 2008a. Directive 2008/98/EC of the European Parliament and of the council of 19 November 2008 on waste and repealing certain directives. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008L0098-20180705.

European Commission, 2008b. The principle of subsidiarity. https://www.europarl.europa.eu/factsheets/en/sheet/7/the-principle-of-subsidiarity.

European Commission, 2016. Principle of proportionality. https://eur-lex.europa.eu/EN/legal-content/glossary/principle-of-proportionality.html.

European Commission, 2018. Council directive 1999/31/EC of 26 April 1999 on the landfill of waste. https://eur-lex.europa.eu/eli/dir/1999/31/2018-07-04.

European Commission, 2019. Directive (EU) 2019/904 of the European Parliament and of the council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment. https://eur-lex.europa.eu/eli/dir/2019/904/oj.

European Commission, 2020. Directive 94/62/EC on packaging and packaging waste. https://eur-lex.europa.eu/EN/legal-content/summary/packaging-and-packaging-waste.html.

European Commission, 2022. EU strategy for sustainable and circular textiles. https://environment.ec.europa.eu/publications/textiles-strategy_en.

European Commission, 2023a. Better regulation: guidelines and toolbox. In: https://commission.europa.eu/law/law-making-process/planning-and-proposing-law/better-regulation/better-regulation-guidelines-and-toolbox_en.

European Commission, 2023b. Proposal for waste framework directive revision-textile waste. https://ec.europa.eu/newsroom/env/items/803765/.

European Commission, 2024a. Regulation (EU) 2024/1157 of the European Parliament and of the council of 11 April 2024 on shipments of waste, amending regulations (EU) no 1257/2013 and (EU) 2020/1056 and repealing regulation (EC) no 1013/2006. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024R1157.

European Commission, 2024b. September 19. Looking ahead, EU competitiveness. https://commission.europa.eu/topics/strengthening-european-competitiveness/eu-competitiveness-looking-ahead_en#paragraph_47059.

European Commission Secretariat-General, 2024. Regulatory Scrutiny Board - Annual Report 2023. https://doi.org/10.2792/893765.

European Court of Auditors, 2024, September 16. Challenging start for the EU's revenue based on non-recycled plastic packaging waste. https://www.eca.europa.eu/en/news/NEWS-SR-2024-16.

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

EY. (2023). When consumers want less but demand more, how will your business grow? https://www.ey.com/en_gl/insights/consumer-products/changing-consumption-will-reshape-business-priorities.

FasterCapital, 2024. June 2. Understanding Compliance Challenges, Regulatory Loopholes Demystified. https://fastercapital.com/content/Regulatory-Loopholes-Demystified–Understanding-Compliance-Challenges.html.
Fletcher, C.A., Hooper, P.D., Dunk, R.M., 2018. Unintended consequences of secondary legislation: a case study of the UK landfill tax (qualifying fines) order 2015. Resour. Conserv. Recycl. 138, 160–171. https://doi.org/10.1016/j.resconrec.2018.07.011.
Flyvbjerg, B., 2006. Five misunderstandings about case-study research. Qual. Inq. 12 (2), 219–245. https://doi.org/10.1177/1077800405284363.
Font Vivanco, D., Freire-González, J., Galvin, R., Santarius, T., Walnum, H.J., Makov, T., Sala, S., 2022. Rebound effect and sustainability science: a review. J. Ind. Ecol. 26 (4), 1543–1563. https://doi.org/10.1111/jiec.13295.
Font Vivanco, D., Kemp, R., van der Voet, E., 2016. How to deal with the rebound effect? A policy-oriented approach. Energy Policy 94, 114–125. https://doi.org/10.1016/j.enpol.2016.03.054.
Gasulla Tortajada, E., Moreira, A.C., Duarte, P., Silva, S.C., 2024. Circular economy and sustainability in luxury fashion consumer behavior: A review and research agenda. In: International Journal of Consumer Studies, vol. 48, Issue 5. John Wiley and Sons Inc. https://doi.org/10.1111/ijcs.13089
Gözet, B., Wilts, H., Manshoven, S., Bakas, I., 2021. Progress towards preventing waste in Europe — the case of textile waste prevention Issue 15. https://doi.org/10.2800/494502.
Grelle, S., Hofmann, W., 2024. When and why do people accept public-policy interventions? An integrative public-policy-acceptance framework. Perspect. Psychol. Sci. 19 (1), 258–279. https://doi.org/10.1177/17456916231180580.
Hallsworth, M., 2023. A manifesto for applying behavioural science. Nat. Hum. Behav. 7 (3), 310–322. https://doi.org/10.1038/s41562-023-01555-3.
Härri, A., Levänen, J., Linnanen, L., 2022. Circular Economy. In: Handbook of Sustainability Science in the Future. Springer International Publishing, pp. 1–19. https://doi.org/10.1007/978-3-030-68074-9_73-1.
Hartley, K., Schülzchen, S., Bakker, C.A., Kirchherr, J., 2023. A policy framework for the circular economy: lessons from the EU. J. Clean. Prod. 412. https://doi.org/10.1016/j.jclepro.2023.137176.
Hertin, J., Turnpenny, J., Jordan, A., Nilsson, M., Russel, D., Nykvist, B., 2009. Rationalising the policy mess? Ex ante policy assessment and the utilisation of knowledge in the policy process. Environ. Plan. A 41 (5), 1185–1200. https://doi.org/10.1068/a40266.
Horrell, S., 2023. Household consumption patterns and the consumer price index, England, 1260–1869. Aust. Econ. Hist. Rev. 76 (4), 1023–1050. https://doi.org/10.1111/ehr.13236.
Iyer, E.S., Kashyap, R.K., 2007. Consumer recycling: role of incentives, information, and social class. J. Consum. Behav. 6 (1), 32–47. https://doi.org/10.1002/cb.206.
Jacobsson, K., Åkerström, M., 2013. Interviewees with an agenda: learning from a 'failed' interview. Qual. Res. 13 (6), 717–734. https://doi.org/10.1177/1468794112465631.
Jimenez-Fernandez, A., Aramendia-Muneta, M.E., Alzate, M., 2023. Consumers' awareness and attitudes in circular fashion. Cleaner and Responsible Consumption 11. https://doi.org/10.1016/j.clrc.2023.100144.
Kim, M.-S., Huruta, A.D., 2021. The relationship between purchasing power and quality of life: the mediating role of safety. Turkish Journal of Physiotherapy and Rehabilitation 32 (3), 21277–21285. www.turkjphysiotherrehabil.org.
King, N., 2014. Using templates in the thematic analysis of text. In: Essential Guide to Qualitative Methods in Organizational Research. SAGE Publications Ltd., pp. 256–270. https://doi.org/10.4135/9781446280119.n21
Konishi, Y., Managi, S., 2020. Do regulatory loopholes distort technical change? Evidence from new vehicle launches under the Japanese fuel economy regulation. J. Environ. Econ. Manag. 104. https://doi.org/10.1016/j.jeem.2020.102377.
Lincoln, Y.S., Guba, E.G., 1985. Naturalistic Inquiry. Newberry Park.
Louis, L., 2024. August 4. *France seeks to slow down wasteful industry*. DW, Fast fashion. https://www.dw.com/en/targeting-fast-fashion-france-aims-to-slow-wasteful-industry/a-68731801.
Lowe, B.H., Bimpizas-Pinis, M., Zerbino, P., Genovese, A., 2024. Methods to estimate the circular economy rebound effect: a review. J. Clean. Prod. 443. https://doi.org/10.1016/j.jclepro.2024.141063.
Maeder, M., Fröhling, M., 2024. Conceptualizing circular economy policy instruments: The case of recycled content standards. In: Sustainable Production and Consumption, vol. 52. Elsevier B.V, pp. 333–346. https://doi.org/10.1016/j.spc.2024.11.009.
Mancha-Navarro, T., Garrido-Yserte, R., 2008. Regional policy in the European Union: the cohesion-competitiveness dilemma. Reg. Sci. Policy Pract. 1 (1), 47–66. https://doi.org/10.1111/j.1757-7802.2008.00005.x.
Marshall, M.N., 1996. Sampling for qualitative research. Fam. Pract. 13 (6), 522–526.
Mickwitz, P., 2003. A framework for evaluating environmental policy instruments: context and key concepts. Evaluation 9 (4), 415–436. https://doi.org/10.1177/1356389003090404.
Milios, L. (2018). Advancing to a circular economy: Three essential ingredients for a comprehensive policy mix. In Sustainability Science (Vol. 13, Issue 3, pp. 861–878). Springer Tokyo. doi:https://doi.org/10.1007/s11625-017-0502-9.
Moussa, N., 2024, March 14. Les sites d'ultra-fast fashion comme Shein et Temu dans le viseur des députés. Le Monde. https://www.lemonde.fr/economie/article/2024/03/14/les-sites-d-ultra-fast-fashion-comme-shein-et-temu-dans-le-viseur-des-deputes_6221904_3234.html.
Niero, M., Jensen, C.L., Fratini, C.F., Dorland, J., Jørgensen, M.S., Georg, S., 2021. Is life cycle assessment enough to address unintended side effects from circular economy initiatives? J. Ind. Ecol. 25 (5), 1111–1120. https://doi.org/10.1111/jiec.13134.
Nowell, L.S., Norris, J.M., White, D.E., Moules, N.J., 2017. Thematic analysis: striving to meet the trustworthiness criteria. *International journal of qualitative*. Methods 16 (1). https://doi.org/10.1177/1609406917733847.
Oliver, K., Lorenc, T., Tinkler, J., Bonell, C., 2019. Understanding the unintended consequences of public health policies: the views of policymakers and evaluators. BMC Public Health 19 (1). https://doi.org/10.1186/s12889-019-7389-6.
Papamichael, I., Voukkali, I., Economou, F., Liscio, M.C., Sospiro, P., Naddeo, V., Zorpas, A.A., 2024. Investigation of customer behavior regarding circular fashion. Sustain. Chem. Pharm. 41. https://doi.org/10.1016/j.scp.2024.101675.
Papamichael, I., Voukkali, I., Loizia, P., Rodrıguez-Espinosa, T., Pedreño, J.N., Zorpas, A. A., 2023. Textile waste in the concept of circularity. Sustain. Chem. Pharm. 32. https://doi.org/10.1016/j.scp.2023.100993.
Prasad, B.D., 2008. Content analysis. In Research Methods for Social Work. https://doi.org/10.13140/RG.2.1.1748.1448.
Puglia, M., Parker, L., Clube, R.K.M., Demirel, P., Aurisicchio, M., 2024. The circular policy canvas: mapping the European Union's policies for a sustainable fashion textiles industry. Resour. Conserv. Recycl. 204. https://doi.org/10.1016/j.resconrec.2024.107459.
Rhein, S., Sträter, K.F., 2021. Intended and unintended effects of statutory deposit return schemes for single-use plastic bottles lessons learned from the German experience. GAIA - Ecological Perspectives for Science and Society 30 (4), 250–256. https://doi.org/10.14512/gaia.30.4.8.
Roberts, C., Geels, F.W., 2019. Conditions for politically accelerated transitions: historical institutionalism, the multi-level perspective, and two historical case studies in transport and agriculture. Technol. Forecast. Soc. Chang. 140, 221–240. https://doi.org/10.1016/j.techfore.2018.11.019.
Roberts, H., Milios, L., Mont, O., Dalhammar, C., 2023. Product destruction: exploring unsustainable production-consumption systems and appropriate policy responses. Sustainable Production and Consumption 35, 300–312. https://doi.org/10.1016/j.spc.2022.11.009.
Rodríguez-Pose, A., Dijkstra, L., 2021. Does cohesion policy reduce EU discontent and Euroscepticism? Reg. Stud. 55 (2), 354–369. https://doi.org/10.1080/00343404.2020.1826040.
Rogge, K.S., Reichardt, K., 2016. Policy mixes for sustainability transitions: an extended concept and framework for analysis. Res. Policy 45 (8), 1620–1635. https://doi.org/10.1016/j.respol.2016.04.004.
Sala, S., Ciuffo, B., Nijkamp, P., 2015. A systemic framework for sustainability assessment. Ecol. Econ. 119, 314–325. https://doi.org/10.1016/j.ecolecon.2015.09.015.
Sassi, F., Belloni, A., Mirelman, A. J., Suhrcke, M., Thomas, A., Salti, N., Vellakkal, S., Visaruthvong, C., Popkin, B. M., & Nugent, R. (2018). Equity impacts of price policies to promote healthy behaviours. In The Lancet (Vol. 391, Issue 10134, pp. 2059–2070). Lancet Publishing Group. doi:https://doi.org/10.1016/S0140-6736(18)30531-2.
Söderholm, P., Ekvall, T., 2019. Metal markets and recycling policies: impacts and challenges. Miner. Econ. 33, 257–272. https://doi.org/10.1007/s13563-019-00184-5/Published.
Solis, M., Huygens, D., Tonini, D., Astrup, T.F., 2024a. Management of textile waste in Europe: an environmental and a socio-economic assessment of current and future scenarios. Resour. Conserv. Recycl. 207, 107693. https://doi.org/10.1016/j.resconrec.2024.107693.
Solis, M., Tonini, D., Scheutz, C., Napolano, L., Biganzoli, F., Huygens, D., 2024b. Contribution of waste management to a sustainable textile sector. Waste Manag. 189, 389–400. https://doi.org/10.1016/j.wasman.2024.08.037.
Sonnberger, M., Gross, M., 2018. Rebound effects in practice: An invitation to consider rebound from a practice theory perspective. In: Ecological Economics, vol. 154. Elsevier B.V, pp. 14–21. https://doi.org/10.1016/j.ecolecon.2018.07.013.
St. Martin, E., 2024, March. 20. What France's crackdown on Shein and Temu means for global ultra-fast fashion, BBC. https://www.bbc.com/worklife/article/20240320-france-bill-crackdown-ultra-fast-fashion-shein-temu.
Stadler, K., Wood, R., Bulavskaya, T., Södersten, C.-J., Simas, M., Schmidt, S., Usubiaga, A., Acosta-Fernández, J., Kuenen, J., Bruckner, M., Giljum, S., Lutter, S., Merciai, S., Schmidt, J.H., Theurl, M.C., Plutzar, C., Kastner, T., Eisenmenger, N., Erb, K.-H., Tukker, A., 2021. October 21. Exiobase 3. https://zenodo.org/records/5589597.
Stebbins, R., 2001. Exploratory research in the. Sociol. Sci. https://doi.org/10.4135/9781412984249.
Steenmans, K., Lesniewska, F., 2023. Limitations of the circular economy concept in law and policy. Frontiers in Sustainability 4. https://doi.org/10.3389/frsus.2023.1154059.
Suomen Tekstiili & Muoti, 2022. Hiilineutraali tekstiiliala 2035. https://www.stjm.fi/palvelut-ja-tietoa-yrityksille/hiilineutraali-tekstiiliala-2035-sitoumus/.
Sveriges Riksdag, 2023, February 22. Höjd mervärdesskatt på vissa reparationer. https://www.riksdagen.se/sv/dokument-och-lagar/dokument/betankande/hojd-mervardesskatt-pa-vissa-reparationer_ha01sku7/.
Swedberg, R., 2020. Exploratory research. In: Elman, C., Gerring, J., Mahoney, J. (Eds.), The Production of Knowledge: Enhancing Progress in Social Science. Cambridge University Press, pp. 17–41.
Taghipour, A., Akkalatham, W., Eaknarajindawat, N., Stefanakis, A.I., 2022. The impact of government policies and steel recycling companies' performance on sustainable management in a circular economy. Res. Policy 77. https://doi.org/10.1016/j.resourpol.2022.102663.
Tamlander, T., 2024. Consumer Willingness to Pay for Circular Fashion Products: Exploring the Role of Sustainable Attributes and Behavioural Factors.
Tukker, A. (2024). Approaches for assessing socio-economic and environmental impacts of circular economy policies. *In Preparation*.
UNEP. (2024). Global Resources Outlook 2024 - Bend the trend: Pathways to a Liveable Planet as Resource Use Spikes. https://wedocs.unep.org/20.500.11822/44901.

United Nations, 2024. Goal 12: ensure sustainable consumption and production patterns. https://sdgs.un.org/goals/goal12.
Vedung, E., 1998. Policy Instruments: Typologies and Theories.
Wurzel, R.K.W., Zito, A.R., Jordan, A.J., 2013. Environmental governance in Europe: a comparative analysis of new environmental policy instruments. Edward Elgar Publishing Ltd. https://doi.org/10.4337/9781849804721.
Zepa, I., Hoffmann, V.H., 2023. Policy mixes across vertical levels of governance in the EU: the case of the sustainable energy transition in Latvia. Environ. Innov. Soc. Trans. 47. https://doi.org/10.1016/j.eist.2023.100699.
Zink, T., Geyer, R., 2017. Circular economy rebound. J. Ind. Ecol. 21 (3), 593–602. https://doi.org/10.1111/jiec.12545.