

RESEARCH ARTICLE

Future perspectives on the role of extended producer responsibility within a circular economy: A Delphi study using the case of the Netherlands

Kieran Campbell-Johnston¹  | Maurits de Munck² | Walter J. V. Vermeulen¹ | Chris Backes²

¹Copernicus Institute of Sustainable Development, Faculty of Geosciences, Utrecht University, Utrecht, Netherlands

²Utrecht Centre for Water, Oceans and Sustainability Law, Faculty of Law, Economics and Governance, Utrecht University, Utrecht, Netherlands

Correspondence

Kieran Campbell-Johnston, Copernicus Institute of Sustainable Development, Faculty of Geosciences, Utrecht University, Vening Meinesz building, Princetonlaan 8a, 3584 CB Utrecht, Netherlands.
Email: k.a.campbell-johnston@uu.nl

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Abstract

Extended producer responsibility (EPR) is a proposed policy approach to promoting the circular economy (CE) within the European Union. This research used a policy Delphi to explore perspectives on improving EPR policies to further contribute to the CE goals of the Netherlands. Both the potential improvement and critical reflections discussed by CE and EPR experts and practitioners from this study contribute to a more detailed understanding of the future governance of CE practices. We present various activities to improve EPR and insights from Delphi participants that emerged from the study. This paper shows that whilst actors agree, in essence, that there is a need for modifying EPR, what the specific changes to the form are and to whom the new responsibilities apply is contested.

KEYWORDS

circular economy, Delphi study, extended producer responsibility, recycling, The Netherlands

1 | INTRODUCTION

The European Union (EU) has embraced the concept of circular economy (CE) as a vehicle to address various societal challenges, including overconsumption of resources, waste generation and high carbon emissions (European Commission, 2018a, 2020a). Multiple EU member states have initiated CE strategies and are at various levels of engagement (cf. Marino & Pariso, 2020). CE is also a core tenant of the Green New Deal, viewed as the basis for the post-Covid-19 economic recovery of the EU. Strengthening the policy instrument of extended producer responsibility (EPR) is one feature of this strategy (European Commission, 2020b).

EPR is an environmental management strategy that makes producers responsible for organising the take-back, treatment and recycling of their products' waste (Mayers, 2007). Originally conceived as a means to incentivise eco-design and sustainable product

innovation (cf. Lifset & Lindhqvist, 2008; Lindhqvist, 2000), yet, in practice, across EU applications, it primarily focuses on the collection and processing of post-consumer products while claiming to encourage eco-design (Atasu, 2019; Deutz, 2009; European Commission, 2008). EPR is mandatory within the EU for Waste Electrical and Electronic Equipment (WEEE) (2002/96/EC; 2012/19/EU), Batteries (2006/66/EC), End of Life Vehicles (ELV) (2000/53/EC), Packaging (94/62/EC; 2018/852), and more recently for single-use plastic products, for example, food containers (EU2019/904). The Waste Framework Directives (2008/98/EC) and subsequent amendment (2018/851¹) outlined principles on the implementation and minimum requirements for the instrument. Many member states have initiated additional EPR schemes, most commonly for tyres, graphic paper, waste oils, paper and cardboard (Monier et al., 2014).

¹See Article 8a

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Earlier writings on CE have criticised the prioritisation of end-of-life (EOL) solutions within current regulatory frameworks (Gregson et al., 2015) or showed the complexities of governing materials in a circular manner within them (Deutz et al., 2017). However, the implementation of CE practices confronts competing discourses and visions of how CE will look and whether these practices can capture the transformational intentions with which some view CE (cf. Calisto Friant et al., 2020; Geissdoerfer et al., 2017). Moreover, existing research on the connection and contribution of EPR to CE has focused on examining best practices and challenges within existing systems (Campbell-Johnston et al., 2020; Kunz et al., 2018; Richter & Koppejan, 2016), challenges of resource recovery (Deutz et al., 2020), the impact of higher recycling targets and greater source separation of EOL waste streams (Andreasi Bassi et al., 2020; Beccarello & Di Foggia, 2018), issues of waste trade—especially from the Global North to Global South—and reduced consumption (Liu et al., 2018). However, such research has not captured the plurality of perspectives on improving EPR nor sought a common understanding of how it can better contribute to the implementation of CE.

Herein, we examine insights and perspectives on strengthening EPR based on a Delphi study conducted with practitioners in the Netherlands. We focus on the Netherlands because (1) it was an early mover with EPR (see Vermeulen & Weterings, 1997), and thus has a long basis of practical experience to draw from, and (2) it has, since 2016, a CE strategy that explicitly outlines the objective of a 50% reduction in the use of primary raw materials (Ministry of Infrastructure and Water Management & Ministry of Economic Affairs, 2016). A Delphi study draws on expert opinion to derive insights and conclusions (see Section 3). Thus, we developed the following research question: how can EPR be further strengthened or transformed to contribute to the CE goals of the Netherlands? This paper builds on Kunz et al. (2018), further outlining stakeholder perspectives on EPR in the context of CE. It additionally provides a clear set of outputs to practitioners to strengthen EPR.

This paper is structured as follows. First, we review the existing literature on EPR, its issues and its implementation within the EU (Section 2). Next, we outline the methodology (Section 3), followed by the results (Section 4), discussion (Section 5) and conclusion (Section 6).

2 | LITERATURE REVIEW

2.1 | EPR: a brief historical overview

EPR emerged in response to the increasing complexity and volumes of waste, which were overburdening municipalities in the late 1980s (Vermeulen & Weterings, 1997). EPR was originally defined as ‘an environmental protection strategy to reach an environmental objective of a decreased total environmental impact from a product, by making the manufacturer of the product responsible for the entire life-cycle of the product and especially for the take-back, recycling and final disposal of the product’. (Lindhqvist, 2000, p. 2).

Nevertheless, subsequent definitions, whilst paying lip-service to the whole ‘life-cycle’ framing, have, in practice, only focused on the EOL and post-consumer phase of a product’s lifecycle through shifting this responsibility away from municipalities to producers (European Parliament and Council, 2003, 2012). The limited scope of EPR is particularly evident in the EU, where the potential for EPR to enable eco-design is more ‘aspirational than real’ due to a lack of targets and objectives (Deutz, 2009, p. 283). Since its introduction in the 1990s, EPR, as a principle of policy design or policy instrument, has become widespread globally, but in a diverse array of practices (cf. Atasu & Subramanian, 2012; OECD, 2016; Ongondo et al., 2011; Yu et al., 2008).

The implementation of EPR has not been uniform; instead, ‘responsibility’ has manifested in different forms and configurations depending on the contextual and legislative decisions of the implementing country (OECD, 2016). However, as outlined by Lindhqvist (2000), formal² EPR systems can consist of different combinations of the following five elements: (1) liability for the proven environmental damages caused by the product. The extent of which is determined by legislation; (2) economic/financial responsibility for the EOL stage, for example, collection, recycling or final disposal; (3) physical responsibility, producers are involved in the physical management of the products and/or their effects; (4) informative responsibility, which can include requiring producers to supply information on environmental properties and contents for the products they produce; and (5) ownership of the product, which can be retained by the producer.

Whilst producers can fulfil their EOL obligations individually, the OECD (2016) distinguishes four modes through which EPR is generally organised: (1) one single organisation made from a consortium of producers, known as a Producer Responsibility Organisation (PRO) with commercial and/or municipal collection and processing services; (2) multiple PROs with the clearing house and commercial and/or municipal collection and processing services; (3) governance structure for tradable credits system; and (4) government-run EPR system.

Over the last 30 years, EPR policies have been steadily adopted by national governments, with most schemes covering electronics, packaging tyres or batteries (OECD, 2016). The broader definition of EPR, as outlined by the OECD (2016), includes other recycling-related policy instruments: market-based instruments, for example, deposit funds, performance standards, for example, minimum recycled content and information instruments, for example, product labelling.

2.2 | EPR in European policy and law

EPR is a significant component of product and environmental policy that has emerged in the EU over the last 30 years. Other key policies include the Ecodesign Directive 2009/125/EC, Energy Labelling 2017/1369, REACH Directive 1907/2006 and the Waste Shipment

²By formal EPR systems, we refer to policies or laws that specifically adopt the term extended producer responsibility. Informal EPR systems refer to systems which promote greater EOL responsibility for producers, yet are not codified as EPR. For example, voluntary agreements or covenant, see OECD (2016) and Worrell and Reuter (2014).

Regulation 1013/2006. In this context, the scope of EPR has been narrow: combining economic and physical responsibility requirements for producers, namely, for the collection and recycling of waste products (Deutz, 2009). Specific characteristics are consistent across all EU EPR Directives, for example, batteries, ELV, WEEE and packaging. Namely, a broad definition of producers to one that includes importers and distributors, that is, the actor who brings the specific product onto the national market; collection, treatment and reporting targets, for example, from 2015, a reuse and recovery target for ELV was set at 95% by an average weight (Directive 2000/53/EC); and the ability of producers to respond to obligations either individually or collectively.

EPR across the EU is also governed by 'general minimum requirements' as set out in Article 8 and 8a (inserted by Directive 2018/851) of the Waste Framework Directive 2008/98/EC. Member states have flexibility when implementing EPR practices, as long as they conform to the general minimum standards. Core specifications of the minimum standards include the definition of clear roles and responsibilities for relevant actors, from producers, waste operators, local authorities, and reuse organisations where appropriate; a reporting system for products put on the market by producers, which also includes specific collection and recycling targets; and the equal treatment of producers regardless of their size.

In responding to the aforementioned requirements, member states have generally followed two operational frameworks at the national level: a national compliance scheme and/or a clearing house model (Khetriwal et al., 2011; Savage, 2006). A national compliance scheme is one dominant organisation, which takes responsibility for all EOL requirements for producers (see Khetriwal et al., 2011). Conversely, in a clearing house model, producers, or PROs, report the number of products put on the market to a government-managed organisation: the clearing house. The clearing house assigns collection responsibilities based on market share (Khetriwal et al., 2011). The Netherlands complies with EU requirements for EPR, with a national compliance scheme in place for each established product category, such as cars, batteries and WEEE. EPR is also used as an approach to organise EOL tyres (Campbell-Johnston et al., 2020) and is the basis of a sectoral agreement on flat glass (Ministry of Infrastructure and Water Management, 2017). Current discussions focus on extending the approach to new streams, for example, mattresses (Dubois et al., 2016).

Research on EPR has raised various critical issues which are either un-or-under addressed in the current EU policy (cf. Calisto Friant et al., 2021; Kunz et al., 2018). We highlight seven essential issues in the current debate: EPR, eco-design and innovation; cost allocation and incentives; targets and goals; reporting and transparency; treatment choices; and monitoring and enforcement.

One debate has broadly focused on the connection between EPR, eco-design and product innovation. Extant research has suggested that formal eco-design requirements have been more effective in influencing product design than EPR (European Commission, 2014; Gottberg et al., 2006; Kunz et al., 2018), with only some slight evidence of the contrary (Kautto, 2006). The question of design interrelates with

organisational issues of EPR, including *cost allocation and incentives*, mainly connected to the role of fees paid by producers. Research has examined how to set fee structures while accounting for historical and orphaned products³ (Kalimo et al., 2015; Mayers et al., 2013), whether the fees can be linked to long-term design incentives (Besiou & Van Wassenhove, 2016), or whether modulating the fee⁴ system can be more impactful on influencing product design (Hogg et al., 2020; Kalimo et al., 2015; Kunz et al., 2018).

Concerning EPR policy and law, research has illustrated the limits of the current *targets and goals* regime, particularly the collection and processing targets based on mass-balance, for example, kilogrammes collected or processed, and not specific materials, quality of materials or components (Ortego et al., 2018; Parajuly & Wenzel, 2017; Wilts et al., 2011). Alternatively, whether the targets are too stringent and unachievable (Favot, 2014), and whether they should be broadened to allow the inclusion (*actor inclusiveness*) of social economy actors (Bahers & Kim, 2018; Campbell-Johnston et al., 2020). EPR systems require reporting obligations from producers or their representatives, yet harmonising definitions and requirements of the system remain an issue (Kunz et al., 2018). Moreover, the detail and transparency of EPR reporting have received criticism, for example, the tracing of the final destinations of collected EOL products (Campbell-Johnston et al., 2020) (*reporting and transparency*).

A large body of research on EPR has focused on the applications of treatment and recycling technologies (*treatment choices*) and standards (cf. Winternitz et al., 2019; Zhang et al., 2019). Finally, issues of transparency are interconnected with issues of *monitoring and enforcement*, particularly concerning non-compliance and free-riders who do not pay nor fulfil their collective obligations, or legal and illegal waste trading, which can include products under EPR schemes which are then sold second-hand abroad (Clapp, 2001; Dubois et al., 2016; Widmer et al., 2005; Wilson et al., 2011). The most pervasive free-riders appear to be 'large and well-known multi-seller platforms with fulfilment centres in the EU' (Hogg et al., 2020, p. 150). The issues outlined above are not uniform and likely vary in the context, product category and conditions of the specific member state. However, they do provide a point of departure to conceiving critical issues related to EPR.

2.3 | Circular economy and extended producer responsibility

Within the long conceptual history of CE (cf. Blomsma & Brennan, 2017; Calisto Friant et al., 2020; Ghisellini et al., 2016), EPR is argued to be an older iteration of CE-like practices that sought to increase accountability of producers and polluters through greater responsibility and visibility of externalities (Campbell-Johnston et al., 2020; Hickle, 2017; Reike et al., 2018). Existing research has

³Orphaned products are those that have been taken off the market by producers, or when the original producer cannot be identified (Kalimo et al., 2015).

⁴Modulated fees refer to differentiating the fees paid by producers based on criteria. For example, producers in France pay a different contribution for packaging depending on whether the packaging is glued together or can be manually separated (Kunz et al., 2018).

TABLE 1 # expert participants per phase per expert category

Expert category	# participated phase 2	# participated phase 3	# participated phase 4	# participated phase 5
Government	6	6	6	4
Knowledge	9	10	6	4
Producers	5	4	3	1
PRO	6	3	3	3
Processors	4	4	2	1
Total	30	27	20	13

Note: See Supporting Information S1.A for an overview of the experts.

examined the complexities between material and product governance within CE, specifically the regulatory challenges of moving from pollution prevention to material recovery (Deutz et al., 2017). However, despite the growth of articles written on CE (Calisto Friant et al., 2020), comparatively few studies have focused on the interrelation between EPR and CE. Researchers have examined the role of EPR in supporting higher waste collection and processing targets (Beccarello & Di Foggia, 2018; Rubio et al., 2019) and as a way to promote sound waste management, specifically through maximising collection rates and reducing material impurities at the point of disposal (Andreasi Bassi et al., 2020). The emphasis on CE within policy discourses coupled with the existing issues within EPR provides an opportunity to explore potential changes to EPR to support the transition to CE.

3 | MATERIALS AND METHODS

3.1 | Research design

To examine how EPR could better contribute to CE, specifically the CE goals of the Netherlands (50% reduction in primary materials by 2030; Ministry of Infrastructure and Water Management & Ministry of Economic Affairs, 2016), this project conducted a policy Delphi.

The Delphi originated in the 1950s as a method to obtain consensus on a specific topic by a group of 'experts' (Dalkey & Helmer, 1963; Okoli & Pawlowski, 2004). Subsequently, it has been adapted for multiple purposes and contexts, for example, forecasting, idea generation and prioritisation or capturing existing knowledge (cf. Franklin & Hart, 2007; Yousuf, 2007). Whilst numerous variations of the methodology exist (cf. Linstone & Turoff, 2002), at its essence, a Delphi consists of multiple questionnaire or discussion rounds with a select group of anonymised experts, with each round interspersed with controlled feedback (Yousuf, 2007). The role of the researcher(s) is to act as a facilitator by distributing surveys and tabulating responses (Gokhale, 2001).

This research adopted a policy Delphi, henceforth referred to as a Delphi or Delphi study, which is useful for idea generation on a specific topic (Franklin & Hart, 2007), by ensuring that "all possible options have been put on the table for consideration, to estimate impact and consequences of any particular option, and to examine and estimate the acceptability of any particular option" (Turoff, 1997,

p. 87). Reaching consensus on a topic is therefore not the sole aim, but instead deriving thorough information that can be the basis of sound decision-making (Franklin & Hart, 2007). This Delphi was structured in five interrelated phases, following the procedural insights of Franklin and Hart (2007), Gokhale (2001) and Okoli and Pawlowski (2004). These phases consisted of the selection of experts, three survey rounds and a concluding workshop.

3.2 | Research steps and analysis

Phase 1 concerned the nomination, selection and contacting of experts. Delphi studies do not seek generalisable representativeness of the population under study; instead, they involve 'experts' who have a deep and qualified understanding of the issues presented. Determining who is considered an expert is, therefore, a critical requirement for the researcher (Okoli & Pawlowski, 2004).

This study followed the selection procedure of Okoli and Pawlowski (2004). First, identifying the relevant disciplines, organisations and knowledge needs related to the question. Second, assigning specific individuals to each of these disciplines. Third, nominating additional experts and ranking them based on qualifications. Finally, inviting the selected experts to the study. In total, we identified and contacted 50 experts in EPR and/or CE from government, industry and knowledge⁵ connected to the following product categories: electrical and electronic equipment (EEE), flat glass, cars, and floor coverings, for example, carpets. These experts were chosen to provide input using their experience of products with existing EPR schemes (EEE, flat glass and cars) and possible future schemes (floor coverings). The logic being that we could draw from those with longstanding incumbent knowledge and those outside of existing frameworks who could hopefully bring alternative or innovative perspectives. See Table 1 for an overview of the number of experts per phase.

In *Phase 2*, the first questionnaire was distributed, which included 30 statements proposing *how* EPR could be changed to meet the CE goals (see Supporting Information S1.B). These statements were derived from (1) an in-depth literature review of EPR, (2) a public consultation executed by the Dutch government of the new draft decree

⁵In this study, 'knowledge' is defined as individuals employed in either academia, consultancy or think-tank/knowledge institutes; 'Industry' is used to signify individuals employed for either *processing*, i.e. recycling companies, PROs and producers as defined under Directive2012/19/EU.

on EPR, and (3) a science-policy workshop held in January 2020 on EPR (see Supporting Information S1.C for the complete list of articles). The latter two inputs were used to capture more immediate perspectives and not just reiterate issues in the literature, which can be dated (Schmidt et al., 2001). The experts were asked to comment on each statements' clarity and suggest alternative ideas for transforming EPR. This round received responses from 30 experts and over 300 comments.

In *Phase 3*, based on the comments from *Phase 2*, we proposed 25 statements to the experts. These included 20 adapted statements from *Phase 2* and five additional statements posed by the experts (Supporting Information S1.B).⁶ Experts were asked, for each statement: (a) to signify the 'likelihood' of the activities in the statement contributing to the CE goals on a 5-point Likert scale, with '1' representing 'highly unlikely', '3' 'neutral' and '5' 'highly likely'; and (b) whether the activities in the statement were 'desirable' for the sector they work on/in, with '1' representing 'highly undesirable', '3' 'neutral' and '5' 'highly desirable'. *Phase 3* received 27 responses.

In *Phase 4*, the final questionnaire was distributed, which included statements deemed the most important or controversial. The Delphi methodology has multiple approaches for consensus measurement (cf. von der Gracht, 2012). When judging which statements were important or controversial, we followed the same approach as Franklin and Hart (2007). For statements deemed important, we selected seven statements with mean scores above a 'cut-off' of 3.7 for both the 'a' and 'b' questions of phase 3. For those deemed controversial, we examined statements with a mean below 3.7 and compared their standard deviations, again selecting 7 (Franklin & Hart, 2007). Controversial statements were included to elicit further discussion from actors with competing positions. Experts were provided space to reflect and elaborate on the statements. This phase received 20 responses.

Phase 5 was the final phase and included a stakeholder workshop. Owing to the Covid-19 social distancing restrictions at the time of research in force in the Netherlands, a workshop with only 13 experts was organised. The results from the final questionnaire round were presented, which included a qualitative analysis of the textual responses. These were used to illustrate the competing and divergent positions of actors towards statements. The workshop then focused on discussing and reflecting on the results of the study and the challenges it raised.

4 | RESULTS

Transforming EPR to more effectively contribute to CE is not a straightforward task given the multitude of challenges (see Section 2.2). The following section presents a synthesis of the key strategies for improving EPR and the critical issues, discussions and reflections raised during the study. The results include the core

strategies for improving EPR (*Phase 3*) with the perceptions of experts on (a) how likely each strategy would contribute to the CE goals of the Netherlands and (b) how desirable it would be for the sector they work on/in (1–5 Likert scale). The complete statements are provided in Supporting Information S1.B, and shortened versions are numbered and presented below for readability. The perceptions and critical issues raised by the experts in *Phases 4* and *5* are discussed. The results are grouped under the seven critical issues for EPR (see Section 2.2). Specific inputs of the experts are discussed, and quotes are presented with quotation marks and in an *Italic* script. Some quotes have been adjusted for readability purposes. The complete data set is included in Supporting Information S2.

4.1 | EPR, eco-design and innovation

Three measures to further spur eco-design within EPR were discussed (Table 2). As illustrated by the descriptive statistics, experts thought PROs introducing binding agreements would most likely contribute to the CE goals (statement 3), whilst mandatory harmonised LCAs would be least likely to do so (statement 1). Overall, none of the statements were perceived very highly: all statements were considered less than 'relatively likely' to contribute to the CE goals.

The in-practice effectiveness of binding agreements was questioned (statement 3). For instance, one expert pointed out that secondary materials face more product safety legislation and tough(er) competition. This can make secondary materials less suitable and more expensive than virgin materials, which, it was argued, cannot simply be solved by establishing binding agreements. Moreover, experts were concerned that agreements do not provide enough financial incentives for stakeholders to change their behaviour fundamentally: 'without "incentives" (e.g., financial), this will typically remain an individual rather than a collective commitment by producers' (producer, EEE, *Phase 4*).

As seen in Table 2, experts considered differentiated EPR fee systems (statement 2) to be between 'neutral' and 'relatively likely' to contribute to the CE goals and neutrally desirable for the relevant sectors. The introduction of differentiated EPR fees has been suggested in various contexts (cf. European Commission, 2018b; Hogg et al., 2020; OECD, 2016). Nevertheless, how effective they are remain to be proven. Differentiated fees were discussed further during the expert workshop, where it became clear that the experts see them as a valuable and acceptable measure.

Considering the various clusters of experts (see Supporting Information S2.C), it is noteworthy that experts representing PROs and knowledge institutes were least positive about these three measures (average means: 2.65 and 2.97), while producers were most positive towards them (average mean: 4.06). In particular, producers were most favourable towards differentiated EPR fee systems (statement 2) and, along with processors, towards binding agreements to work towards more circular products (statement 3). Regardless, individual producers pointed out the significance of costs and financial incentives in establishing agreements beyond

⁶Nine of the original 30 statements we dropped or combined with other statements based on comments from the experts.

current targets. One producer stated, ‘establishing agreements beyond current targets normally means additional costs, which is difficult to turn into short-term competitive advantages’ (producer, EEE, phase 4).

4.2 | Cost allocation and incentives

The statements in Table 3 address issues of costs and incentives for the existing EPR actors. The experts were more receptive to using the EPR fees for consumer campaigns (statement 4) and R&D (statement 5) than allowing PROs to manage these funds independently (statement 6). Interestingly, experts representing the government were very positive towards consumer campaigns (statement 4, means Qa and Qb: 5.0 and 5.0), while PROs were opposed (means: Qa and Qb: 2.38 and 2.83). However, PROs were happy to spend a percentage of the fees on R&D (statement 5, means Qa and Qb: 4.47 and 4.47), along with processors (means Qa and Qb: 4.73 and 4.73). This discussion raised further questions on designating EPR fees to R&D. For instance, one expert asked: ‘Who is entitled to decide? What is the goal or aim? What to do with the outcome? Who is responsible and who is accountable?’ (EEE, producer, Phase 4).

Independent management by EPR fees for R&D by PROs (statement 6) was not considered desirable by experts. During the discussions, some mentioned the advantages of putting an independent organisation in charge of such funds, for example, increasing transparency and reducing conflicts of interest. Yet, a majority of the experts pointed to the disadvantages: ‘The money is paid by the producers, so they should decide how the funds are spent’ (producer, flat glass, phase 4) and ‘there is no independent organisation which has the (practical) know-how’ (PRO, EEE, Phase 4). It is noteworthy that producers were most positive towards independent management by PROs (means Qa and Qb: 3.91 and 2.69), while PROs themselves are opposed to such new responsibilities (means Qa and Qb: 2.21 and 1.41).

4.3 | Targets and goals

Table 4 outlines statements addressing EPR targets and goals. On average, producers, processors, government and knowledge experts were positive about these five statements, with average means between 3.55 and 3.96 (see Supporting Information S2.C). PROs were the least positive (average mean: 2.98). Two statements were perceived most favourably to contribute to CE and the sectors of the participants: PROs should establish binding agreements that go

TABLE 2 Statements and results phase 3 concerning EPR, eco-design and innovation

Statement and #	Likelihood of contribution to CE (1–5 scale): Mean and stand. dev.	Desirable in my sector (1–5 scale): Mean and stand. dev.	Source
1. <i>All producers conduct mandatory harmonised Life Cycle Assessments (LCAs) of products</i>	3.0; 1.2	2.9; 1.4	(Valente et al., 2019)
2. Government introduces differentiated EPR fee systems based on sustainability criteria	3.3; 1.2	3.0; 1.3	(Dubois et al., 2016; OECD, 2016)
3. PROs should introduce binding agreements on percentage of recycled content in new products	3.7; 1.2	3.7; 1.2	(Esenduran et al., 2019; Sugeta & Shinkuma, 2014)

Note: N = 27; statements in **bold** are those deemed most important; statements in *italics* are those deemed most controversial.

TABLE 3 Statements and results phase 3 concerning cost allocation and incentives

Statement and #	Likelihood of contribution to CE (1–5 scale): Mean and stand. dev.	Desirable in my sector (1–5 scale): Mean and stand. dev.	Source
4. PROs use fees for consumer campaigns	3.6; 1.4	3.6; 1.2	Based on workshop, consultation and (European Commission, 2014)
5. Percentage of fees to PRO to be spent on R&D	3.8; 1.2	4.0; 0.9	(European Commission, 2014; OECD, 2016), and consultation
6. <i>R&D funds of PROs to be managed independently</i>	3.0; 1.1	2.6; 1.5	Based on workshop
7. Government introduces VAT reduction or exemption for repair and recycling	3.6; 1.2	3.8; 1.1	(Taranic et al., 2016)

Note: N = 27; statements in **bold** are those deemed most important; statements in *italics* are those deemed most controversial.

TABLE 4 Statements and results phase 3 concerning targets and goals

Statement and #	Likelihood of contribution to CE (1–5 scale): Mean and stand. dev.	Desirable in my sector (1–5 scale): Mean and stand. dev.	Source
8. PROs establish binding agreements beyond current targets	4.1; 0.9	4.3; 0.9	(European Commission, 2015)
9. Government makes collection and recovery targets more specific and measurable	3.8; 1.1	3.9; 0.9	(Watkins et al., 2017)
10. EPR targets to be updated every 5–7 years by the government	3.4; 1.1	3.4; 1.2	(Coopman, 2014)
11. Government introduces and updates product reuse targets for PROs	3.3; 1.2	3.0; 1.2	(European Commission, 2015)
12. Government introduces mandatory EPR schemes for more waste streams	3.7; 1.2	3.4; 1.1	(Ministry of Infrastructure and Water Management, 2017; Ministry of Infrastructure and Water Management, 2020) and based on workshop

Note: $N = 27$; statements in **bold** are those deemed most important.

beyond current targets (statement 8), and the government should make the collection and recovery targets more specific and measurable (statement 9).

Both the government and PROs were positive about the desirability of the proposal in statement 8 for their sectors. While the government was furthermore convinced about its contribution to CE (mean: 4.78), PROs did not agree that such agreements would contribute to realising CE (mean: 2.99) (see Supporting Information S2.C). Additionally, experts again emphasised that there must be a (financial) trigger to engage in such agreements. As stated by one expert: ‘Without a commercial interest, no company will go beyond targets’ (EEE, processor, *Phase 4*). Experts warned that producers might be unwilling to participate due to the associated extra costs: ‘Not a lot of willingness from participants to do more due to costs and organisational time consumption involved’ (EEE, PRO, *Phase 4*).

Experts from the government were most positive towards statement 9 that addressed the specificity of targets (see Supporting Information S2.C). Experts engaged in a discussion about the organisation of more detailed targets, moving instead to targets based on quality, components or specific materials. On the one hand, experts stated that the government should set and enforce such targets, following by industry implementation. On the other, some experts emphasised cooperation with other stakeholders in target setting: ‘Differentiation of targets to product groups might be interesting, but not to be set (solely) by the government ... it's also up to the EPR organisation and its stakeholders’ (Floor coverings, knowledge, *Phase 4*). Experts also pointed out during the workshop that the government should connect with and involve various stakeholders from relevant supply chains. While government officials were specifically in favour of such targets, they also raised doubts about the implementation: ‘Such targets are desirable, but difficult to implement, measure and enforce’ (Government, *Phase 4*).

Statements 10 and 11 were also received relatively positively by the experts. Interestingly, the introduction of product reuse targets for PROs by the government was heavily opposed by both PROs (means Qa and Qb: 2.21 and 2.45) and the government (means Qa and Qb: 2.77 and 2.77). Statement 12 relates to introducing mandatory EPR schemes for more waste streams, a proposal currently being developed at the EU level concerning single-use plastics and in the Netherlands for mattresses. This statement was received well by producers (means Qa and Qb: 4.42 and 4.22), but received substantial opposition by PROs (means Qa and Qb: 2.78 and 2.34) (see Supporting Information S2.C).

4.4 | Actor inclusiveness

These statements focused on the inclusiveness of relevant actors and their roles and responsibilities (Table 5). Of the proposed statements, experts suggested that clarification of specific roles and responsibilities of value chain actors by the government would be most likely to contribute to the realisation of the CE goals and would also be most desirable for the sectors they work on or in (statement 13). Nevertheless, none of these statements were brought forward in *Phases 4* or *5*.

Experts were neutral about social economy actors having a formal role in PROs (statement 14). In their inputs, experts were mainly divided on such a role. On the one hand, ‘A “formal” position is not required, involvement is’ (EEE, PRO, *phase 4*). On the other hand, ‘they should have their own defined responsibilities and targets to be set by government so that they are really judged on their claimed apparent positive contribution in the field of EPR’ (EEE, PRO, *Phase 4*). This division also became apparent within the specific groups of experts. While experts representing the government, knowledge

TABLE 5 Statements and results phase 3 concerning actor inclusiveness

Statement and #	Likelihood of contribution to CE (1–5 scale): Mean and stand. dev.	Desirable in my sector (1–5 scale): Mean and stand. dev.	Source
13. Government clarifies specific roles/responsibilities of value chain actors	3.6;1.1	3.7; 1.2	(European Commission, 2014)
14. <i>Social economy actors should have formal role in PROs</i>	3.0; 1.2	3.0;1.2	Based on workshop and consultation
15. <i>Government reduces administrative requirements of EPR schemes for SMEs</i>	2.8;1.1	2.7;1.1	(OECD, 2019)

Note: $N = 27$; statements in *italics* are those deemed most controversial.

TABLE 6 Statements and results phase 3 concerning reporting and transparency

Statement and #	Likelihood of contribution to CE (1–5 scale): Mean and stand. dev.	Desirable in my sector (1–5 scale): Mean and stand. dev.	Source
16. Producers adopt standardized labelling of products	3.5; 0.9	3.5; 1.0	Based on workshop
17. All EPR schemes and participants use common definitions and standards	4.1;1.0	4.5; 0.7	(Kunz et al., 2018; Pouikli, 2020)
18. PROs provide info on collection rate, types of recycling and final destinations	4.2;1.0	4.4;0.9	(Pouikli, 2020; Watkins et al., 2017)

Note: $N = 27$; statements in **bold** are those deemed most important.

institutes and processors were relatively positive towards a formal role, neither PROs (means Qa and Qb: 2.63 and 2.63) nor producers (means Qa and Qb: 2.49 and 2.99) thought that a formal role for social economy actors would contribute to CE or would be desirable for their sectors. One producer argued: ‘producers are responsible and should therefore be able to decide whether in their specific case social economy actors should have a formal role’ (EEE, producer, *Phase 4*).

Finally, experts were least positive on the statement that suggested that the government should reduce administrative requirements related to EPR for small and medium-sized enterprises (SMEs) (statement 15). Several arguments were brought forward to retain the current administrative requirements: ‘Administrative requirements relating to EPR are currently not high ... even for SME’ (EEE, processor, *Phase 4*) and ‘all companies have an equally balanced responsibility for products brought on the market. Why should larger companies pay for the smaller ones?’ (EEE, PRO, *Phase 4*).

4.5 | Reporting and transparency

All statements in Table 6 concern reporting and transparency were received positively. In particular, experts believed that two statements would be more than ‘relatively likely’ to contribute to the realisation of the CE goals: using common definitions and standards within EPR (statement 17) and PROs providing information on the collection rate, types of recycling and final destinations of products (statement 18).

While there was agreement that common definitions and standards should be used within EPR, doubts were expressed about their in-practice effectiveness. After all, establishing common definitions and standards does not necessarily mean that they will be used (effectively) in practice. Processors were most positive about common definitions and standards (means Qa and Qb: 5.0 and 5.0). PROs were more sceptical about their effectiveness (means Qa and Qb: 3.31 and 4.16). For instance, one PRO expert indicated that ‘not all schemes and products are easy to compare’ (Cars, PRO, *Phase 4*), so it would be difficult to establish and enforce such definitions and standards. Several experts suggested various institutions to coordinate the common definitions and standards: the EU, the OECD, or a task force designated to this task.

Providing more information on recycling activities increases transparency towards stakeholders (statement 18). This is even more crucial because globalisation and interests have led to rising imports and exports of products and waste. At the same time, experts identified the current waste trading practices as the primary obstruction for providing more information. As stated by one expert, ‘recycling data are (more or less) available, (reliable) export data not’ (EEE, producer, *phase 4*). Some experts stated that such information is available but unreliable, particularly when it concerns products exported outside the EU: ‘the problem is not the availability of this information, but its reliability. Many companies in emerging markets ... will promise anything if it is needed to protect their production’ (EEE, processor, *Phase 4*). Government officials favoured the reporting of additional information (means Qa and Qb: 4.78 and 5.0), while PROs themselves

TABLE 7 Statements and results phase 3 concerning treatment choices

Statement and #	Likelihood of contribution to CE (1–5 scale): Mean and stand. dev.	Desirable in my sector (1–5 scale): Mean and stand. dev.	Source
19. <i>Determine preferable treatment options based on independent LCAs paid by PROs</i>	3.0; 1.0	3.1; 1.2	(Campbell-Johnston et al., 2020)
20. <i>Government updates EPR treatment requirements every 2–4 years</i>	3.1; 1.2	3.2; 1.2	(European Commission, 2015; OECD, 2016)
21. Government incentivises source separation of waste streams by last users (e.g. deposit scheme)	3.2; 1.3	3.0; 1.3	(European Commission, 2015)

Note: $N = 27$; statements in *italics* are those deemed most controversial.

TABLE 8 Statements and results phase 3 concerning monitoring and enforcement

Statement and #	Likelihood of contribution to CE (1–5 scale): Mean and stand. dev.	Desirable in my sector (1–5 scale): Mean and stand. dev.	Source
22. Government forces free-riders (like internet sellers) to join EPR schemes	4.0; 1.1	3.7; 1.1	(OECD, 2019; Wilson et al., 2011)
23. Government intensifies enforcement of waste shipment to countries not meeting EU standards	3.5; 1.2	3.8; 1.1	(EUROSAI, 2013)
24. <i>Government fines PROs for the percentage of products they failed to collect/process</i>	2.9; 1.4	2.8; 1.3	(Leclerc & Badami, 2020)
25. Government extends EPR to recycling and circular treatment of second-hand goods, inside and outside EU	3.3; 1.3	2.7; 1.5	(Kunz et al., 2018)

Note: $N = 27$; statements in **bold** are those deemed most important; statements in *italics* are those deemed most controversial.

expressed their concerns about such measures (means Q_a and Q_b : 3.13 and 2.63). As stated by a PRO expert: ‘PROs can provide information about collection rates and recycling, but not on final destinations of exported products. As long as a product is a product, a PRO has no competence to regulate anything; the owner/trader is in charge’ (Cars, PRO, Phase 4).

4.6 | Treatment choices

Statements in Table 7 concern treatment choices and recycling practices. Experts were neutral about the contribution of these statements to the realisation of the CE goals and their desirability for the relevant sectors. Some differences can be observed between the specific groups of experts.

Several doubts were raised about LCAs being conducted periodically by an independent organisation (statement 19), which is paid by the PROs. Amongst others, experts argued that conducting LCAs for products with a long lifetime can be challenging; conducting periodical LCAs could become quite costly, and it is uncertain whether more assessments and research would enhance circular activities.

Moreover, experts from PROs and producers stated that this ‘should be regulated in EU legislation’ (Cars, PRO, Phase 4) and that ‘an EU tool with this methodology should become available, and the outcomes should be kept in an (open access) database’ (EEE, processor, Phase 4). Current policy developments in this area include standardised product category rules. Furthermore, the majority of experts agree that the government should incentivise greater source separation (statement 21).

4.7 | Monitoring and enforcement

Statements in Table 8 concern monitoring and enforcement. In general, all groups of experts were neutral to positive about greater enforcement (average means between 3.01 and 3.69). More specifically, experts believed that it would benefit the CE goals and their sectors if the government were to force free-riders to join EPR schemes (statement 22). However, doubts were expressed about the government’s capabilities to address this issue. For instance, ‘government lacks market knowledge’ (EEE, PRO, Phase 4). Therefore, a few experts recommended that authorities should have more

competencies and market knowledge. Other measures to tackle free-riders were proposed, such as naming and shaming and highlighting successful EPR practices and examples (OECD, 2019).

Experts were unfavourable to the introduction of fines for the percentage of uncollected products by PROs (statement 24). Unsurprisingly, PROs were least positive about this measure (means on Qa and Qb: 1.68 and 2.45). It was pointed out that PROs have limited influence over producers and other stakeholders: 'it's not that the PRO's do not try to meet targets, it is that many other actors intervene' (EEE, PRO, Phase 4) and 'there are too many factors out of direct control of an EPR organisation' (Floor coverings, PRO, Phase 4). Furthermore, processors also expressed their discontent about this measure (means on Qa and Qb: 2.38 and 1.86). As stated by one processor: 'The statement is too black and white. In some cases, targets cannot be met as they are not realistic or for other reasons. Targets and achievement should be monitored and actions to improve should be decided upon' (EEE, PRO, Phase 4). Experts also offered alternatives to this measure, such as providing positive collection and processing incentives and establishing closer cooperation and structural dialogues between involved stakeholders.

5 | DISCUSSION

This research used a Delphi study to examine how to transform EPR to contribute to the CE goals of the Netherlands. It builds on the work of Kunz et al. (2018), exploring perspectives and ways forward for EPR but connecting it explicitly to the development of CE. Seven of twenty-five potential activities proposed in this study were delineated as having a greater agreement regarding their propensity to contribute to the CE goals (see Table 9). These proposals provide direction for greater economic responsibility, e.g. R&D research; informative responsibility, e.g. transparency and specify of reporting; and physical responsibility, e.g. more specific goals.

Nevertheless, the transition to CE will require a profound change in the behaviour of EPR stakeholders via the assignment of new responsibilities. The majority of the activities above concern changes and modifications to the existing EPR system, except the statement to create agreements for more circular products. Yet, as indicated in the results, actors brought a wide variety of (competing and divergent) perspectives, interests and agendas to the study. Whilst experts agreed on the necessity of transitioning to CE, tensions emerged over what these responsibilities should be and to whom they should apply. Namely, who is and should be responsible for what? In the original conceptualisation of EPR, Lindhqvist (2000) proposed five means through which 'responsibility' could be extended to producers. The EU formalised two of these: economic and physical responsibility. The results from the Delphi indicate that new responsibilities for changing EPR to support CE are contested, often when this involves incumbent actors accepting new responsibilities. For instance, experts representing the PROs were less favourable towards consumer campaigns (statement 4), providing additional data on recycling destinations (statement 18) and including new actors (statements 13–15).

TABLE 9 EPR activities regarded as contributing to CE

Statement and #	Likelihood of contribution to CE (1–5 scale): Mean and stand. dev.	Desirable in my sector (1–5 scale): Mean and stand. dev.
3. PROs should introduce binding agreements on percentage of recycled content in new products	3.7; 1.2	3.7; 1.2
5. Percentage of fees to PRO to be spent on R&D	3.8; 1.2	4.0; 0.9
8. PROs establish binding agreements beyond current targets	4.1; 0.9	4.3; 0.9
9. Government makes collection and recovery targets more specific and measurable	3.8; 1.1	3.9; 0.9
17. All EPR schemes and participants use common definitions and standards	4.1; 1.0	4.5; 0.7
18. PROs provide info on collection rate, types of recycling and final destinations	4.2; 1.0	4.4; 0.9
22. Government forces free-riders (like internet sellers) to join EPR schemes	4.0; 1.1	3.7; 1.1

Whilst some actors were favourable towards measures that would not affect their own practices. For example, experts representing the producers were generally favourable to statements concerning eco-design and product innovation (Table 2). Yet, none of these specified new responsibilities for producers themselves. These results connect to previous writings on the complexities of dividing responsibilities within EPR systems and the necessity of a clear regulatory framework (Kalimo et al., 2015; Kunz et al., 2018).

These results echo earlier claims on how to improve EPR. For example, previous research has stressed the need for greater enforcement to prevent free-riders, harmonising legislation and responsibilities between member states and greater transparency of waste data (Kalimo et al., 2015; Kunz et al., 2018). These points were evident from the Delphi outcomes (see Table 9). Moreover, statement

9 related to moving beyond EPR recycling targets based on mass to more dynamic ones. The proposal to adapt EPR targets in this manner similarly reiterates previous research and proposals (cf. Ortego et al., 2018; Parajuly & Wenzel, 2017; Wilts et al., 2011). However, the results from the Delphi did not support proposals for common treatment standards for collected products (Kunz et al., 2018). Yet, the results did provide new insights not generally discussed in the literature. For example, the need for financing preferable EOL activities through the mechanism of EPR, the perspectives of some participants who pushed for balanced responsibility between all actors, including SMEs (see section 4.5), and the need for greater transparency in the reporting requirements of ERP systems, e.g. final destinations of collected products.

Whilst the seven activities above likely represent a starting point from which to develop EPR to further contribute to CE, they must be put into perspective. Collectively, they represent a point of agreement and negotiation between divergent groups. Consequently, they are unlikely to represent a radical point of departure for transforming EPR, given the strong evidence of interest-related positions that emerged. While actors agreed in essence on change and new responsibilities, negotiating these was different, with 'agreement' falling within areas within current policy discussions, e.g. common definitions fall within Directive 2018/851. This finding complements earlier research on material governance within CE, showing how the intention and motivation for circularity are interpreted by various actors and consequently contested based on self-interests (Deutz et al., 2017).

The necessity of pursuing CE practices is, ultimately, the reduction of material inputs (Ghisellini et al., 2016). EPR was originally conceived as a means of increasing sustainability through the entire product lifecycle (Lindhqvist, 2000), yet, regulatory approaches prioritised EOL aspects without making the connection to eco-design concrete (Deutz, 2009; Kunz et al., 2018). One measure to connect EPR more explicitly with eco-design is through fee modulation (cf. Hogg et al., 2020; OECD, 2016), with France a leading country in this area. During the workshop, eco-design and modulation of EPR fees were suggested to provide financial triggers for participants, with experts discussing how eco-modulation of EPR fees had furthered the circularity of packaging materials. This insight was surprising given the group's neutrality towards eco-modulation (see statement 2 and Supporting Information S2.C). This evidenced a disconnect between the experts and current policy developments. However, it can further point to a tension between visions of EPR, either as purely an EOL policy tool or one to stimulate product innovation. For example, the reluctance of the PROs to expand the scope of EPR to include additional actors (statements 13–15) could be attributed to this. This tension on the scope of EPR is still debated intensively within academic research (see Atasu, 2019).

As this study illustrates, much of the discussion on EPR is still framed within the EOL arena, reflecting earlier criticisms of CE (Gregson et al., 2015). We suggest that the limited attention to strengthening the connection between EPR and product design and materials inputs needs to be overcome for EPR to contribute to a

more transformational CE vision. This statement reflects earlier scientific critiques of the limitations of EPR (Deutz, 2009), with more recent research outlining more concrete pathways for how EPR can contribute to CE, including through fee modulation and interconnection with EPR and other policy approaches (see Vermeulen et al., 2021).

This study has several limitations. First, the panel selection, which is vital to the success and outcome of any Delphi (Okoli & Pawlowski, 2004). Despite following a clear typology and selection procedure for experts, the loss of participants in each phase diminished the richness of the data. As the intention of a policy Delphi is to facilitate a discussion process, any loss of a participant reduces this debate. However, as *Phases 4* and *5* contained representation from all groups, we are confident in the variety of perspectives (Table 1). Second, a Delphi study is, by nature, an expert study, meaning it does not seek population representativeness. Whilst such a typology of actors was necessary from a knowledge perspective, it did not mean that said actors would approach the questions from a neutral perspective, i.e. thinking beyond the interests of their organisation or sector. Consequently, whilst this study intended to explore ways of 'transforming' EPR to meet the CE goals, statements that were signified collectively as important (*Phase 3*) were those less likely to be controversial from any of the actors, e.g. industry or government (see additional analysis of *Phase 3* Supporting Information S2.B). This implies that many of the discussed outcomes were not as radical as the intention of the study assumed. Whilst the typology of experts impacted the types of results presented, we contend that the inclusion of more 'controversial' statements in the latter phases provided a means of eliciting a more varied discussion in *Phases 4* and *5*. Finally, a critical limitation in the design of this study concerns the formulation of the statements themselves. Namely, each statement specified both an activity and a responsible actor. Despite these statements being based on the literature and reviewed during the Delphi, an underlying question relates to whether more sceptical reactions pertained to the proposed activity or the actor. Future research on CE and EPR should provide more research and support into the seven statements. For instance, how to explicitly specify EPR targets.

6 | CONCLUSION

This study conducted a policy Delphi to explore stakeholder perceptions of transforming EPR to contribute to CE goals of the Netherlands. Through four phases, experts reflected on improving EPR to support the development of the CE further. Seven potential areas for future improvement of EPR were outlined, which would bring existing EPR schemes above and beyond the current minimum requirements that apply to such schemes.

The transition to a CE requires a substantial change in the roles and behaviours of actors within the value chains of products. Moreover, the legal and economic frameworks surrounding the value chains ought to be reorganised as well. This research points specifically to transformational changes within EPR policies concerning targets,

goals, incentives, transparency and reporting. By implementing such changes, EPR schemes would potentially incentivise the use of more eco-design principles in products at the beginning of the value chain and lead to a higher quantity and quality of recycling at the end of the chain. At the same time, however, the perceptions of experts in the policy Delphi indicate that agreement on the assignment of new responsibilities is contested. Furthermore, the experts point to various issues that may hamper such transformation of EPR schemes.

EPR has been implemented in a wide variety of context and configurations over the past 30 years. This study focused on a more narrow understanding of EPR, which is explicitly connected to responsibility (economic and physical) for the post-user phase of a product's lifecycle. The practice in the Netherlands is based on this more narrow approach to EPR, where market actors have a limited set of responsibilities. Since its inception, EPR has faced continuous criticism for failing to deliver product eco-design changes and allocating insufficient individual responsibility to producers. This study echoes those critiques, as the discussions between experts overtly focused on the EOL aspects of EPR. Given this, future research should investigate how waste practices, such as EPR, and product design requirements, such as eco-design, can be further integrated and connected. This has implications for the development of EPR within CE. Namely, the need for cross-boundary and transnational cooperation to strengthen these links.

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ORCID

Kieran Campbell-Johnston  <https://orcid.org/0000-0001-8098-6778>

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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