



## LIFE4EPR

Towards harmonized Extended Producer Responsibility schemes across the EU

### D2.4 – Report on Benchmarking Methodology

WP2 – EPR Schemes EU State of Play

T2.2 – Developing a Benchmarking Methodology

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## Table of contents

1	Document Attributes .....	5
1.1	Document Overview .....	6
1.2	Table of Acronyms .....	7
1.3	LIFE4EPR Project Summary .....	8
1.4	Task 2.2 of LIFE4EPR Project.....	8
2	Introduction.....	9
2.1	Context and background .....	9
2.1.1	Benchmarking EPR systems .....	9
2.1.2	Benchmarking in diverse contexts.....	10
2.1.3	Existing knowledge on benchmarking EPR systems .....	11
2.1.4	Objectives and rationale of benchmarking development .....	11
2.1.5	Overview of the process .....	12
3	Detailed description of the methodology.....	14
3.1	Selection of benchmarks for analysis.....	14
3.1.1	Developing the initial, long list of candidate benchmarks.....	14
3.1.2	Selecting the shortlist of benchmarks for in-depth analysis: Benchmark Selection Tool.....	15
3.2	Developing the benchmarking tool for selected benchmarks .....	26
3.2.1	Defining the benchmarks to be analysed (1).....	26
3.2.2	Selection of product groups and countries (2) .....	27
3.2.3	Unifying factors (3) .....	27
3.2.4	Confounding factors (context sensitivity) (4).....	28
3.2.5	Data sources (5) .....	28
3.2.6	Occurrence of the benchmark (6).....	29
3.2.7	From occurrence to results: the objectives and their achievement (7) .....	30
3.2.8	Integrating side effects and system interactions (8) .....	30
3.3	Challenges and limitations .....	32
4	Summary and next steps .....	33
5	Annexes .....	35
5.1	The benchmark selection tool.....	35
5.2	Short description of candidate benchmarks .....	39
5.3	Methodological details on the sensitivity analyses conducted.....	40
6	Bibliography.....	43

## List of tables

Table 1 The long list of candidate benchmarks .....	14
Table 2 Attributes against which each candidate benchmark was assessed, and their brief description .....	18
Table 3 Different scenarios used to weigh the scores.....	20
Table 4: Short-listed benchmarks, the results of combined overall ranking.....	21
Table 5: Categorisation of short-listed benchmarks in accordance with the qualitative groupings..	24
Table 6: Benchmarks selected for further analysis and those excluded but are ranked high quantitatively, and their categorisation in accordance with the qualitative groupings .....	25
Table 7 Simplified representation of the benchmark selection tool.....	35
Table 8 Short description of candidate benchmarks.....	39

## List of figures

Figure 1 Visual representation of the methodology development process .....	13
Figure 2 Benchmarks which were ranked highest in different scorings.....	41
Figure 3 Overview of rankings based on robustness checks/different calculations. ....	42

# 1 Document Attributes

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1. Document Management Control Sheet

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2. Document Revision History

### 1.1 Document Overview

This document is one of the deliverables of LIFE4EPR project, stemming from the WP2. It details the process and rationale of development of the benchmarking methodology.

## 1.2 Table of Acronyms

Acronym	Full name
<b>DRS</b>	Deposit return system/scheme
<b>ECA</b>	European Court of Auditors
<b>ELVs</b>	End-of-life vehicles
<b>EOL</b>	End of life
<b>EPR</b>	Extended Producer Responsibility
<b>EU</b>	European Union
<b>MS</b>	Member States
<b>PPWD</b>	Packaging and Packaging Waste Directive
<b>PPWR</b>	Packaging and Packaging Waste Regulation
<b>PROs</b>	Producer Responsibility Organisations
<b>SUPs</b>	Single-use plastics
<b>VUB</b>	Vrije Universiteit Brussel
<b>WEEE</b>	Waste electrical & electronic equipment
<b>WFD</b>	Waste Framework Directive

## 1.3 LIFE4EPR Project Summary

Extended Producer Responsibility (EPR) builds on the ‘polluter pays’ principle, holding producers accountable for the entire lifecycle of their products. While EPR is mandated in EU laws including the Waste Framework Directive (Article 8a), its implementation varies across the Member States (MS). Currently, a comprehensive overview of EPR schemes at the national level is lacking, creating a gap for policymakers as well as EPR stakeholders from producers and recyclers to consumers.

The project LIFE4EPR – towards harmonized Extended Producer Responsibility schemes across the EU – is designed in response to three main knowledge gaps regarding EPR schemes in the EU: the absence of (a) an EU-wide overview of EPR schemes at MS level, (b) knowledge on the level and forms of harmonization among existing producers/products’ registers, and (c) the knowledge on the environmental effectiveness of EPR systems. In view of this, the project aims to create knowledge so as to enhance the effectiveness, governance, and cost efficiency of EPR schemes. The project will study current practices, develop a technical tool, and deliver policy recommendations for EPR systems in the EU. The methods deployed in LIFE4EPR include stakeholder engagement, a mapping of EPR schemes, a benchmarking of selected EPR systems, and the development and testing of a harmonized EU-wide EPR register. Findings will inform policymaking for national EPR schemes. A lasting impact will be ensured by creating a knowledge-sharing community consisting of academia, practitioners, and stakeholders focused on EPR. The LIFE4EPR consortium includes ENT, as project coordinator, along with ACR+, WEEE Forum, Zero Waste Europe, ECO, SOTELO, and VUB. Together, they bring a rich mix of not-for-profit organisations, practitioners, Producer Responsibility Organisations, and academic expertise in EPR systems, circular economy, and digital solutions. Their collaborative efforts will map existing schemes, test an EU-wide register, and engage stakeholders to ensure policy improvements and long-term knowledge sharing.

## 1.4 Task 2.2 of LIFE4EPR Project

This document is a report on Task 2.2 of the LIFE4EPR Project. Work Package 2 (WP2) of LIFE4EPR project concerns the ‘state of play’ of the EPR systems in the EU. One objective of WP2 is to identify, analyse and provide guidance on how to further develop EPR schemes on the basis of benchmarking. Task 2.2 of WP2, constitutes the first part of fulfilling this objective – developing a methodology for benchmarking EPR systems in the EU.

## 2 Introduction

### 2.1 Context and background

Extended Producer Responsibility (EPR) has become a widely used environmental policy tool in many parts of the world, with Europe taking the lead in its early development and roll-out. Early EPR policies emerged in response to the large quantities of packaging waste in municipal streams. Germany was the first country to legislate on EPR, introducing household packaging EPR in its 1991 Packaging Ordinance, followed by France in 1992. Further national schemes that incorporated the concept of EPR appeared after the first EU level law for specific waste streams came into force in 1994: the Packaging and Packaging Waste Directive (94/62/EC (PPWD)). Since then, mandatory EPR systems have been introduced in the EU through various pieces of EPR legislation, including the End-of-Life Vehicles (ELV Directive 2000/53/EC), Waste Electrical and Electronic Equipment Directive (2002/96/EC) (WEEE) and the Batteries Directive (2006/66/EC). The sectoral EPR laws have been followed by an overarching law on EPR, the 2008 Waste Framework Directive (WFD) that replaced the original 1975 WFD. The revised WFD put forward the EPR as a cross-cutting policy instrument that the EU MS could apply to any other product that requires end of life management. In its 2018 revision, it also defined the general principles and minimum requirements that MS should follow when establishing EPR systems. The past decade has seen a further expansion of EPR to other waste streams, most recently to textiles and urban wastewater, while the above-mentioned, first EPR systems have been revisited regularly to accommodate changes in waste management technologies and environmental challenges. A key impetus for the developments is that a circular economy is increasingly seen by the EU as essential for achieving the double objective of sustainability and competitiveness. EPR is considered an important lever for circularity, so it needs to be fully exploited.

#### 2.1.1 Benchmarking EPR systems

In the context of the benchmarking exercise that we seek to conduct in this project, EPR systems are understood as a system based on EPR legislation within a Member State (e.g., Ireland) for a specific product group (e.g., household packaging). EPR systems usually require the existence of a Producer Responsibility Organisation (PRO) which functions as a compliance system. An EPR system can be implemented by a single PRO, or multiple PROs. The first part of WP2 (Task 2.1– mapping of EPR schemes and Producer Responsibility Organisations (PROs)) identified 159 regulatory frameworks for a waste stream in an EU Member State, as well as 429 PROs operating an EPR system in the EU (as of October 2025). This multiplicity leads to considerable experience with different types of EPR systems, both in terms of design and implementation.

A method to explore and take advantage of this wealth of knowledge is benchmarking. The European Court of Auditors defines benchmarking as '*a process for comparing an organisation's (programme's) methods, processes, procedures, products and services against those of organisations (programmes) that consistently distinguish themselves in the same categories*' ([ECA, 2021](#)). Although benchmarking came to be within the business world, today it is considered a useful tool to compare public policies, assuming that it is adapted to the specificities of policy assessments.

When applied correctly and rigorously, benchmarking of public policies can provide insights on their performance.

The comparison of the design, implementation and/or results of EPR systems through benchmarking can help policy makers identify differences in performance; and reveal the features or qualities that account for these outcomes. Such comparison can also support the identification of an aspirational benchmark, i.e. the best performer in theoretical or practical terms, and the features and qualities leading to such best performance. Benchmarking thus enables a more focused assessment and development of EPR systems.

### 2.1.2 Benchmarking in diverse contexts

Although benchmarking is potentially useful for EPR systems, there exist multiple factors that are external and internal to EPR systems, which may confound the benchmarking analysis. The differences observed in performance may reflect the contexts rather than the quality of the system itself. If for example the regulatory objectives or settings (internal factors), or the geographies, market structures, waste collection and treatment infrastructures or overall legal systems (external factors) of the benchmarked EPR systems differ substantially, the comparative analysis risks producing misleading conclusions.

The importance of confounding factors to benchmarking is in the EU context alleviated by the existence of the common EU law framework on EPR – but only to a limited degree. The EU has introduced general and sector-specific EPR-based legislation until recently in the form of directives, reflecting the subsidiarity principle. Directives need to be transposed by the MS into their national legislation, a process which allows them to take into consideration the respective socio-economic contexts. National approaches on EPR may therefore vary markedly both in terms of design and implementation. Important financial, organisational and governance aspects are still designed at national level. Some of this is intentional and likely positive: the diversity can bring advantages by tailoring EPR to local conditions and enabling policy experimentation. However, this may also lead to some drawbacks, because it may fragment the internal market, generating costs and inefficiencies for multiple actors. Joltreau et al. (forthcoming) argue that on balance, the drawbacks outnumber the benefits. Either way, significant diversity remains among European EPR systems, which a benchmarking analysis must take into account.

Recently, there have been attempts within the law-making process to increase the level of legislative uniformity across the EU. The main means for this is the shift to regulations. Because regulations are directly applicable in all MS, they do not need to be transposed into national legislation. The first examples of this approach are the 2023 Battery Regulation and the 2025 Packaging and Packaging Waste Regulation, which replaced the earlier directives in their respective fields. These shifts are intended to increase the level of harmonisation. However, EU EPR legislation on other waste streams is still based on directives. As a result, there is a risk that parts of the EPR landscape across the EU remain fragmented. The diversity of the non-harmonized and even nominally harmonized EPR rules remains a factor that increases the difficulty of comparing EPR systems in terms of their performance, governance and cost-effectiveness. Understanding the basis for differing performance of EPR systems in benchmarking can be a challenging endeavour.

### 2.1.3 Existing knowledge on benchmarking EPR systems

In the first phase of the research, some 40 existing studies relating to the benchmarking of EPR systems were identified, as listed in the reference section. However, the project team could not identify any existing studies that would guide the type of research it was tasked to conduct, namely where the entire EU and all its EPR systems constituted the possible case study material to engage with. Nor was the team able to identify a general approach for benchmarking selected elements of EPR systems which could take into account confounding factors explained above. Therefore, a novel methodology has been developed by the project team, which is explained in detail in Section 3. For this endeavour, the study by [Pruess](#) (2023) proved particularly insightful, as it breaks EPR systems down to various elements and seeks to systematically compare their design features. Combined with the study of [Mallick et al.](#) (2024) and the existing knowledge of the project team members, it formed the basis for developing the needed benchmarking methodology on EPR systems. Other literature was also consulted, for example when developing the qualitative selection of benchmarks. Moreover, the studies reviewed that cover a particular benchmark or specific features of EPR systems (e.g. eco modulation, reuse) will be revisited in detail when conducting the concrete benchmarking analyses during the later steps of the project.

### 2.1.4 Objectives and rationale of benchmarking development

The main task of benchmarking of EPR systems is to identify attributes of the systems or combinations thereof that contribute to ‘better’ or ‘worse’ performance in relative terms. The main research questions, ‘What works and what does not’ aim to provide insights which can help with better design and implementation of EPR systems, both in the now and in the future.

The previous studies mentioned above provided valuable guidance for the present study. These were used as the basis for developing a methodology that meets the objectives of benchmarking for the LIFE4EPR project. However, as also mentioned above, these studies have important limitations from the viewpoint of the task described in this report. They remain narrow in terms of reflecting on what constitutes a ‘benchmark’ in the context of EPR, and usually do not explain why a specific benchmark has been selected for analysis. As discussed further below, there are many aspects of EPR systems that could be defined as a benchmark. However, they measure different aspects of an EPR system, so the choice of benchmark will determine which aspect of the EPR system will be further developed through the benchmarking. In other words, it is important to understand identification and assessment of candidate benchmarks. Moreover, the comparative analysis of each benchmark is a demanding and resource intensive exercise which needs to be carried out within the resources of the project. This requires a careful prioritisation of limited number of benchmarks. The methodology was thus developed to enable a robust selection while meeting the quality requirements of the project. This exercise not only provided for a robust result: it also led to the creation of valuable tools which can be adapted and used beyond the scope of this project, for instance by policy makers<sup>1</sup>.

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<sup>1</sup> This tool will be refined and delivered at the end of the project with practical guidance on how to use it.

### 2.1.5 Overview of the process

The development of the benchmarking methodology was undertaken as a collaborative exercise by experts in the consortium, particularly those with expertise on EPR policy, implementation and benchmarking. A core team of 7 people were directly involved in all steps from the design to the refinement. All consortium members were consulted on several occasions and provided feedback.

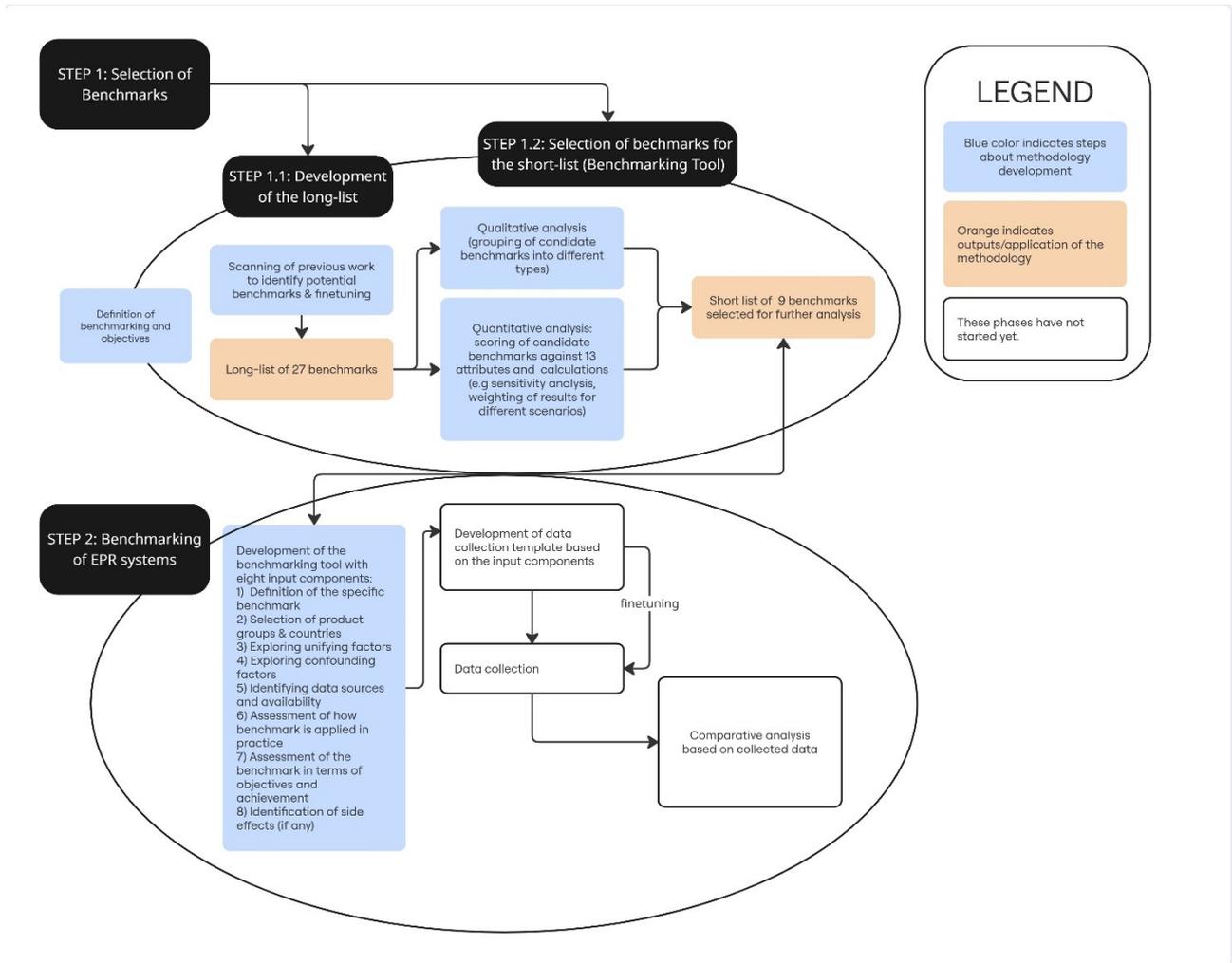
The process reflects the rationale explained below follows two main parts:

**The first part focuses on the identification and selection of benchmarks, exploring what is going to be analysed.** It is further broken down into two main steps. First, a long list of candidate benchmarks was developed based on literature review and consultation with the consortium members. Next, from this longer list of candidates, a shortlist of priority benchmarks was selected. This was done based on the methodology developed specifically for this task by the project team. The methodology combines a qualitative and quantitative analysis of the candidate benchmarks. The quantitative analysis supports the prioritisation of the benchmarks from the perspective of different attributes, relevant for the environmental, economic, scientific, regulatory and other aspects of EPR. The qualitative analysis groups the benchmarks in different ways to ensure the optimal diversity of the final selection. Based on the combination of qualitative and quantitative analysis two, a short-list of 9 benchmarks was identified. This is referred to as the 'Benchmark Selection Tool' in this report.

**The second part focuses on the methodology for benchmarking of EPR systems, exploring how the analysis will take place.** This part is closely linked to the next steps of the project and describes what and how exactly is to be measured regarding the specific benchmarks identified in the first part, while taking into account various dimensions such as unifying and confounding factors, data sources and data availability. This is referred to as the 'Benchmarking Tool' in this report document.

This task will directly lead to the analysis phase which will be completed once the data is collected based on the Benchmarking Tool. A comparative analysis of EPR systems in the EU will be carried out based on the shortlisted benchmarks.

Figure 1 Visual representation of the methodology development process



## 3 Detailed description of the methodology

### 3.1 Selection of benchmarks for analysis

As explained above, this part combines the identification of initial longer list of candidate benchmarks and their subsequent prioritisation combining a qualitative and quantitative analysis.

#### 3.1.1 Developing the initial, long list of candidate benchmarks

The process of developing the benchmarking methodology started by defining what benchmarks are in the context of this project. Based on the earlier-noted definition of the European [Court of Auditors \(ECA, 2021\)](#), it was defined broadly as ‘a property of an EPR scheme that allows measurement of the EPR's practical 'better' or 'worse' performance in comparison to a theoretical ideal, as well as to the best performing practical example of such property’. This conceptualisation was subsequently refined based on existing academic literature. The study by [Mallick et al. \(2024\)](#) was identified as the most relevant for focusing the notion of benchmarks in the specific context of EPR. Mallick et al. divide EPR into its constituent elements, which were adopted here as potential benchmarks.

Next, this initial list of benchmarks was curated through an iterative co-creation process and based on sources in the research literature as well as on the partners’ empirical experiences. This resulted in the exclusion of some of the initial EPR elements such as taxation, subsidies and tradable waste credits. These are valuable policy tools often used in the context of EPR but were considered to fall outside the scope of ‘EPR’ as they are not as part of an EPR system in that their design and application is usually separate from EPR policy. Further, a distinction was made between a ‘benchmark’ and a ‘descriptor’. While a descriptor is also a property of an EPR scheme, it does not in itself provide a basis for an assessment of how, or how well, the scheme is performing. A property that is binary (it exists or is absent) is typically a descriptor and not a benchmark. For instance, whether an EPR scheme is monopolistic or competitive is a binary aspect, and is therefore considered a descriptor. The descriptors were thus excluded from the list of candidate benchmarks. This process helped consolidate the final list to 27 candidate benchmarks (N = 27). Table 1 below presents a summary of the final list of candidate benchmarks. A short description of each can be found in the Annex section 5.2.

*Table 1 The long list of candidate benchmarks*

1	Environmental objective setting	10	Eco-modulation	19	Rules on recycling
2	Economic objective setting	11	Digital product passport	20	Recycling result
3	Cost coverage of removing litter	12	Awareness raising	21	Rules on refurbishing
4	Administrative burden of compliance on companies	13	Labelling rules (mandatory)	22	EOL-related standards
5	EPR fees invested in reuse/repair infrastructure	14	Rules on re-use	23	Monitoring on EPR
6	Scope of application of EPR rules	15	Re-use result	24	Reporting
7	Measures against free riding	16	Rules on collection and takeback	25	Transparency and data quality

8	Active measures to enforce EPR rules	17	Diversion result	26	Environmental impacts
9	Product design requirements	18	Collection result	27	Cost effectiveness

### 3.1.2 Selecting the shortlist of benchmarks for in-depth analysis: Benchmark Selection Tool

Following the identification of long list; this step constitutes the development and application of a methodology to arrive to a shortlist of 9 benchmarks. The choice of shortlisted benchmarks is important, because it defines which benchmarked aspects of EPR systems this project will seek to compare in-depth. Principles of objectivity, transparency and co-creation guided the selection process. The methodology for selecting the shortlisted EPR benchmarks, which is described next in more detail, constitutes in itself a key output of this project and as referred to as ‘Benchmark Selection Tool’ in this report. It was designed so that the selection tool could be used by others in different contexts. It combines two elements: a qualitative and a quantitative one. The choice of benchmarks for the in-depth analysis integrates findings from both components.

#### 3.1.2.1 Qualitative analysis to select the benchmarks

The candidate benchmarks on the long list can be grouped in different ways based on the qualities that they have. The benchmarks were categorised using the groups listed below. The groups correspond to analytical axes used by EPR scholars, supplemented by two new ones for a more granular analysis.

- **Target stakeholder:** whom does the EPR benchmark address?
  - Options: national government, municipality, producer, PRO, distributor, waste management operator, consumer.
- **Level of maturity:** is the EPR benchmark an established or a novel metric? ([Brown, Laubinger & Börkey 2023](#))
  - Options: established existing metric (e.g. collection result), established EPR component without much in-depth research (e.g. enforcement), novel existing metric (such as reuse investments), emerging metric subject to limited research (e.g. readiness for digital product passport integration).
- **Life cycle phase:** which life cycle phase of a product does the EPR benchmark refer to? (see e.g. [Compagnoni 2022](#); [Mallick et al. 2024](#))
  - Options: upstream (product design; manufacture); mid-stream (distribution; sales; refurbishment; re-use); downstream (end of life management, including recycling).
- **(Policy) instrument type:** what is the main operating logic of the instrument? (see e.g. [OECD 2001](#); [Pruess 2023](#))
  - Options: administrative (target objective, legal obligation, performance requirement), market-based; informational.

- **Effect type:** what kind of effect does or should the benchmark mainly refer to? (See e.g. [Compagnoni, 2022](#); [Ramasubramanian et al. 2023](#))
  - Options: an effect on a policy ('output'), effect on a process ('process'), effect to reach the ultimate impact ('results') or an effect on the system in practice ('impact').
- **Transferability:** how conducive is the benchmark to produce generalizable lessons that are transferable between EPR systems, keeping in mind potentially diverging local conditions?
  - Options: not suitable; susceptible at EU level; low; medium; high.

Although there are no hard boundaries between these groupings, they illuminate diverse aspects of EPR systems, necessary to consider for a selection of range of benchmarks from various perspectives. The final choice of selected benchmarks should cover, to the extent feasible, the main aspects of each of these groups. For example, it is important to include both new and a classic type of a benchmark (group based on the maturity), and benchmarks that consider each of the key target stakeholders such as the PROs, waste management operators, administrations as well as consumers (grouping focusing on stakeholder type).

However, this qualitative grouping is not yet sufficient by itself for selecting benchmarks from the long list for further consideration. For example, it does not inform the choice between the benchmarks of results on waste collection, results on recycling, or results on diversion within the same group ('effect type'). Neither it informs the selection between two benchmarks from two groups, such as a benchmark from the target stakeholder and the life cycle phase groups. Therefore, qualitative grouping needs to be complemented by a quantitative analysis, which is explained below. In the final phase, the qualitative and quantitative analyses are integrated as explained in Section 3.1.2.3 below.

### 3.1.2.2 *Quantitative analysis of the candidate benchmarks*

#### *Identification of the attributes*

In parallel to the qualitative benchmark selection, a quantitative analysis of each of the benchmarks was conducted. Each candidate benchmark on the long list was analysed against a set of 'benchmark attributes'. Each of these attributes measure the significance and/or suitability of a proposed benchmark from a specific perspective. The aim is to provoke a deeper reflection on each candidate benchmark. In total, 13 attributes are used: 12 attributes relevant for different policy considerations, as well as an additional time-horizon attribute, which assesses the backward-looking, forward-looking, or both forward and backward- looking nature of the benchmark. The list of the attributes that were used in this quantitative part of the benchmark selection process is provided in

Table 2 below. The use of attributes aimed at making the selection as objective as possible by restricting the choice to these pre-determined criteria (not what the team member may prefer to use as criteria). The team members were instructed to provide an objective and transparent analysis of the benchmarks with respect to the attributes, and to avoid a normative assessment as much as possible.

Table 2 Attributes against which each candidate benchmark was assessed, and their brief description

Attribute	Description
<b>1. Time horizon</b>	<p>Is the benchmark relevant for the past, the future or both?</p> <p>This element indicates whether a benchmark addresses past performance or intended actions and results.</p>
<b>2. Society-wide environmental importance of the benchmarked issue</b>	<p>To what extent is the benchmark important for the environment in the society as a whole?</p> <p>Most EPR systems have stated environmental objectives and have the potential to contribute to sustainability goals such as the European Green Deal. Refers to direct environmental impacts, and indirect impacts that are significant and unambiguous. If the attribute could have both positive and negative impacts, the extent of each is assessed separately. The assessment here thus does not consider the <i>balance</i> between possible negative and positive ends of the impacts.</p>
<b>3. Environmental importance of the benchmarked issue for producers</b>	<p>To what extent is the benchmark important for the environmental performance of the producers?</p> <p>Refers only to direct impacts on the environmental performance of producers, and indirect impacts that are significant and unambiguous. The attribute does not include indirect, programmatic impacts that stem from, e.g., increased overall recycling rate. If the attribute could have both positive and negative impacts, the extent of each is assessed separately. The assessment here thus does not consider the <i>balance</i> between possible negative and positive ends of the impacts.</p>
<b>4. Economic societal importance of the benchmarked issue</b>	<p>What is the economic importance of the benchmark for the society?</p> <p>Refers to direct economic impacts, and not to indirect impacts unless they are unambiguous and significant. Examples include compliance monitoring of the EPR scheme becoming cheaper, i.e., smaller administrative costs or increased administrative burden. This attribute excludes negative economic costs that are about internalizing the externalities of economic activities as they are not caused by EPR, they are caused by the actors' own activity that is being internalised.</p>
<b>5. Economic importance of the benchmarked issue for producers</b>	<p>To what extent is the benchmark important for the producers from an economic perspective?</p> <p>Refers to direct economic impacts, and not to indirect impacts unless they are unambiguous and significant. Examples include: reduction in the cost of dismantling their products or increased costs due to reporting requirements. As above, this attribute excludes negative economic costs that are about internalizing the externalities of economic activities as they are not caused by EPR, they are caused by the actors own activity that is being internalised.</p>
<b>6. Importance of the benchmarked issue for resilience</b>	<p>To what extent is the benchmark important for the EU's resilience?</p> <p>Refers to the extent to which the attribute is relevant for EU's resilience, in particular as regards EU's capacity to withstand and cope, and to adapt to and to recover from external shocks, as well as to maintain sustainable, democratic and inclusive transitions. Concretely, it means e.g. access to raw materials and resources that are strategically important for the EU, and that ensure the EU's autonomy in terms of its security and economy.</p>
<b>7. Importance of the benchmarked issue for regulatory agenda</b>	<p>To what extent is the benchmark important for the on-going relevant policy agenda, for instance in relation to the development of the upcoming Circular Economy Act?</p>
<b>8. Academic importance of the benchmarked issue</b>	<p>To what extent is the benchmark important to explore (further) in academic terms (for instance whether there is already research on it or not).</p>
<b>9. Availability of literature on the benchmarked issue</b>	<p>To what extent will it be possible to find literature on the benchmark (journal articles, policy briefs, government report, or other grey literature)?</p>
<b>10. Availability of primary data on the benchmarked issue</b>	<p>To what extent are there data (qualitative or quantitative) - to be collected by the team- on this benchmark (such as statistics, other quantitative data, legislation, policy documents, case law, interviews, surveys)?</p>

Attribute	Description
<b>11. Influence of the benchmarked issue on other EPR elements</b>	To what extent does this benchmark have an impact on other aspects of EPR?  This would mean that this benchmark has a strong influence and has system defining characteristics.
<b>12. Confounding impacts of other EPR elements on the benchmarked issue</b>	To what extent do other EPR elements confound this specific benchmark?  Unlike the previous attribute, if other EPR elements create strong confounding impacts on the benchmark, it is difficult to isolate the impacts of the benchmark for a precise analysis. Thus, this attribute is scored in reverse (benchmark having strong confounding factor receives a low score).
<b>13. Context sensitivity of benchmarked issue</b>	To what extent does the context in which the EPR system operates influence this specific benchmark?  Similar to the previous one, to what extent this benchmark can be isolated from the context in which it is operating. If it is highly context-dependent, it would be difficult to measure. Thus, this attribute is scored in reverse (benchmark having strong context sensitivity receives a low score).

### *Independent analyses of candidate benchmarks by the team members*

Next, as the main part of quantitative analysis, each team member first independently scored all the benchmarks against each of the 13 attributes on a scale of one to five (1-5)<sup>2</sup>. They also provided a brief explanation for each score to provide clarity and to ensure consistency across the team. A higher score indicated a higher importance and/or suitability of the EPR benchmark from the viewpoint of the attribute. As such, a combined higher score across all attributes for a benchmark meant that the benchmark was considered more important/suitable for a closer analysis.

Multiple scoring rounds were conducted. After the initial round of scoring, the benchmark tool was finetuned, with some of the benchmarks adjusted in wording and three new ones added to the list, clarifying and increasing the robustness of the approach. Scoring by each team member was kept undisclosed to preserve methodological integrity and to avoid influencing each other. After a further round, the final scores of the quantitative assessment were confirmed. A final version of the selection tool was consolidated. A simplified version of the tool is provided in the Annex 5.1.

### *Synthesis of the benchmark analyses*

Once this final version of the selection tool was developed, the independent assessment of all candidate benchmarks by each team member were compiled into a single 'Benchmark Synthesis'. The synthesis includes 2457 datapoints in total (27 candidate benchmarks scored against 13 attributes by 7 team members). The synthesis allowed for a comparative overview of members' scoring as well as their qualitative explanations across all attributes. Divergencies across the team members were identified: if the range of the team members' scores diverged by more than 2 points (on a 1 to 5 scale), this was highlighted for a subsequent iteration to distinguish possible scoring errors (for instance misunderstanding an attribute or simply inserting a wrong score) from differences of opinion. This was important to address any misunderstandings about the attributes and how they related to the benchmarks. The qualitative remarks by each member proved helpful, providing transparency and focusing the discussions on key divergences. On the basis of the

<sup>2</sup> One of the seven benchmark selection score sets was produced in a process that involved [three\*] members of the same organisation.

discussions, each team member was given the choice to adjust their scoring, working on separate files once again. Divergences merely due to differences in opinion were kept as they were. This process was repeated until all team members considered their scoring complete and free of error.

### *Benchmarking Dashboard: refining the results*

Next, the final synthesis dataset containing each team member’s complete list of scores was used to build a ‘Benchmark Dashboard’. It is a tool for processing the benchmark selection data in different ways, in particular to conduct different sensitivity analyses in order to minimise and mitigate potential biases. The dashboard also allowed introducing a ‘normative’ element into the benchmark selection process: the relative importance of each of the 13 attributes could be changed by multiplying the scores they received, giving them more ‘weight’. For example, by multiplying the scores of the attributes relating to the environment (attributes 2 and 3), an environmental scenario emphasising the importance of the benchmarks for environmental protection can be created. In other words, when the environmental potential of EPR systems over the academic research needed or economic considerations are prioritised, the dashboard allows choosing the most relevant benchmarks for that purpose. In the present study, it was assessed how each of the benchmark scored under six scenarios: the baseline scenario (without any multipliers) and five different scenarios. The five scenarios reflect the role of EPR, respectively, for the environment, the economy, research, the EU’s current regulatory agenda, as well as its functioning in the complex policy context. The weights given to the attributes in different scenarios are summarised in Table 3 below. Because there are many factors internal and external to EPR systems that may confound the functioning of the benchmarks, the three attributes (11-13) on the confounding factors were weighted in all scenarios, and separately in the complexity scenario. The weights (i.e. the size of the multipliers) were chosen based on a sensitivity analysis. The overall weighting is similar across all scenarios, amounting to 24. Finally, a co-efficient was used to make the maximum points available in the baseline and each of the five scenarios identical (100). Table 3 below summarises the scenarios in the benchmark selection.

*Table 3 Different scenarios used to weigh the scores*

Scenario	Attributes included	Emphasis given (i.e. multipliers used)	Co-efficient to normalise the score to 100
<b>Baseline scenario</b>	All attributes	Not weighted	1.54
<b>Environmental scenario</b>	Environmental societal importance	Weighted by a factor of 6	0.63
	Environmental importance for producers	Weighted by a factor of 6	
	Effect of benchmark on other EPR elements	Weighted by a factor of 4	
	Effect of other EPR elements on the benchmark	Weighted by a factor of 4	
	Context sensitivity	Weighted by a factor of 4	
	All other attributes	Not weighted	
<b>Economic scenario</b>	Economic societal importance	Weighted by a factor of 6	0.63
	Economic importance for producers	Weighted by a factor of 6	
	Effect of benchmark on other EPR elements	Weighted by a factor of 4	
	Effect of other EPR elements on the benchmark	Weighted by a factor of 4	
	Context sensitivity	Weighted by a factor of 4	
	All other attributes	Not weighted	

Scenario	Attributes included	Emphasis given (i.e. multipliers used)	Co-efficient to normalise the score to 100
<b>Polymaking scenario</b>	Importance for regulatory agenda	Weighted by a factor of 6	0.63
	Effect of benchmark on other EPR elements	Weighted by a factor of 4	
	Effect of other EPR elements on the benchmark	Weighted by a factor of 4	
	Context sensitivity	Weighted by a factor of 10	
	All other attributes	Not weighted	
<b>Research scenario</b>	Academic importance	Weighted by a factor of 6	0.61
	Data availability	Weighted by a factor of 6	
	Effect of benchmark on other EPR elements	Weighted by a factor of 4	
	Effect of other EPR elements on the benchmark	Weighted by a factor of 4	
	Context sensitivity	Weighted by a factor of 4	
	All other attributes	Not weighted	
<b>Complexity scenario</b>	Effect of benchmark on other EPR elements	Weighted by a factor of 8	0.59
	Effect of other EPR elements on the benchmark	Weighted by a factor of 8	
	Context sensitivity	Weighted by a factor of 8	
	All other attributes	Not weighted	

### Results of the quantitative selection

Further checks were performed with the results to check for robustness. Eight scoring and ranking variations (as explained in detailed the annex 5.2) combining the individual scores were tested in sensitivity analyses. Individual and institution-level results were compared, and heat-mapped for bias, indicating an inter-rater reliability that was largely good. Final ranking combined five calculation methods and led to the selection of those benchmarks that performed well in one or more of these five calculations. **5.2** This robustness-based shortlisting led to the 12 benchmarks found in Table 4 below<sup>3</sup>. More details on these calculations are provided in Annex 5.2.

Table 4: Short-listed benchmarks, the results of combined overall ranking.

Shortlist of candidate benchmarks based on the quantitative analysis	How many times a benchmark is in top 6 (in five calculations for different scenarios)	Overall rank
<b>Monitoring on EPR</b>	5 / 5	1
<b>Rules on recycling</b>	5 / 5	2
<b>Product-design related requirements</b>	3 / 5	3
<b>Collection result</b>	3 / 5	3
<b>Active measures to enforce EPR rules</b>	3 / 5	5
<b>Transparency and data quality</b>	3 / 5	6
<b>Recycling result</b>	3 / 5	7
<b>Digital product passports</b>	2 / 5	8
<b>Environmental objective setting</b>	1 / 5	9
<b>Reporting</b>	1 / 5	10
<b>Rules on re-use</b>	1 / 5	11
<b>Diversion result</b>	1 / 5	12

<sup>3</sup> The reason there are 12 benchmarks (but not 10) is because there are multiple that ranked equally, which can be seen in the table

### *3.1.2.3 Combining qualitative and quantitative analysis*

As the final part of the benchmark selection, the quantitative short list was assessed in light of the qualitative groupings discussed under the qualitative analysis section 3.1.2.1. This is to ensure the representativeness of the selection. The result is found in

Table 5 on the next page. There is relatively limited variance in some of the groupings. Some alternatives were chosen many times, while others rarely or not at all. The groupings with limited variance are the life cycle phase (only one upstream benchmark), typology of policy instruments (only one overarching and no economic incentive benchmarks) and effects (only one benchmark related to bio-physical impacts). Further, it can be seen that the qualitative characteristics of some of the top-ranking benchmarks are almost identical. This was the case, for instance, for benchmarks 'monitoring on EPR' and 'transparency and data quality', as well as 'collection result' and 'recycling result'. In both cases, the only difference is the target stakeholder while the other characteristics are the same.

Table 5: Categorisation of short-listed benchmarks in accordance with the qualitative groupings

Benchmarks	Target stakeholder	Maturity	Life cycle phase	Policy instrument	Effect	Transferability	Overall quantitative rank
Monitoring on EPR	G* <sup>1</sup>	Novel* <sup>6</sup>	All	Informational	Process	Medium	1
Rules on recycling	G	Novel	Downstream	Administrative	Output	High	2
Product design related requirements	P, G	Established	Upstream	Administrative	Output	EU level* <sup>7</sup>	3
Collection result	P* <sup>2</sup> , M* <sup>3</sup> , D* <sup>4</sup>	Established	Downstream	Administrative	Result	No* <sup>8</sup>	4
Active measures to enforce EPR rules	G	Novel	All	Administrative	Process	Medium	5
Transparency and data quality	PRO, G	Novel	All	Informational	Process	Medium	6
Recycling results	P	Established	Downstream	Administrative	Result	No	7
Digital product passport	G, P, C* <sup>5</sup>	Emerging	All	Informational	Output	Medium	8
Environmental objective setting	G	Novel	All	Overarching	Impact	High	9
Reporting	G	Novel	All	Informational	Process	Medium	10
Rules on re-use	G	Emerging	Midstream	Administrative	Output	High	11
Diversion results	P, M	Novel	Downstream	Administrative	Result	No	12

The colours highlight the different alternatives **within** the groupings (i.e. the vertical columns), but are **not** relevant horizontally **across** groupings.

\*<sup>1</sup> G = government; \*<sup>2</sup> P = Producer; \*<sup>3</sup> M = Municipality; \*<sup>4</sup> D = Distributor, \*<sup>5</sup> C = Consumer

\*<sup>6</sup> Novel = benchmark in use, but still subject to limited existing research – assessment based on the ranking by the seven experts engaged in scoring – all the benchmark ranked lower than 3 regarding the availability of literature criteria was considered as limited existing research

\*<sup>7</sup> EU Level = determined mostly at the EU level.

\*<sup>8</sup> No = no transferability, as results per se cannot be transferable to other EPR systems. However, the reasons behind the results and enabling or hindering factors, will be transferable.

In order to provide a broader representativeness and enhance variety of the final selection, some of the benchmarks ranked higher in the quantitative analysis were replaced with those ranked lower. Table 6 In terms of novelty and life cycle phase, ‘rules on re-use’ was moved up, as a new type of benchmark that addresses the mid-stream (i.e. slowing loops, as a critical aspect of circularity). On policy instruments, the benchmark ‘environmental objective setting’ was prioritised as an instrument setting the overarching direction of the policy. Finally, eco-modulation was included in the final list as the highest scoring economic instrument in the group ‘policy instruments’ in the quantitative ranking. These adjustments (highlighted in **red font** Table 6 below) had the trade-off

that the level of diversity was slightly reduced in the group ‘target stakeholders’. Below is the final shortlist of the nine benchmarks selected for the next step of benchmarking study.

*Table 6: Benchmarks selected for further analysis and those excluded but are ranked high quantitatively, and their categorisation in accordance with the qualitative groupings*

Benchmarks for further analysis	Target stakeholder	Maturity	Lifecycle phase	Policy instrument	Effect	Transferability	Overall quantitative rank
Monitoring on EPR	G	Novel* <sup>5</sup>	All	Informational	Process	Medium	1
Rules on recycling	G	Novel	Downstream	Administrative	Output	High	2
Product design related requirements	P, G	Established	Upstream	Administrative	Output	EU level	3
Collection result	P* <sup>2</sup> , M* <sup>3</sup> , D* <sup>4</sup>	Established	Downstream	Administrative	Result	No* <sup>6</sup>	3
Active measures to enforce EPR rules	G	Novel	All	Administrative	Process	Medium	5
Digital product passport	G, P	Emerging	All	Informational	Output	Medium	8
Environmental objective setting	G	Novel	All	Overarching	Output	High	9
Rules on re-use	G	Emerging	Midstream	Administrative	Output	High	11
Eco-modulation	P, G	Emerging	Upstream	Economic	Process, output	High	20
<b>Benchmarks NOT Selected for the First Round of Analysis</b>							
Transparency and data quality	PRO, G	Novel	All	Informational	Process	Medium	6
Recycling results	P	Established	Downstream	Administrative	Result	No	7
Reporting	G	Novel	All	Informational	Process	Medium	10
Diversion results	P, M	Novel	Downstream	Administrative	Result	No	12

The colours highlight the different alternatives **within** the groupings (i.e. the vertical columns), but are **not** relevant horizontally **across** groupings. The specific traits taken into consideration when including the benchmarks that were otherwise ranked lower for further analysis are highlighted in red font.

\*<sup>1</sup> G = government; \*<sup>2</sup> P = Producer; \*<sup>3</sup> M = Municipality; \*<sup>4</sup> D = Distributor, \*<sup>5</sup> C = Consumer

\*<sup>6</sup> Novel = benchmark in use, but still subject to limited existing research – assessment based on the ranking by the seven experts engaged in scoring – all the benchmark ranked lower than 3 regarding the availability of literature criteria was considered as limited existing research

\*<sup>7</sup> EU Level = determined mostly at the EU level.

\*<sup>8</sup> No = no transferability, as results per se cannot be transferable to other EPR systems. However, the reasons behind the results and enabling or hindering factors, will be transferable.

## 3.2 Developing the benchmarking tool for selected benchmarks

On the basis of the selected benchmarks, LIFE4EPR project is proceeding to the in-depth analysis of the benchmarks in question. For that purpose, the project designed a benchmarking tool that operationalises the selected benchmarks into a research instrument enabling systematic, country-level and product-group -specific comparison of EPR systems across the EU.

The benchmarking tool is structured around a set of mandatory eight input components that must be completed for each benchmark that is being assessed. These components cover:

- 1) the benchmark definition (including its description and objectives)
- 2) the relevant product group; and the country context in which the EPR system operates. Relevant to these, the tool captures:
- 3) unifying factors, such as supranational laws that apply to the analysed EPR system and,
- 4) confounding factors related to other EPR elements and contextual sensitivities
- 5) a dedicated data section, which distinguishes between information collection by the team (both qualitative and quantitative information and their sources—and insights from desktop, literature review or interviews, if applicable).

Against these components, the tool (6) provides the assessment of how the benchmark is applied in practice, comparing it with theoretically and/or practically optimal configurations, and (7) evaluates the benchmark objectives and their attainment. In the final section, (8) the tool allows identifying and assessing potential side effects, including how the benchmark interacts with and influences other elements of the EPR system. Below, these eight components of the methodological tool are clarified in more detail (from section 3.2.1 to section 3.2.8). A final section is added to explain how the tool will be used in practice. It is important to note that the exact number and contents of these components is still subject to adjustments, based on experiences collected while applying the tool.

### 3.2.1 Defining the benchmarks to be analysed (1)

The first component of the tool is dedicated to defining the benchmark. It provides the generic name and a more detailed name/description of the benchmark, avoiding ambiguity. This is accompanied by a short description of what the benchmark would measure in general terms, i.e. what aspect of the EPR system it captures, and how it measures performance (e.g. in terms of the result or outcome).

This conceptualization anchors each benchmark, so that a more detailed assessment metrics can be refined as a part of the empirical analysis of the benchmark in question. This ensures that coding and analysis across countries and product groups are aligned in the subsequent stages. It also reduces subjective interpretations of individual researchers.

### 3.2.2 Selection of product groups and countries (2)

The tool then proceeds to identifying the concrete cases to be investigated. Two aspects need to be defined. First, the product group (e.g. packaging, batteries, EEE) that is best suited for analysing EPR systems from the viewpoint of the benchmark must be selected. For instance, a benchmarking of eco-modulation requires the selection of a product group, for which eco-modulation has been implemented or concretely considered. This to ensure that the product group is as informative as possible regarding the best and worst performance in eco-modulation, and the factors that determine such performances. Second, EPR systems that offer the richest comparative insights regarding the benchmarked aspect must be identified. This typically means choosing EPR systems from particular EU MS.

Through purposeful sampling ([Patton 2015](#)), the most information-rich cases will be selected based on existing studies, expert views including advice provided by the LIFE4EPR Advisory Board Members, as well as the knowledge of consortium members. The selection of product groups as well as MS is likely different for each benchmark.

The selection of the product group and the EPR systems is crucial. As explained in the introduction, while the conceptual definitions of benchmarks are common to all product groups, the policy design and implementation can vary significantly by product group and EU MS. The tool is designed to capture and to allow consideration to this diversity by finetuning specific data to be collected for the selected product groups across selected countries (see Section 3.2.5). This is achieved by establishing the components of analysis in the benchmarking process, so that the tool maintains a level of comparability across different product groups and countries.

### 3.2.3 Unifying factors (3)

Given the harmonisation stemming from the EU level requirements and the private sector (e.g., technical standardisation), various factors common to all MS and products are to be expected. This applies to general rules of EPR systems as well as to sector/waste stream specific legislation.

The benchmarking tool therefore explicitly seeks to identify and describe, in appropriate detail the international, EU level and other overarching legal provisions, as well as common operational aspects (such as key technologies or financial requirements) which are relevant for the benchmarking and are common in the analysed MS and product groups.

The analysis of unifying factors fulfils several methodological functions. First, it provides a reference point for the assessment of the benchmark. If a benchmark is anchored in, for example, an EU law or a technological solution, variations in performance draws attention to issues of transposition and implementation, as well as the operational factors of the EPR system. Finally, it also brings forth to what extent the benchmarked quality is (partly) mandatory or voluntary.

### 3.2.4 Confounding factors (context sensitivity) (4)

The analysis of the confounding factors is an important methodological component and a safeguard. It focuses on two separate elements, also discussed as attributes relevant to the selection of benchmarks in the quantitative analysis (Section 3.1.2.2 above). First is the confounding impacts of other EPR elements on the benchmarked quality of EPR. For instance, the existence of rules on waste collection is likely to influence the collection result, as well as the results of downstream recycling. Second is the context sensitivity of the benchmarked EPR quality to other societal factors. Following the same example, the local waste collection infrastructure is likely to influence the achieved collection and recycling results, and therefore requires scrutiny.

The tool deepens the earlier desktop-based quantitative analysis conducted during the benchmark selection process into a more detailed assessment of the confounding factors, leading to a documentation of the other elements of the EPR system that influence the analysed benchmark. This allows reflections on whether and to what extent the benchmark's performance is dependent on the specific contextual conditions.

The consideration of confounding factors is essential to focus the analysis on the qualities of the benchmark itself and to ensure a more robust and nuanced interpretation and communication of best practices. The analysis of the confounding factors may, in some cases, even lead to discarding a particular benchmark. This would be the case where the influence of the confounding factors shapes the benchmark to such an extent that comparison among EPR systems would be misleading.

### 3.2.5 Data sources (5)

The tool separates the data and literature components of the methodology. The component on data entails a preliminary assessment of what and where the data exists to analyse the benchmark. This includes the identification of data sources such as EPR laws of the selected countries, administrative data, PRO reports, regulatory files, monitoring reports, and statistical databases. The objective is to clarify the data availability, format and limits.

The component on literature entails identifying the literature relating to the occurrence and attainment of the benchmark. It strives to capture the insights in academic and grey literature that discuss how and where the benchmark (or closely related, similar issues) have been previously researched, to allow drawing on such results in the analysis.

By explicitly distinguishing primary and secondary sources the tool makes its conclusions transparent, as to when they are rooted in measurable evidence and when they are supported by secondary/qualitative insights. The split also helps flag benchmarks for which robust literature or expert views are scarce, necessitating reliance on primary data collection (e.g through consultation with relevant stakeholders).

### 3.2.6 Occurrence of the benchmark (6)

The next step in our benchmarking methodology is an assessment on the occurrence of the benchmark. It can be further broken down into two elements: how the benchmark is deployed in the specific EPR system, and how the system compares to the best (or worst) performer on the issue or to a theoretical ideal performance on that benchmark.

These two assessments serve different analytical purposes: the first ('how the benchmark is deployed') captures the observable, measurable variables that describe how the benchmark actually operates within the specific EPR system. These include variables such as targets, bonuses, maluses, cost signals, thresholds, or any other quantifiable components that constitute datapoints for the analysis.

Example: The benchmark 'Environmental objective setting' characterizes the extent to which the rules that govern the EPR system describe and target actual environmental objective(s).

The occurrence of this benchmark could be assessed against the following, tentatively defined levels, where 1 is the lowest level and 6 the highest:

- 1) No direct or indirect environmental objective described for the EPR system
- 2) A very generic objective (such as 'improving environmental sustainability') described in non-mandatory and/or imprecise terms for the EPR system
- 3) An environmental objective is defined indirectly (i.e. with reference to a proxy, such as product lifetime, durability objective, reduction of waste; re-use rate; collection and/or recycling rate, or product composition), and in non-mandatory term for the EPR system
- 4) An environmental objective is defined indirectly (i.e. with reference to a proxy as above), but in mandatory and precise terms for the EPR system
- 5) An environmental objective is defined with direct reference to a single, mandatory environmental impact objective (such as CO2 emitted) for the EPR system.
- 6) An environmental objective is defined with direct reference to multiple and granular mandatory environmental impact objectives (such as tons of CO2 or pollutants emitted) for the EPR system

The second component ('how the system compares to best performance') uses those measured variables to compare the product- and EPR-system specific case data relative to the best and worst performers. The best and worst performers can be a part of the comparative benchmarking that is being conducted (that is among the cases being analysed), and where feasible also against an ideal, theory-based performance level or a performance level outside of the EU.

Example: How the Benchmark 'Environmental objective setting' in EPR system on packaging in Member State X (e.g. Level 3) compares against the best and worst performing MS Y (Level 4) and Z (Level 2), respectively, or against the theoretically best performance (Level 6).

Methodologically, the two-part approach separates the description of *what exists in practice* from the *normative/evaluative comparison*. It also allows operationalising the earlier conceptual work (selection stage, dashboard scenarios, literature) to define what ‘optimal’ or ‘best practices’ are for each benchmark.

### 3.2.7 From occurrence to results: the objectives and their achievement (7)

Next, the analysis of benchmarks is deepened to include their objective(s) and how well such objective(s) are achieved. The objective means the outcome (i.e., result) that the benchmarks is expected to achieve: the short- or medium-term change anticipated in the behaviour or performance of the target stakeholder, whether a person or an institution. The focus of this component is to analyse whether, to what extent and how the EPR system reaches (or fails to reach) the targeted benchmarked outcome/result. This assessment can be qualitative and/or quantitative and is conducted on the basis of either existing literature or secondary data that needs to be collected separately.

Example: the benchmark ‘environmental objective setting’ is intended to contribute to understanding whether, why and how the environmental impacts of the products covered by an EPR system are reduced. Thus, the result of this benchmarked element is analysed by investigating changes in the EPR system and the stakeholders from the viewpoint of the objective. Depending on the benchmark, it may be that no data on achieving the objective can be identified or accessed, so that benchmarking may need to be limited to the previous phase of assessing its occurrence.

A clear separation is thus necessary between the deployment/occurrence of the benchmarked element of the EPR system on the one hand (section 3.2.6, and the achievement of the targeted outcome in the EPR system (section 3.2.7 ), on the other. The latter draws attention to data sufficiency and quality during the assessment, going beyond the intention of the intervention on paper and seeks to examine actual impact.

### 3.2.8 Integrating side effects and system interactions (8)

In policy research, side effects are unintended consequences of a policy intervention, in and outside of the target area, whether they are anticipated or not ([Mickwitz 2003](#)). In the context of this task, side effects refer to the effects attributable specifically to the benchmarked element of the EPR system. In other words, this component on the side effects reverses the earlier question on the confounding factors: this time, the EPR benchmark is assessed ‘inside-out’. The benchmarked aspects of EPR systems rarely act in isolation. An assessment of the side effects helps understanding how a given benchmark interacts with the broader policy mix and institutional setting.

The assessment of the side effects focuses on their types and magnitude, examining the benchmarked EPR performance has on the EPR system itself, or beyond it. For example, a high performance in terms of the benchmark of ‘collection result’ may have the positive side effect of increasing available feedstock for downstream recycling, potentially encouraging investment in recycling technologies and hence on improving ‘recycling result’. Another type of a side effect is that

the broader EPR policy is developed on the basis of the benchmarked performers. For example, an EPR policy that prioritizes robust recycling rules can lead to less focus, and thus a worse performance, on 'reporting'. An example of side effects outside the EPR system is that enhanced enforcement of an EPR system might enhance the quality of enforcement in other environmental components (positive) or might take resources away from other components (negative). The benchmarking in this project focuses only on significant positive and significant negative side effects of the benchmarked element of the EPR system. In the same vein, the analysis of these complex interactions will be based on what is identified through literature and targeted consultations with the stakeholders, if needed. The feasibility of incorporating side effects in the analysis will nevertheless be re-assessed based on experiences obtained while conducting this task.

### *Using the benchmarking tool in practice*

Taken together, the methodological structure provides a standardised benchmarking template, usable in several ways:

- **Comparative analysis across EPR systems:** For a given benchmark (e.g. monitoring, rules on recycling), each 'product—EPR system' combination can be described and evaluated using the same set of components. This creates a dataset that is standardised in structure, enabling the comparison of how the benchmarked EPR element is implemented, how the results differ, and how the context and confounding factors may explain differences.
- **Comparative analysis across benchmarks within a single EPR system:** For each EPR system, several aspects can be benchmarked side by side. This allows identification of potential synergies and trade-offs in some of the underlying factors relating to the case. It also allows comparing which elements of the EPR system are relatively speaking strong or weak, how they interact positively and negatively, and what combinations of features may explain performance variation.
- **Link back to selection-stage:** Many components in the template (confounding factors, context sensitivity, influence on other EPR elements, objectives, data availability) mirror the 13 attributes used for the selection of the benchmarks to be analysed. The knowledge generated in each step is thus mutually supportive and can be added in heuristic rounds and creates coherence between the selection and the operationalization and interpretation of the benchmarks in practice.
- **Flexibility for future changes in the benchmark set:** The developed benchmarking tool is not hard-wired to any particular benchmark. It is a general template that has been developed to accommodate any potential benchmarks defined in this project and beyond it.

### 3.3 Challenges and limitations

Due to the complexity of the exercise; a number of challenges were expected and encountered during the process. The first challenge presented itself early in the process when the project team realised the need to select the benchmarks, before thinking about what the benchmarking would entail. EPR systems have many elements, and a robust methodology should avoid taking for granted any 'obvious' paths, for instance focusing on the collection and recycling results. This meant an additional step: the selection of a shortlist of priority benchmarks from a long list of candidates. This proved to be an arduous process. The assessment of each benchmark using 13 attributes and several rounds of reflections among the team however helped to enhance a common understanding of each benchmark and proved very valuable for the next steps.

Another important decision was to adapt the final list of selected benchmarks on the basis of the groupings explained in section 3.1.2.1. To go beyond mere quantitative scores and to ensure diversity and the coverage of core aspects of EPR, adjustments were necessary. For instance, if no benchmarks focusing on the upstream part of the EPR system featured on the final list, the benchmark with the highest score from this group was moved into the final selection. In other words, an optimal combination of the quantitative and qualitative assessments was sought for.

Finally, as stated in the introduction, the concept of benchmarking was developed within the business world and for assessing systems operating within much more confined, clear-cut boundaries. EPR systems are complex and interact with a myriad of other things, such as environmental legislation, market structure and consumer behaviour, to name a few. Some of these interactions are referred to as 'confounding factors' in this report. These are by definition, quite complex and not always immediately apparent. The benchmarking tool developed by this project has specific sections trying to capture these interactions as much as possible. On the other hand, the project scope does not allow to provide an exhaustive assessment of intended and unintended impacts of the EPR systems, nor the possible influences of other factors on the EPR systems that are being benchmarked.

## 4 Summary and next steps

The LIFE4EPR project team developed a benchmarking methodology comprising two main parts. The first part aims at identifying the benchmarks that will be used for in-depth analysis. It combines a quantitative and a qualitative analysis. In the quantitative analysis, the benchmarks are scored against 13 pre-defined attributes. These attributes reflect different dimensions of policy and research (environment, economic impacts, data availability...). Several rounds of scoring were conducted by the team members to ensure co-creation and robustness of the results. These scores are brought together on a 'dashboard', providing an overview of the results, developing scenarios across which to compare the results, and conducting sensitivity analyses. In the qualitative analysis, the EPR benchmarks are grouped along their core qualities, such as the instrument type (administrative, market-based, informational), effect (result, output, process or impact) or maturity (established, novel, emerging). The qualitative grouping ensures that benchmarks reflecting all core qualities are considered. Finally, the qualitative and quantitative steps are combined in the tool. This leads to a shortlist of benchmarks, selected for a detailed analysis. The process led to an initial selection of 27 benchmarks, from which a final selection of nine benchmarks was curated. The resulting list includes the following benchmarks: Monitoring on EPR; rules on recycling; product design related requirements; collection result; active measures to enforce EPR rules; digital product passport; environmental objective setting; rules on re-use, and eco-modulation.

The second part is the benchmarking itself. It will be carried out using the 'benchmarking tool'. It embeds eight components, including a detailed description of the benchmark, the data sources, confounding factors, the objectives, and side effects. The benchmarking tool is designed to allow both a standardised data collection (for comparability) and flexibility (for updates in benchmark selection and case coverage). It will guide detailed, evidence and literature-based investigation of concrete cases of selected benchmarks. At the same time, it is the backbone of the comparative analysis that will be conducted once the data collection is completed.

In the next steps, the project will proceed as follows:

The benchmarking tool will be finalised and finetuned. This will be done mainly by pilot-testing the tool with real-life examples of the selected benchmarks in a small set of EPR systems (countries) and products. The experiences on the usability of the benchmarking tool will be utilised to refine the tool.

At the same time, a priority selection of the waste streams and EPR systems in specific countries will be made for the finalisation of the benchmarking exercise. This will be done iteratively, based on a number of considerations (yet to be determined) such as compatibility of each benchmark for a given EPR system or product, data availability, usefulness of insights to be gained from each system and an adequate diversity across different contexts (e.g market size, geographical location, old vs. new systems). The benchmarking will consider the streams selected for the project work on the harmonised EU register, without being dependent on it, as need and priorities of the two tasks may not be necessarily aligned in all cases.

In concrete terms, a data collection template will be developed, mirroring the benchmarking tool (second phase of Task 2.1). This template will be in excel form and it will be distributed among the team members who will perform the data collection. The template will include guidance notes for users to ensure consistency between researchers using the benchmarking tool. The data collection team will be briefed, and a first round of pilot testing will be performed. Following this, some adjustments will be made to the template. There will be regular progress meetings for the data collection exercise during the pilot phase.

# 5 Annexes

## 5.1 The benchmark selection tool<sup>4</sup>

Table 7 Simplified representation of the benchmark selection tool

		Attribute												
Benchmark	1. Time horizon	2. Society-wide environmental importance of the benchmarked issue	3. Environmental importance of the benchmarked issue for producers	4. Economic societal importance of the benchmarked issue	5. Economic importance of the benchmarked issue for producers	6. Importance of the benchmarked issue for resilience	7. Importance of the benchmarked issue for regulatory agenda	8. Academic importance of the benchmarked issue	9. Availability of literature on the benchmarked issue	10. Availability of primary data on the benchmarked issue	11. Influence of the benchmarked issue on other EPR elements	12. Confounding impacts of other EPR elements on the benchmarked issue	13. Context sensitivity of benchmarked issue	
Environmental objective setting														
Economic objective setting														
Cost coverage of removing litter														
Administrative burden of compliance														

<sup>4</sup> This is only a part of the tool which is impossible to present in a word-format in a reader-friendly way. The full version in PDF can be consulted [here](#). The final version of the Excel tool will be provided at the end of the project.

Attribute													
Benchmark	1. Time horizon	2. Society-wide environmental importance of the benchmarked issue	3. Environmental importance of the benchmarked issue for producers	4. Economic societal importance of the benchmarked issue	5. Economic importance of the benchmarked issue for producers	6. Importance of the benchmarked issue for resilience	7. Importance of the benchmarked issue for regulatory agenda	8. Academic importance of the benchmarked issue	9. Availability of literature on the benchmarked issue	10. Availability of primary data on the benchmarked issue	11. Influence of the benchmarked issue on other EPR elements	12. Confounding impacts of other EPR elements on the benchmarked issue	13. Context sensitivity of benchmarked issue
on companies													
EPR fees invested in reuse/repair infrastructure													
Scope of application of EPR rules													
Measures against free riding													
Active measures to enforce EPR rules													
Product design requirements													
Eco-modulation													
Digital product passport													
Awareness raising													

Attribute													
Benchmark	1. Time horizon	2. Society-wide environmental importance of the benchmarked issue	3. Environmental importance of the benchmarked issue for producers	4. Economic societal importance of the benchmarked issue	5. Economic importance of the benchmarked issue for producers	6. Importance of the benchmarked issue for resilience	7. Importance of the benchmarked issue for regulatory agenda	8. Academic importance of the benchmarked issue	9. Availability of literature on the benchmarked issue	10. Availability of primary data on the benchmarked issue	11. Influence of the benchmarked issue on other EPR elements	12. Confounding impacts of other EPR elements on the benchmarked issue	13. Context sensitivity of benchmarked issue
Labelling rules (mandatory)													
Rules on re-use													
Re-use results													
Rules on collection and takeback													
Diversion result													
Collection result													
Rules on recycling													
Recycling result													
Rules on refurbishing													
EOL-related standards													
Monitoring on EPR													
Reporting													
Transparency and data quality													

Attribute													
Benchmark	1. Time horizon	2. Society-wide environmental importance of the benchmarked issue	3. Environmental importance of the benchmarked issue for producers	4. Economic societal importance of the benchmarked issue	5. Economic importance of the benchmarked issue for producers	6. Importance of the benchmarked issue for resilience	7. Importance of the benchmarked issue for regulatory agenda	8. Academic importance of the benchmarked issue	9. Availability of literature on the benchmarked issue	10. Availability of primary data on the benchmarked issue	11. Influence of the benchmarked issue on other EPR elements	12. Confounding impacts of other EPR elements on the benchmarked issue	13. Context sensitivity of benchmarked issue
Environmental impacts													
Cost effectiveness													

## 5.2 Short description of candidate benchmarks

Table 8 Short description of candidate benchmarks

NO	Benchmark	Short Description
1	Environmental objective setting	The extent to which the EPR scheme defines its objective(s) in environmental terms.
2	Economic objective setting	The extent to which the EPR scheme defines its objective(s) in (specific) economic terms.
3	Cost coverage of removing litter	The extent to which PRO fees as opposed to municipalities are able to cover the cost of removing litter
4	Administrative burden of compliance on companies	The extent to which the administrative obligations of companies participating in a PROs (such as reporting and communications) are burdensome.
5	EPR fees invested in reuse/repair infrastructure	The extent to which the PRO is investing in reuse/repair of received products
6	Scope of application of EPR rules	The way that rules on EPR are applicable and/or vary in terms of the size of the actor (producer, PRO, retailer, etc.)
7	Measures against free riding	The extent of measures in the EPR system to ensure compliance/avoidance of free riding
8	Active measures to enforce EPR rules	The extent of measures other than reporting and monitoring that are specific to addressing free riding (visible fees)
9	Product design requirements	The granularity with which the composition of the product is governed
10	Eco-modulation	how advanced is an eco-modulation system and its implementation
11	Digital product passport	The extent to which the deployment of DPP for implementing EPR is determined
12	Awareness raising	The extent to which the EPR scheme sets requirements to raise awareness among consumers and other stakeholders
13	Labelling rules (mandatory)	The scope of a mandatory label in terms of EPR-related actions (e.g. takeback, segregation, etc.)
14	Rules on re-use	The ambition, granularity and stringency of reuse related rules.
15	Re-use results	Quantity and quality of products collected by the EPR system that is diverted to re-use
16	Rules on collection and takeback	The extent to which the EPR system governs takeback and collection
17	Diversion result	The quality, quantity and prices of EPR-covered waste, which the EPR system is able to divert
18	Collection result	The quality and quantity of the EPR-relevant waste that is collected back
19	Rules on recycling	The extent to which the scheme has rules on recycling
20	Recycling result	The quantity, quality and/or price of recyclate
21	Rules on refurbishing	The extent to which the system has specified a refurbishing target and its achievement
22	EOL-related standards	The extent to which the system specifies and implements an EOL treatment requirement
23	Monitoring on EPR	The extent to which there are requirements to monitor the implementation of and performance in EPR
24	Reporting	The extent to which there are requirements to report on the implementation of and performance of a EPR system
25	Transparency and data quality	The extent to which the EPR system allows access to its procedures, data, and enforcement actions, and the reliability of such data
26	Environmental impacts	The impacts of EPR system on relevant aspects of the biophysical environment
27	Cost effectiveness	The ratio of the EPR goals achieved to the costs incurred

### 5.3 Methodological details on the sensitivity analyses conducted

As explained in section 3.1.2.2, various sensitivity analyses were conducted using different score calculation methods:

- sum total of scores given on the 1–5 scale (preserves magnitude differentials across benchmark scores);
- rank order of benchmarks (removes magnitude differentials by normalising benchmark score differentials);
- sum total of rank order scores (produces a rank order of benchmark rank orders across team members and the institutions they belong to).

In the end, eight different sets of results were produced:

- Set 1 - The score sets of each expert without weighing (the baseline scenario)
- Set 2 - The score sets of experts without weighing (the baseline scenario), but using the mean score of individual team member from the same institution
- Set 3 - Rankings of benchmarks in the baseline scenario and the five scenarios described above, based on the scores of all team members per benchmark (six in total)

Sensitivity analyses across the sets of scores:

1. Aggregate rank orders of seven team members and weighting as in Table 4
2. Rank order of sum of scores, when grouping team members into institutions they belong to (VUB, ACR+, WF)
3. Rank order/averages of all team members per benchmark without weighting ('baseline scenario')
4. Overall points of all team members across the baseline and all five scenarios, rank order
5. Rank of the combinations of the above four calculations by individual team members (including the co-efficient on the scenarios (see Table 3)
6. Combination of 1, 3, and 4 above, using combined rank orders while giving each equal weight
7. Combination of 1-4 above, using combined rank orders while giving each equal weight

It was discussed whether individual team member scores (Set 1) or institutional scores (set 2) should be taken as the basis as this choice altered the selection of benchmarks to some degree. In addition, institutional scores for each attribute (N = 13) were calculated and displayed as a heatmap to examine whether any institution had consistently favoured an attribute by scoring it on an outlier magnitude. No bias was detected. Inter-rater reliability on attributes was good, except for minor divergences on the attribute 'resilience' and one attribute on the confounding factors. It was decided that the results from the different ways of ranking the benchmarks would be combined for the final ranking of the candidate benchmarks. Therefore, on the one hand, no specific way of calculation was given preference; on the other hand, this allowed choosing benchmarks that were

the most robust, i.e., those that were consistently among the top candidates, regardless the calculation method used. It can be seen in the table below, two of the benchmarks ranked in the top 5 in all five calculations (monitoring in EPR systems and rules on recycling) while five others (active measures to enforce EPR rules, collection results, transparency and data quality, product design requirements and recycling results) also ranked in top.

Figure 2 Benchmarks which were ranked highest in different scorings

IN ALL 5 CALCULATIONS	4 TIMES OR MORE	3 TIMES OR MORE	2 TIMES OR MORE	AT LEAST ONCE
Monitoring	Monitoring	Monitoring	Monitoring	Monitoring
Rules on recycling	Rules on recycling	Rules on recycling	Rules on recycling	Rules on recycling
		Active measures to enforce EPR rules	Active measures to enforce EPR rules	Active measures to enforce EPR rules
		Collection result	Collection result	Collection result
		Transparency and data quality	Transparency and data quality	Transparency and data quality
		Product design related requirements	Product design related requirements	Product design related requirements
		Recycling result	Recycling result	Recycling result
			Digital product passport	Digital product passport
				Rules on re-use
				Diversion result
				Reporting
				Environmental objective setting

The figure below provides the long list of benchmarks and their ranking as a result of different calculations.

Figure 3 Overview of rankings based on robustness checks/different calculations.

Rankings in top 3 marked with red, top 4-6 marked with blue and 7-10 marked yellow.

	(A) AGGREGATE RANK ORDERS of 7 ANALYSTS, WEIGHING 1-3 AND 1-5	(B) RANK of SUM OF SCORES WHEN GROUPED INTO 3 (VUB, ACR+, WF)	(C) RANK ORDER / AVERAGES OF ALL ANALYSTS PER BENCHMARK WITHOUT MULTIPLIERS (BASE)	(D) RANK ORDER OF ALL ANALYSTS ACROSS ALL FIVE SCENARIOS	(E) RANK OF THE COMBINATIONS OF ALL FOUR CALCULATIONS
Rules on recycling	4	2	2	2	1
Monitoring on EPR	1	4	2	4	2
Product design related requirements	6	10	2	1	3
Collection result	4	1	6	8	3
Active measures to enforce EPR rules	2	5	6	7	5
Transparency and data quality	10	7	1	3	6
Recycling result	2	3	6	15	7
Digital product passport	10	11	2	6	8
Environmental objective setting	15	9	6	5	9
Reporting	10	6	12	9	10
Rules on re-use	6	13	6	12	11
Diversion result	6	8	12	14	12
EOL-related standards	19	18	6	9	13
Rules on refurbishing	15	14	14	11	14
Re-use result	14	12	14	17	15
Environmental impacts	15	17	14	19	16
Rules on collection and takeback	25	15	14	12	17
Economic objective setting	19	19	18	15	18
Measures against free riding	19	17	18	18	19
Ecomodulation	19	21	18	20	20
EPR fees invested in reuse/repair infrastructure	19	21	18	24	21
Awareness raising	19	21	21	22	22
Scope of application of EPR rules	25	16	21	21	23
Cost coverage of removing litter	25	20	21	23	24
Cost effectiveness	25	21	18	25	24
Administrative burden of compliance on companies	25	21	21	26	26
Label (mandatory, scale of actions)	25	21	21	27	27

## 6 Bibliography

### **References cited in this report**

Brown, Andrew, Laubinger, Frithjof and Börkey, Peter (2023), 'New Aspects of EPR: Extending producer responsibility to additional product groups and challenges throughout the product lifecycle', *OECD Environment Working Papers*, No. 225, OECD Publishing, Paris, <https://doi.org/10.1787/cfdc1bdc-en>.

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

European Court of Auditors Website (no date). 'Benchmarking' Ref.36.700, available at: <https://methodology.eca.europa.eu/aware/PA/Pages/Examination/Benchmarking.aspx> (last accessed: 21.01.2026)

Joltreau, Eugénie, Jukka, Antti and Kalimo, Harri. (Forthcoming). Extended Producer Responsibility for Food Packaging. In: D.S.Lee & K.L.Yam 'Encyclopedia of Food Packaging: State of the Art in Science and Technology. (Elsevier)

Mallick, Pravin K., Salling, Kim B., Pigosso, Daniela C.A., and McAlloone, Tim C. (2024). 'Designing and operationalising extended producer responsibility under the EU Green Deal.' *Environmental Challenges*. 16. <https://www.sciencedirect.com/science/article/pii/S2667010024001434>

Mickwitz, Per. (2003). 'A Framework for Evaluating Environmental Policy Instruments: Context and Key Concepts.' *Evaluation*. 9(4). <https://doi.org/10.1177/135638900300900404>

OECD. (2001). *Extended Producer Responsibility. A Guidance Manual for Governments*. Paris: OECD.

Patton, Michael Quinn. (2015). *Qualitative Research & Evaluation Methods. Integrating Theory and Practice* (4<sup>th</sup> ed). Utilization-Focus Evaluation, Saint Paul, MN.

Pruess, Jakob. (2023). 'Unraveling the complexity of extended producer responsibility policy mix design, implementation, and transfer dynamics in the European Union.' *Journal of Industrial Ecology*. 27(6): 1500-1520. <https://onlinelibrary.wiley.com/doi/10.1111/jiec.13429>

Ramasubramanian, Brindha, Tan, Jovan, Chellappan, Vijila and Ramakrishna, Seeram. (2023). 'Recent Advances in Extended Producer Responsibility Initiatives for Plastic Waste Management in Germany and UK.' *Materials Circular Economy*. 5(6). <https://link.springer.com/article/10.1007/S42824-023-00076-8>

### **Potential references for upcoming EPR benchmarking study**

Adrain, Rachael H., Grimaud, Guilhem, Leal, Jorge M., Pompidou, Stéphane, Charbuillet, Carole, Laratte, Bertrand, Alix, Thecle and Perry, Nicholas. (2019). 'Influence of scope definition in recycling rate calculation for European e-waste extended producer responsibility.' *Waste Management*. 84: 256-268. <https://doi.org/10.1016/j.wasman.2018.12.002>

Ahlers, Julian, Hemkhaus, Morton, Hibler, Sophia and Hanrak, Jürgen. (2021). *Analysis of Extended Producer Responsibility Schemes. Assessing the performance of selected schemes in European and EU countries with a focus on WEEE, waste packaging and waste batteries*. Adelphi Consult 7GmbH. [https://erp-recycling.org/wp-content/uploads/2021/07/adelphi\\_study\\_Analysis\\_of\\_EPR\\_Schemes\\_July\\_2021.pdf](https://erp-recycling.org/wp-content/uploads/2021/07/adelphi_study_Analysis_of_EPR_Schemes_July_2021.pdf)

Atlantic Canada Electronic Stewardship. (2013). *Research and recommendations for performance measures for regulated, industry-led, end-of-life electronics recycling programs in Canada*. Winnipeg, Manitoba, Canada, InterGroup Consultants Ltd.: 85. <https://books1.scholarsportal.info/viewdoc.html?id=616105>

Baum, Heinz-Georg and Schuch, Dieter. (2017). 'On the importance of adjusting for distorting factors in benchmarking analysis, as illustrated by a cost comparison of the different forms of implementation of the EU Packaging Directive.' *Waste Management & Research* 35(12): 1266-1277. <https://pubmed.ncbi.nlm.nih.gov/29100481/>

Colelli, Francesco, P., Croci, Edoardo, Pontoni, Federico B., and Zanini, Sara F. (2022). 'Assessment of the effectiveness and efficiency of packaging waste EPR schemes in Europe.' *Waste Management*. 148: 61-70 <https://www.sciencedirect.com/science/article/abs/pii/S0956053X22002720>

Compagnoni, Marco. (2022). 'Is Extended Producer Responsibility living up to expectations? A systematic literature review focusing on electronic waste.' *Journal of Cleaner Production*. 367. <https://www.sciencedirect.com/science/article/abs/pii/S0959652622026907>

Croci, Edoardo, Colelli, Francesco, Zanini, Sara F., Pontoni, Wilts, Henning, Schinkel, Jennifer and Turrini, Stefano. (2022). *Screening the efficiency of packaging waste in Europe*. GREEN Research Centre of Bocconi University Consorzio Nazionale Imballaggi (CONAI): 77. [https://www.conai.org/wp-content/uploads/2022/06/Study\\_CONAI\\_BOCCONI\\_final\\_report\\_EN.pdf](https://www.conai.org/wp-content/uploads/2022/06/Study_CONAI_BOCCONI_final_report_EN.pdf)

Environmental Research & Education Foundation. (n.d.). *Extended Producer Responsibility Literature Review*. <https://erefdn.org/product/project-summary-extended-producer-responsibility-literature-review/>

ERION. (n.d.). *ERION VISION 2050: Past, present and future of Extended Producer Responsibility Systems*. [https://erion-media.s3.eu-south-1.amazonaws.com/wp-content/uploads/2024/06/EPR-2023\\_UK\\_int.pdf](https://erion-media.s3.eu-south-1.amazonaws.com/wp-content/uploads/2024/06/EPR-2023_UK_int.pdf)

Eunomia. (n.d.). *European Commission – Establishing best practice policy for extended producer responsibility across the EU*. <https://eunomia.eco/our-clients/european-commission-establishing-best-practice-policy-for-extended-producer-responsibility-across-the-eu/>

Eunomia. (2025). *Extended Producer Responsibility Administrative Burden and One Stop Shops. A Study for Ecommerce Europe*. [https://ecommerce-europe.eu/wp-content/uploads/2025/06/EPR-Administrative-Burden-Study\\_v5.0-CLEAN.pdf](https://ecommerce-europe.eu/wp-content/uploads/2025/06/EPR-Administrative-Burden-Study_v5.0-CLEAN.pdf)

European Commission. (2014). *Development of Guidance on Extended Producer Responsibility (EPR). Final Report*. [https://ec.europa.eu/environment/pdf/waste/target\\_review/Guidance%20on%20EPR%20-%20Final%20Report.pdf](https://ec.europa.eu/environment/pdf/waste/target_review/Guidance%20on%20EPR%20-%20Final%20Report.pdf)

European Commission. (2022). *COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Accompanying the document Proposal for a Regulation of the European Parliament and Council on packaging and packaging waste, amending Regulation (EU) 2019/1020, and repealing Directive 94/62/EC. SWD(2022) 384 final*. <https://environment.ec.europa.eu/system/files/2022-11/Impact%20assessment%20accompanying%20the%20proposal%20-%20part%202.pdf>

European Commission. (2025). *Study supporting the evaluation of Directive 2012/19/EU on waste electrical and electronic equipment (WEEE). Final Report.*

[https://environment.ec.europa.eu/document/download/8572b5bb-2416-44a7-aaa8-5e8f8a4661c4\\_en?filename=Study%20supporting%20WEEE%20evaluation\\_Final%20report.pdf](https://environment.ec.europa.eu/document/download/8572b5bb-2416-44a7-aaa8-5e8f8a4661c4_en?filename=Study%20supporting%20WEEE%20evaluation_Final%20report.pdf)

Hesterman, Bryce, Dimino, Resa and Ricchi, Katy. (2020). *Impact of EPR for PPP on Recycling Rates.* Ann Arbor, Michigan, USA, Resource Recovery Systems

(RRS): 4. <https://www.oregon.gov/deq/recycling/Documents/rscRRSrates.pdf>

Huang, Zimin (Natalie), Atasu, Atalay and Toktay, Beril L. (2019). 'Design Implications of Extended Producer Responsibility for Durable Products.' *Management Science*. 65(6).

<https://pubsonline.informs.org/doi/abs/10.1287/mnsc.2018.3072>

Ikpe, Elias, Jatinder Kumar, and George Jergeas. (2015). 'Benchmarking Projects: How to Apply It on Non-Industrial Projects.' *Business and Management Horizons* 3 (1): 24. <https://doi.org/10.5296/bmh.v3i1.7704>.

Jetmarová, Barbora. (2011). 'Comparison of Best Practice Benchmarking Models.' *Problems of Management in the 21st Century* 2 (1): 76–84. <https://doi.org/10.33225/pmc/11.02.76>.

Joltreau, Eugénie. (2022). 'Extended Producer Responsibility, Packaging Waste Reduction and Eco-design.' *Environmental and Resource Economics*. 83: 527-582. <https://link.springer.com/article/10.1007/s10640-022-00696-9>

Lankford, William. 2022. 'Benchmarking: Understanding the Basics.' *The Coastal Business Journal* 1 (1). <https://digitalcommons.coastal.edu/cbj/vol1/iss1/8>

Laubinger, Frithjof, Brown, Andrew, Dubois, Maarten and Börkey, Peter. *Modulated fees for Extended Producer Responsibility schemes (EPR)*. OECD Environment Working Papers No. 184.

[https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/11/modulated-fees-for-extended-producer-responsibility-schemes-epr\\_bbf84337/2a42f54b-en.pdf](https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/11/modulated-fees-for-extended-producer-responsibility-schemes-epr_bbf84337/2a42f54b-en.pdf)

Lorang, Shari, Yang, Zhang, Zhang, Hua, Lü, Fan and He, Pinjing. (2022). 'Achievements and policy trends of extended producer responsibility for plastic packaging waste in Europe.' *Waste Disposal & Sustainable Energy*. 4: 91-103. <https://link.springer.com/article/10.1007/s42768-022-00098-z>

Mallick, Pravin K., Salling, Kim B., Pigosso, Daniela C.A., and McAlloone, Tim C. (2024). 'Designing and operationalising extended producer responsibility under the EU Green Deal.' *Environmental Challenges*. 16. <https://www.sciencedirect.com/science/article/pii/S2667010024001434>

Massarutto, Antonio. (2014). 'The long and winding road to resource efficiency – An interdisciplinary perspective on extended producer responsibility.' *Resources, Conservation and Recycling*. 85:11-21 <https://doi.org/10.1016/j.resconrec.2013.11.005>

OECD. (2003). *Proceedings of OECD seminar on extended producer responsibility: EPR programme implementation and assessment: Part 1: Taking stock of operating EPR programmes.* Paris, Organisation for Economic Cooperation and Development (OECD).

[https://one.oecd.org/document/ENV/EPOC/WPNEP\(2003\)10/PART1/FINAL/en/pdf](https://one.oecd.org/document/ENV/EPOC/WPNEP(2003)10/PART1/FINAL/en/pdf)

OECD. (2003). *Proceedings of OECD Seminar on Extended Producer Responsibility, EPR: Programme Implementation and Assessment. PART 2: Assessing EPR Policies and Programmes.* Paris, France,

Organisation for Economic Co-operation and Development (OECD).

[https://one.oecd.org/document/ENV/EPOC/WPNEP\(2003\)10/PART2/FINAL/en/pdf](https://one.oecd.org/document/ENV/EPOC/WPNEP(2003)10/PART2/FINAL/en/pdf)

OECD. (2024). *Extended Producer Responsibility: Basic facts and key principles*.

[https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/04/extended-producer-responsibility\\_4274765d/67587b0b-en.pdf](https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/04/extended-producer-responsibility_4274765d/67587b0b-en.pdf)

Policy Hub. (2019). *A common framework for EPR in the apparel and footwear industry*. <https://fesi-sport.org/wp-content/uploads/2021/12/EPR-policy-recommendations-December-2019.pdf>

PRO Europe. (2025). *Participation Costs Overview 2025*. Brussels, Belgium, PRO Europe s.r.l.: 46. <https://www.pro-e.org/files/PRO-Europe-Participation-Costs-Overview-2025.pdf>

Pruess, Jakob T., Garrett, Rachael D. (2025). 'Potential effectiveness of extended producer responsibility: An ex-ante policy impact analysis for plastic packaging waste in Belgium, France, and Germany.' *Resources, Conservation and Recycling*. 219: <https://www.sciencedirect.com/science/article/pii/S0921344925001764>

Purwanto, Agus. (2020). 'Benefit of Benchmarking Methods in Several Industries: A Systematic Literature Review.' SSRN Scholarly Paper No. 3986775. Social Science Research Network. <https://papers.ssrn.com/abstract=3986775>.

Repair EU. (2024). *Reforming Extended Producer Responsibility Schemes to Promote Repair*.

<https://repair.eu/news/reforming-extended-producer-responsibility-schemes-to-promote-repair/>

Rubio, Sergio, Ramos, Tânia R.P., Leitão, Manuel M. R., Barbasa-Pavoa, Ana Paula. (2019). "Effectiveness of extended producer responsibility policies implementation: The case of Portuguese and Spanish packaging waste systems." *Journal of Cleaner Production*. 210. 217-230.

<https://www.sciencedirect.com/science/article/abs/pii/S0959652618333328>

Runkel, Macro. (2003). 'Product Durability and Extended Producer Responsibility in Solid Waste Management.' *Environmental and Resource Economics*. 24: 161.182.

<https://link.springer.com/article/10.1023/A:1022800206337>

Saidani, Michael, Kendall, Alissa, Yannou, Bernard, Leroy, Yann and Cluzel, François. (2019). 'Management of the end-of-life of light and heavy vehicles in the U.S.: comparison with the European union in a circular economy perspective.' *Journal of Material Cycles and Waste Management*. 21(6): 1449-1461. <https://doi.org/10.1007/s10163-019-00897-3>

Smith, Stephan. (2005). *Analytical framework for evaluating the costs and benefits of extended producer responsibility programmes*, Organisation for Economic Co-operation and Development (OECD).

[https://one.oecd.org/document/ENV/EPOC/WGWPR\(2005\)6/FINAL/en/pdf](https://one.oecd.org/document/ENV/EPOC/WGWPR(2005)6/FINAL/en/pdf)

The World Bank. (2022). 'The Role of Extended Producer Responsibility Schemes for Packaging towards Circular Economies in APEC.'

<https://documents1.worldbank.org/curated/en/099640003102239957/pdf/P1709940b3dbd3092083b208e60bcd5719a.pdf>

World Benchmarking Alliance. (2024). 'Methodology for the 2024 Financial System Benchmark'

[https://assets.worldbenchmarkingalliance.org/app/uploads/2024/05/2024-FSB-methodology-V2024\\_1.pdf](https://assets.worldbenchmarkingalliance.org/app/uploads/2024/05/2024-FSB-methodology-V2024_1.pdf)

Zero Waste Europe. (2025). *Designing EPR to foster the EU's competitiveness and strategic autonomy*.  
<https://zerowasteurope.eu/library/designing-epr-to-foster-the-eus-competitiveness-and-strategic-autonomy/>  
<https://zerowasteurope.eu/library/designing-epr-to-foster-the-eus-competitiveness-and-strategic-autonomy/>  
<https://zerowasteurope.eu/library/designing-epr-to-foster-the-eus-competitiveness-and-strategic-autonomy/>

# LIFE 4.EPR

