INDICATORS AND METHODS FOR MEASURING TRANSITION TO CLIMATE NEUTRAL CIRCULARITY

Task 5: Case-study group PSS3

Report for: DG RTD, Directorate B – Healthy Planet, Unit B1: Circular Economy & Biobased Systems

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1. INTRODUCTION

The transition to a circular economy (CE) must occur on multiple levels, from households and individual consumers to national and cross-border ecosystems. Measuring and monitoring the development of this transition is an ambitious task, ideally supported by indicators relevant to all steps in that process.

This case study is one of 19 developed for a research project into "*Indicators and methods for measuring transition to climate neutral circularity, its benefits, challenges and trade-offs*". It provides a detailed summary of the development and testing programme conducted for Group 3 of the Product Service Systems sub-policy area during Task 5 of the project. The primary purpose of this case study is:

1. Provide an overview of the testing and monitoring method adopted for each indicator.
2. Outline the key results and performance of each indicator.
3. Highlight any challenges or lessons learnt from identifying, planning, delivering and analysing the relevant methodology for each indicator.

The aim of Task 5 is to take the learnings of all other Tasks thus far and develop and test the new indicators identified in Tasks 3 and 4 as having the potential to enable a deeper understanding of the three facets of circularity for the five key approaches. This case study is a direct output of Task 5.

This case study focuses on the following 3 indicators outlined in Table 1.

Table 1. Overview of case-study group 3 (PSS 4, 7-8)

URN		Indicator name	Methodology	Level of implementation				
				EU	National	City / Region	Companies	Household
PSS4	1	EU project funding allocated to research and development (R&D) projects on PSS	Desk research	X				
PSS8	2	No. of countries that have included PSS in their national CE strategies	Desk research		X			
PSS7	3	No. of public financial incentives directed at PSS providers/models	Desk research		X			

2. INDICATOR 1 – EU PROJECT FUNDING ALLOCATED TO RESEARCH AND DEVELOPMENT (R&D) PROJECTS ON PSS

Indicator: PSS4 - EU project funding allocated to research and development (R&D) projects on PSS

This indicator measures the EU investment for research and development registered in the CORDIS database, which includes and specifies project elements concerning Product Service Systems (PSS).

Research & Development (R&D) activities are seen as drivers for change that may support creating a more circular and sustainable future as outlined in the European Commission's Circular Economy Action Plan (CEAP). R&D funding can facilitate the development of knowledge and understanding of the potential of PSS models, as well as the development of innovations and new PSS solutions across industries. This may secure greater implementation and use of PSS models in the European and global economy, ultimately contributing to the goals of the CEAP.

EU institutions are significant contributors to R&D across Member States, with multiple programmes that fund a variety of business sectors and research areas.

The key potential benefits of monitoring this indicator are:

- Tracking how much funding is given to projects that include elements of PSS.
- If proven useful, this methodology may also be applied to monitor funding directed toward other core areas of the CEAP.
- Providing insight to allow targeting of potential gaps in funding to further facilitation a transition to PSS as business-as-usual.

2.1 KEY METHODOLOGY

2.1.1 Testing method

System Boundary

The indicator is measured at an EU level, with data collected on funding provided by EU institutions. The direct focus on the EU serves to assess the alignment of EU policy priorities and funding.

Methodology

The methodology maps and assesses publicly available information on funded projects in the Community and Development Information System (CORDIS) (n.d.). The CORDIS database provides information on all EU-funded research and development projects - from FP1 to Horizon Europe. The approach allows the utilisation of the database's large amount of readily available data directly linked to the indicator's focus.

2.1.2 Data collection method

The CORDIS database provides multiple methods of searching for EU-funded projects and their results and activities. The database search function can be used to identify reports, activity descriptions, deliverables, and high-level "project profiles" with an overview of project-related information, descriptions of, and links to more information.

The research has focused on the project profiles as this provides the best balance between enabling a qualitative assessment of the projects' content and the effectiveness of the data collection.

Keyword used were:

- "Product Service Systems".
- "'Servitisation' AND NOT 'Product Service Systems'".
- "'Circular Business Model' OR 'Circular Business Models' AND NOT 'Product Service Systems'".
- "'PaaS' AND NOT 'Product Service Systems'".

The term 'Product Service Systems' was added as an exclusion criterion for the other search terms to avoid overlapping the identified projects with each term. *"Product-as-service"* is the term used in the CEAP, but when applying this term in CORDIS, the database delivered tens of thousands of results when hyphens are included in the search. Without hyphens (i.e. *Product as service)* zero search results appear. A review of projects listed when searching "Product as service" indicated that many of them were not related to the research. Thus, it was decided not to use this term.

The search was filtered only to provide project profiles (and not reports and other documents). Data collection was conducted on 22nd and 23rd January 2024. All project profiles listed from these searches were analysed.

The project profiles had a substantial amount of information with reference to the EU programme they support, a list of project participants, the funding scheme and much more. The information fields mainly used to assess the relevance of the projects included the following fields on the primary Fact Sheet page:

- Project description.
- Objective.
- Fields of science.
- Keywords.

Some projects included multiple other pages on 'Reporting' and 'Results' with links and descriptions of their deliverables, activities, reports, and publications. The information on these pages were used to the extent necessary to understand the projects' substance, but the evaluation emphasised the 'Fact Sheet' pages.

A high-level assessment was conducted to evaluate the projects' specific relation to PSS. Inspired by the Rio Markers System (Directorate-General for International Partnerships, n.d.), the projects were given a percentage score of 0, 33, 67, or 100. This enables a rough calculation of the amount of funding directed at PSS per project, even if projects were focused on a variety of topics or had incomplete project descriptions.

The findings were mapped in a Microsoft Excel sheet with the columns Project ID, Project name, Start month/year, End month/year, EU Project Contribution, and Evaluated share of PSS elements in the project.

Central to the conclusions is an assessment of the distribution of the project funding across the years. The total amount for all projects gave a running total for funding to PSS R&D, which may be a relevant indication for progress over time. Another illustration of the development can be given by providing annual data based on projects' start years.

In brief, the step-by-step data collection method included:

1. Search the CORDIS database for the defined keywords one by one.
2. Apply filter to view only project profiles.
3. Assess all projects that appear and evaluate the project profiles for PSS elements.
4. Collect project data in an Excel sheet.
5. Score each project based on the level of PSS elements.
6. Calculate and analyse the data relevant to conclude and report on the indicator.

2.1.3 Calculations

The main output is an estimate of EC project funding for PSS R&D. The data collection from the CORDIS database provided a figure for the total EU funding contribution per project, and project scoring gave an approximation of how large a percentage of the funding was directed at PSS elements.

The total EU funding contribution was multiplied by the scoring percentage to calculate the funding amount directed at PSS R&D:

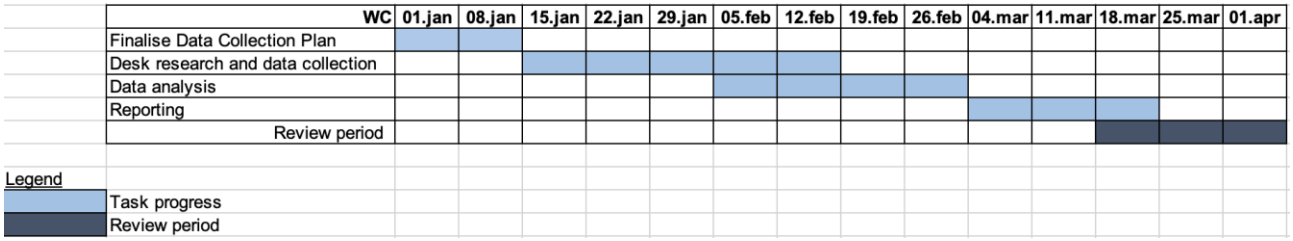
$$Scoring\ \% * EU\ Contribution\ in\ € = Contribution\ to\ R\&D\ on\ PSS\ in\ €$$

This calculation was carried out individually for each project and summarised in a total for all the identified projects to give an approximate result for the indicator.

2.1.4 Timeline

The testing phase was conducted as outlined in the Gantt chart in Table 3. Data collection took place in January and February 2024, and analysis and reporting took place in February and March 2024.

Table 2. Gantt chart - PSS4



2.1.5 Data gaps and mitigation

The CORDIS database was found to be the most relevant and comprehensive data source for this indicator since it is the "*European Commission's primary source of results from the projects funded by the EU's framework programmes for research and innovation, from FP1 to Horizon Europe*" (CORDIS, n.d.). Thus, it is expected that there will be minimal data gaps only in terms of the gross list of funding projects being searched. As an alternative to using the CORDIS search functions, it is possible to download the datasets that the CORDIS database builds on (Publications Office of the European Union, n.d.), but an assessment of this methodology showed no significant benefits.

PSS models can be described in multiple ways, and applying a limited selection of search terms implies a risk of missing out on some relevant projects. The keywords applied include the main and common alternative formulations, sufficient to capture of the main part of projects with a substantial share of PSS elements.

The scoring of projects for PSS elements is based on a qualitative review of the available high-level information on the project. This involves a degree of uncertainty and risk of data gaps compared to a more detailed analysis of the projects (e.g. by reviewing the tender proposal, budget, and final reports). The methodology was chosen to reach a reasonable balance of cost-effectiveness and precision. No direct mitigation efforts are feasible in practice considering necessary resources, since the alternative methodologies wouldn't be generalisable to all projects (e.g. interviews with project owners or review of all project documents of a random sample of projects).

However, one action that was taken to mitigate the data gap indirectly was to provide a result for EU funding for PSS R&D, which included the sum of all projects scoring above 0 in terms of PSS elements. This alternative approach tracked all projects with any PSS element. The result of this approach lacked the granularity that the scoring model provides, which is necessary to give a full understanding of PSS funding amounts for qualitative reasons but avoids any risk of bias from the evaluations. Thus, depending on priorities for the indicator tracking, either approach may be chosen.

Table 3. Overview of identified data gaps, limitations and mitigation efforts.

	Description of data gap	Mitigation efforts	Level of confidence
1	Risk of incomplete database of funded projects	Data collection conducted in the most comprehensive database and alternatives reviewed.	High
2	Risk of incomplete list of identified projects due to keyword selection	Common definition of the term and alternatives used	Medium
3	Risk of inaccurate scoring of percentage of PSS elements in reviewed projects	The overall results on the EU funding amount to PSS R&D is provided based on both a scoring model of projects and a	Medium

	Description of data gap	Mitigation efforts	Level of confidence
		binary model where the full funding amount is given scoring for PSS is above 0.	

2.1.6 Quality review of analysis

To ensure robust and high-quality results, we have conducted the following data validation and quality control procedures:

- Prior to work beginning, the Project Director (Jess Twemlow) reviewed the proposed research methodology and ensured that the data collection plan was fit for purpose. Once the research team addressed any comments from the review process, they proceeded to the data collection phase.
- Project Coordinator Bjørn Bauer oversaw the data collection phase to ensure that the collected data and analysis conducted was of a high standard and provided useful content for the final case study output.
- Andrew Dunwoody is responsible for the quality of the final case study output. Rob Snaith has assisted Andrew Dunwoody in judging the quality of the output and suggested ways to improve.

2.2 KEY ANALYSIS RESULTS

2.2.1 Analysis

The keyword search in the CORDIS database identified 107 projects. See Appendix 5.1 for the full list of projects reviewed.

The identified projects are distributed among the different keywords shown in the Table 4 below. The data for the primary rows (in bold) are the total number of projects identified and the for the categories, whereas the data for the secondary rows represent the distribution of projects on scoring categories within each search term.

Table 4. Results of keyword searches in the CORDIS database.

Search Terms and Scoring	No. of Projects	% of Projects
"'Circular Business Model' OR 'Circular Business Models' AND NOT 'Product Service Systems'"		
0%	47	92%
33%	2	4%
67%	2	4%
Subtotal	**51**	**48%**
"'PaaS' AND NOT 'Product Service Systems'"		
0%	1	17%
33%	3	50%
67%	1	17%
100%	1	17%
Subtotal	**6**	**6%**
"'Product Service Systems'"		
0%	15	47%
33%	2	6%
67%	8	25%
100%	7	22%
Subtotal	**32**	**30%**
"'Servitisation AND NOT 'Product Service Systems'"		
0%	15	83%
67%	2	11%
100%	1	6%
Subtotal	**18**	**17%**
Grand Total	**107**	**100%**

The assessment of PSS content (0-100 %) showed that 73% of the projects from the initial list do not include any elements related to PSS.

Table 5. Distribution of projects among scoring categories.

Scoring Categories	No. of Projects	% of Projects
0%	78	73%
33%	7	7%
67%	13	12%
100%	9	8%
Grand Total	**107**	**100%**

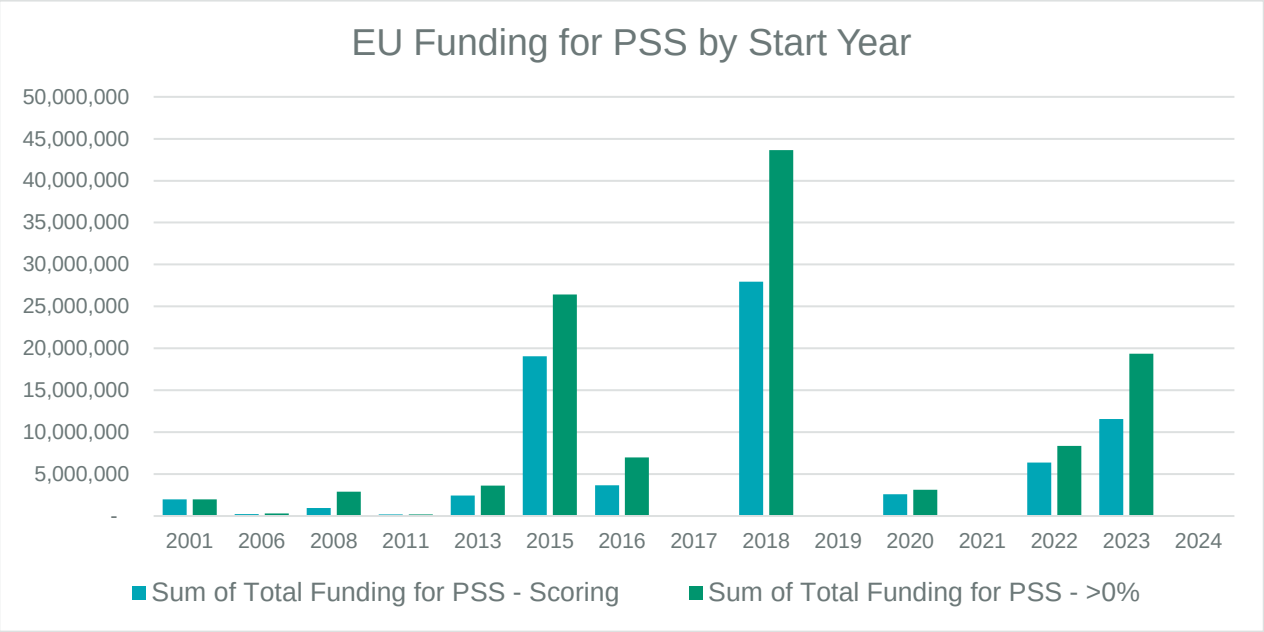
The result, as shown in Table 6, on EU funding for PSS R&D is approximately 74 million euro based on the calculated amount from the scoring of projects, and approximately 117 million if the total project amount is included for all projects scoring above 0%. The first figure is based on the scoring model, whereas the second figure is a total funding amount, when the entire project funding is considered for all projects scoring above 0.

Table 6. Total funding for PSS.

Sum of Total Funding for PSS - Scoring	Sum of Total Funding for PSS - >0%
€ 73,921,259	€ 117,017,294

These total amounts cover all funding for projects that span implementation periods from 2001 to 2027. As explained in Section 2.1.2, the data can also be illustrated with an annual focus based on start year of the projects. The data on start year clearly shows a substantial increase in funding for PSS related projects from 2015 and onwards, corresponding very directly with the establishment of the first CEAP of the EU that same year (Directorate-General for Environment, 2015). This plan included actions and measures to implement the action plan, which explains the increase in funding on PSS R&D. See Figure 1 for a chart of the annual funding.

Figure 1. Yearly EU funding for PSS based on start year



2.2.2 Limitations

The limitations of the collected data have already been described in the previous sections. The limitations mainly relate to the challenges of collecting an authoritative list of projects with PSS substance based on keyword searches and the subjective qualitative assessment of the content of PSS.

Funding from governments and entities within states or international collaborations other than the EU institutions were not investigated. Collecting data from all these entities would add another dimension to the indicator - but is outside the scope of this testing.

While the analysis provides insights into the distribution of funding over time, it does not account for the impact of inflation or changes in purchasing power parity. Adjusting funding amounts for inflation would offer a more accurate representation of the real value of investment over time.

2.2.3 Performance

During the Task 4 project phase, a RACER evaluation of the indicator was conducted. Below is the original evaluation and an updated one based on the insights of Task 5. Following in-depth considerations on data collection, the indicator has been changed slightly in Task 5 to better align with the CEAP and goals of this study, yet the original RACER evaluation is still comparable. Below is a brief assessment of each RACER criteria.

Table 7. RACER evaluation.

Stage of project	RACER criterion					Score
	Relevance	Acceptability	Credibility	Ease	Robustness	
Task 4 (original RACER assessment)	2	2	3	2	1	10*
After Task 5 (following testing)	3	2	2	2	1	10

** The original indicator formulation receiving this RACER score was: "Public R&D spending to support PSS innovation."*

Relevance

Section 6.3 of the CEAP, titled “Driving the transition through research, innovation and digitalisation”, describes how funding for research and innovation will be utilised to support the “whole innovation cycle” to benefit circular innovations. This is aimed at priorities across the topics of the CEAP, including a specific focus on “circular business models.” Thus, the indicator’s focus on R&D funding from the EU for PSS is clearly aligned with the strategic priorities of EU policy, which is a critical element of the Relevance criteria. The indicator also supports higher-value opportunities by indirectly encouraging PSS and efforts to build circular solutions related to the other Relevance criteria.

Acceptability

Based on the same arguments as for the Relevance criteria, and since the indicator is related to the EU’s own funding activities and is based on a data collection method using an EU-controlled database, it can be argued that EU actors should be motivated to implement the indicator. There are clear benefits of increasing transparency regarding the benefits of EU funding to CEAP priorities. The main downsides relate to the administrative costs of implementation, the risks of measuring an indicator based on funding amounts rather than results, and the challenges of scoring projects objectively.

Credibility

The data collection method employed for testing the indicator is not based on an EU-defined methodology, and it involves several issues in terms of reliability and robustness. The results are fairly easy to communicate, but due to the challenges of conducting a scoring and evaluation of projects’ inclusion of specific topics, the score is reduced to “2” (medium) following the testing phase.

Ease

The data in the CORDIS database is readily available and can also be downloaded and manipulated in ways other than those used in this research. However, the PSS content of each project in the CORDIS database is difficult to assess, which is a matter of the availability and quality of the data and the derived relatively high level of resources necessary to assess each project in-depth. Thus, this aspect receives a medium score as data is available but can be difficult to assess.

Robustness

Since there is no consistent methodology or dataset available, there are several challenges related to robustness. It is impossible to assess if the methodology creates a list of all relevant projects to assess, but the scoring on PSS elements illustrated that both relevant and irrelevant projects were identified, indicating that the search terms may have been sufficiently broad. Scoring the EU-funded projects for their content of PSS involves a certain degree of subjective analysis, which reduces the robustness of the methodology. There is a substantial risk related to scoring the projects only looking at one topic. If multiple topics had been considered simultaneously, the scoring on PSS specifically might have been different. Due to these concerns, the approach used for this indicator testing results in a low on this criterion.

Facets of CE

The indicator was supposed to assess transition over time towards more circularity and economic impacts, in terms of the overarching facets of CE. The result analysis showed that the indicator fared well on providing insights on both these aspects.

2.3 CHALLENGES AND LESSONS LEARNED

As described in Section 2.1, especially regarding data gaps and mitigation efforts, there are several challenges related to collecting data on this indicator. These include:

a) There is a risk of not being able to identify all possible projects funded by the EU, which may include elements of PSS, due to the data source used and/or the search terms applied to create the gross list.
b) There is a risk of being unable to accurately score the projects' content of PSS elements in relation to the actual proportion of these elements in the project activities. There is also a risk of overseeing PSS elements due to variations in how these activities are described and/or the projects not using the most common terms on PSS.
c) The ineffectiveness of a manual research model of analysing the project pages within the CORDIS database rather than using methods with a higher degree of automatic analysis.

The mitigation efforts and challenges conducted are seen as sufficient to achieve a satisfactory research result. However, there are some more substantial challenges in terms of how this method is applied and the potential alternatives.

Data collection in CORDIS database

The method of using keyword searches to identify suitable projects for analysis was chosen because it was impossible to use any other in-built element of the database to sort for relevant projects. It is possible to search for specific keywords used to tag projects reported by the project owners using the format "/project/keywords="" in the search. However, appropriate keywords for PSS seem not to have been systematically applied since insufficient results appeared using this method. Several filtering options may be used instead, following a search. These are also pre-registered for the projects and include "fields of science" as the most relevant for a topic-based search. However, none of the options available would be specific enough to give a list of gross projects to investigate for this indicator. Additionally, the datasheets of the CORDIS database can be downloaded for analysis using data management software, giving the opportunity to analyse and map data using other methods. However, due to the lack of systematic registration of data on PSS specifically, it would still require manual analysis of the projects to assess the content of PSS.

The categories in the "fields of science" filter are defined by the European Science Vocabulary (EuroSciVoc). This is the most appropriate high-level information to sort, and it is sufficiently detailed to provide a relevant subset of results. The most appropriate selection for circular economy projects would be "sustainable economy" or "sustainability sciences". However, even though there are, for example, 15,454 results when using the search term "circular", there are no (0) results when filtering for either of these two fields of science. It is worth noting that projects can mark several fields of science, so any single term does not need to capture all aspects of a project. This indicates that these Fields of Science options are not frequently chosen by projects.

Reflections on these challenges and considerations on potential alternative data collection methods and initiatives to reduce the uncertainties of the data collection on the indicator will be discussed in the next section.

2.4 CONCLUSIONS AND RECOMMENDATIONS

It is recommended that this indicator is considered for further development with significant work required to facilitate its progress.

Final indicator formulation:

EU project funding allocated to research and development (R&D) projects on PSS

The indicator is relevant for measuring the implementation of the CEAP on the specific topic of R&D funding in relation to PSS and builds on publicly available information in the CORDIS database managed by the EU. The database covers most projects funded by the EU that may include elements of R&D on PSS, and, thus, provides a good foundation for analysing how much funding is directed at this priority area. Today, it is only

possible to filter the investment data for a limited number of general Thematic Priorities, which does not include subjects specifically on the circular economy.

The testing of the methodology to gather data on the indicator has highlighted several substantial challenges related to identifying data and the reliability of the data analysis, including concerns about the ability to identify all relevant projects and subjectiveness in the scoring of PSS elements in projects. These challenges require further investigation for it to be possible to progress towards the use of the indicator.

If challenges are overcome, the indicator can be used to create increased transparency and granular insights for EU institutions and policymakers on how the strategies and priorities are reflected by the R&D investments. What constitutes an appropriate level of investment is a political question, which itself is an argument for why there should be better monitoring and tracking of investment in more specific topics and thematic priorities. The current EU Circular Economy Monitoring Framework includes indicators related to innovation but does not include any indicators on public/EU investment in R&D despite the emphasis on this in the CEAP. Therefore, the focus of this indicator, despite the deficiencies of the methodology, is relevant to track the alignment of policy priorities with the thematic and priority areas of funding projects.

Recommendations

The potentially best way to ensure an accurate categorisation of projects on the degree to which they target specific priority areas of the CEAP, or other frameworks, will be to ask project owners to categorise the content of the funded projects. This could be done by selecting one or more topics, fields of science or keywords from a comprehensive list that their project activities address and then attributing percentages to each topic. This would allow assessment of the distribution of EU funding to various topics, including PSS and other CEAP priorities. The methodology must balance the necessary use of human resources with granularity in the data, transparency in the categorisation of topics, and alignment with other data being collected, e.g. during the scoring process of funding applications.

To proceed with such an initiative, it would be necessary to consider the perspective of various stakeholders on the relevance of being able to track funding amounts against certain policy areas or topics. The requirements should also be assessed to make the results relevant and useful for each stakeholder group. For example, a scoring method could be based on the EuroSciVoc categories for Fields of Science since this is already an authoritative framework for project categorisation. However, the granularity on certain fields is low, and thus, it is uncertain if the framework would allow for mapping the result of a scoring based on these categories against policy priorities. Recommendations could be developed on whether to adopt the EuroSciVoc categories or other research elements that could involve investigating other new or existing methods for categorising projects.

A hindrance to developing a useful scoring model will be the need to bridge the model for scoring new projects with the need for data on previously funded projects. It would either be necessary to accept a lack of ability to compare new with previously funded projects, or a method for scoring these would need to be developed and implemented. Projects were reviewed based on high-level information and with a lens on one specific topic. Simply due to the vast number of projects funded by the EU, a manual data collection process like this would be unfeasible. An investigation considering a larger number of topics and using a more detailed analysis (e.g. based on reviewing budgets and activity plans) would most likely demand a different data collection method.

Table 8. Summary of recommendations for indicator PSS4.

Type of recommendation	Recommendation	RACER Criteria Addressed	Timeline	Key stakeholders or partners
Research project	Assessing stakeholders' interest in and identifying appropriate methods for tracking the alignment EU funding with of CEAP priorities.	Acceptability, Ease and Robustness	Short (0.5 – 1.5 years)	DG RTD to initiate the research with input given by the various stakeholders (incl. EU Commission, national governments, EU Parliament) on the relevance of the indicator and technical input from EU Publications Office, DG RTD and other stakeholders on the technical aspects of implementing such an indicator.

3. INDICATOR 2 – NO. OF COUNTRIES THAT HAVE INCLUDED PSS IN THEIR NATIONAL CE STRATEGIES

Indicator: PSS8[1] - No. of countries that have included PSS in their national CE strategies

This indicator assesses the inclusion of Product Service Systems (PSS) business models in the national or sectoral CE strategies across EU Member States (MS).

The use of the PSS terminology and its application across product groups and sectors varies a lot and therefore the indicator has a very high-level focus on simply the binary data point of inclusion (i.e. mentioning) of PSS in national strategies. Additionally, it is only recently that the EU and MS have given priority to the circular economy agenda and PSS models are a small subset of circular business models, which are still marginal in the general economy. We do therefore not expect to find significant attention given to PSS in national strategies of EU MS, if the subject is mentioned at all.

Considering these limitations, the goal of the indicator is to provide a very general overview of whether any national strategic attention is given to PSS in the MS. The benefit of testing and analysing the indicator methodology is that it provides insights into MS' strategic priorities and commitments in integrating PSS models into national CE strategies and sustainability efforts. By giving public attention to the MS focus, or lack thereof, on PSS models, the indicator may enhance transparency across MS and give insight into the member states' strategic priorities and commitments.

The indicator does not allow for measuring the quality and extent of the commitments in the strategies, because this would require a standardised framework for the MS national CE strategies, which is not existing. Furthermore, due to the expected low level of presence of PSS in national strategies, a detailed measure with multiple levels, including for example implementation and funding to PSS, would be premature.

The potential benefits of this indicator include:

- The indicator can potentially be combined with other measures, such as indicator PSS7, to monitor multiple aspects of national strategic priority to the area, which can give a more nuanced and detailed understanding.
- Highlight areas of 'exemplar' practice where PSS has been included in national strategies, to encourage wider uptake.

3.1 KEY METHODOLOGY

3.1.1 Testing method

System boundary

This indicator is assessed nationally in three MS. It explores the presence of national action plans for the CE, explicitly focusing on incorporation of PSS or specific PSS models.

Finland, Romania, and Spain were selected to test this indicator and constitute the system boundary for the data collection. The selection of Finland, Romania, and Spain for this case study aimed to capture diverse perspectives on PSS model implementation across different regions/countries within the EU. Finland is generally considered a frontrunner in prioritizing circular economy innovation and will act as a potential best-practice example, where data is expected to be identified. Data availability and proficiency in the national language were additional considerations when selecting these countries.

The specific variances between these countries are of limited importance for any conclusions on the indicator's relevance, but they were also selected for potential synergies in comparing with results on the indicator PSS7.

[1] This indicator, PSS8, is described before PSS7 to allow for a more logical flow from the strategic level of policy (PSS8) to more implementation efforts related to such policies and strategy (PSS7).

Methodology

The indicator was tested using a desk-study approach by collecting data from authoritative sources on a national level. Depending on the reliability and availability of the data, stakeholder consultation via interviews will be conducted to collect additional insights and understand potential data gaps.

3.1.2 Data collection method

Data collection involved comprehensive desk research from authoritative sources. Stakeholders were contacted via email or phone. Data was sourced from the government and ministry websites and from ETC – Circular Economy country profile. Including diverse sources of information enhances the credibility and comprehensiveness of the findings. The same method was used for all three MS.

The definition of keywords/search parameters for data collection was followed by a review of written sources. Findings were collated in a Microsoft Excel sheet with the following columns: keywords, data availability, source, links/websites to the source, PSS within the CE strategy, accessed on/date, and contact details. Refer to Appendix 5.2 for the full framework for data collection.

Below is a description of the specific approach for data collection for each case.

Romania

Desk research

Data was sourced from the Romanian Government website and the Ministry of Environment, Water and Forestry. [2]

The research and data collection were conducted in English and Romanian.

Keywords used for exploring, analysing, and interpreting the collected data for this specific indicator included:

- "Product Service Systems within the Circular Economy Strategy Romania"
- "Product Service Systems" and "Circular Economy Romania"

Despite extensive efforts, no relevant data and information for the indicator were found in English. The Action Plan for the Circular Economy Strategy from the Ministry of Environment, Water, and Forestry is available only in Romania.

Some of the key terms/words in Romanian central to this specific indicator included:

- "Sisteme produs-serviciu în economia circulară"
- "Produs ca serviciu privind economia circulară in Romania"

Consultations

An interview was conducted with a senior advisor on sustainable development from the Government of Romania's Department for Sustainable Development.

Finland

Desk research

The data was sourced from the Ministry of the Environment[3], the Ministry of Employment and the Economy[4], and The Finnish Innovation Fund Sitra[5].

The key search terms/words included:

- "Product Service Systems within the Circular Economy Strategy in Finland".
- "circular economy service models" and "repair services" in Finland.

[2] Ministeru Mediului, Apelor si Pădurilor (https://www.mmediu.ro/ (Accessed on 01-04/2024)

[3] The Ministry of the Environment (https://ym.fi/en/front-page) (Accessed on 01-04/2024)

[4] Ministry of Employment and the Economy (https://tem.fi/en/frontpage) (Accessed on 01-04/2024)

[5]The Finnish Innovation Fund Sitra (https://www.sitra.fi/en/) (Accessed on 01-04/2024)

Consultations

An interview was conducted with a senior specialist in circular economy from the Ministry of the Environment.

Spain

Desk research

Data was sourced from the Directorate for the Circular Economy of the Ministry of Ecological Transition and Demographic Challenge[6], the Ministry of Industry and Tourism[7], and the ETC - Circular Economy Country Profile – Spain[8].

The research and data collection were conducted in English and Spanish.

Key search terms included:

- "Product Service Systems within the Circular Economy Strategies Spain".
- "Product Service Systems" and "Circular Economy Spain".
- "National strategy" or "circular economy strategy" or PSS model" in the "textile" and "industry" or "sector" in Spain" .
- 'National strategy'' or ''circular economy strategy'' or PSS model'' in the ''electrical and electronic equipment'' and ''industry'' or ''sector'' in Spain''.

No pertinent data and information related to the PSS8 indicator were found in English. The Circular Economy Strategy and other sectorial national strategies are exclusively provided in Spanish.

Some of the key terms/words in Spanish central to this specific indicator included:

- "Estrategias de Economía Circular España" y ''Sistemas Producto Servicio" en España".
- "Sistemas Producto Servicio" y "Economía Circular en España".
- "estrategia" o "economía circular" o "modelo PSS" en los sectores "textil" o "industria" o "sector" en España".

Consultations

Stakeholders from the Directorate for the Circular Economy of the Ministry of Ecological Transition and Demographic Challenge and the Ministry of Industry were contacted via e-mail and phone, however arranging an interview proved to be unfeasible.

An email from the Directorate for the Circular Economy of the Ministry of Ecological Transition and Demographic Challenge was received, stating that *"At the moment, we cannot offer you more information than what we have published on the website of the Ministry for Ecological Transition and the Demographic Challenge*.''

3.1.3 Calculations

No calculations were used to assess the indicator.

[6] Directorate for the Circular Economy of the Ministry of Ecological Transition and Demographic Challenge (https://www.miteco.gob.es/)

[7]Ministry of Industry and Tourism – Spain (https://www.mintur.gob.es/en-us/Paginas/index.aspx Accessed on 01-04/2024)

[8]ETC - Circular Economy Country Profile – Spain (https://www.eionet.europa.eu/etcs/etc-ce/products/etc-ce-products/etc-ce-report-5-2022-country-profiles-on-circular-economy/spain-ce-country-profile-2022_for-publication.pdf (Accessed on 01-04/2024)

3.1.4 Timeline

Table 9 illustrates the data collection plan using a Gantt chart format, which occurred during January and February 2024, while the analysis and reporting phases occurred in February and March 2024.

Table 9. Gantt chart - PSS8

	WC	01.jan	08.jan	15.jan	22.jan	29.jan	05.feb	12.feb	19.feb	26.feb	04.mar	11.mar	18.mar	25.mar	01.apr
	Finalise Data Collection Plan														
	Desk research and data collection														
	Stakeholder engagement														
	Data analysis														
	Reporting														
	Review period														

Legend

	Task progress
	Review period

3.1.5 Data gaps and mitigation

Table 10 shows an overview of identified data gaps, limitations, and mitigation efforts.

There is no existing methodology for testing this indicator. The national CE action plans and strategies emerged as the most pertinent and extensive data reservoir for this indicator. It is expected that the overall data collection to be straightforward. However, one significant data gap identified is the lack of publicly available information on the national strategy and/or other relevant strategies. This gap hinders comprehensive analysis and understanding of the subject matter, limiting the ability to assess the effectiveness of current strategies and develop informed recommendations.

To address this data gap, stakeholder consultations are conducted as part of the research process. In cases where data is not readily available, stakeholder engagement becomes crucial for obtaining valuable insights and perspectives. While it may not always be feasible to access relevant stakeholders for interviews, efforts are made to engage with them to the extent possible. Stakeholder consultations offer an opportunity to gather firsthand information, opinions, and experiences related to the indicator measurement.

Table 10. Overview of identified data gaps, limitations and mitigation efforts.

	Description of data gap	Mitigation efforts	Level of confidence
1	Lack of a comprehensive national circular economy strategy to be assessed	Sectoral or industry specific strategies to be identified and assessed as well if necessary	High
2	Lack of publicly available information on the national strategy and/or other strategies	Stakeholder consultations will be conducted in case data is not available. It might not be possible to get access to the relevant stakeholders for interviews, but to the extent this is possible, interviewees are expected to give highly relevant information on the indicator measurement.	High

3.1.6 Quality review of analysis

To ensure robust and high-quality results, Norion and Ricardo conducted the following data validation and quality control procedures:

- Prior to work beginning, the Project Director (Jess Twemlow) reviewed the proposed research methodology and ensured that the data collection plan was fit for purpose. Once the research team addressed any comments from the review process, they proceeded to the data collection phase.
- Project Coordinator Bjørn Bauer oversaw the data collection phase to ensure that the collected data and analysis conducted were of a high standard and provided useful content for the final case study output.
- Andrew Dunwoody held responsibility for the quality of the final case study output. Rob Snaith assisted Andrew Dunwoody in judging the quality of the output and suggesting ways to improve.

3.2 KEY ANALYSIS RESULTS

The national action plans or strategies for the circular economy of the three EU MS were assessed to determine whether PSS or PSS-related business models are included in their national CE strategies.

Table 11. Overview of national action plans or strategies for the circular economy of the three EU MS

Country	Inclusion of PSS models in the CE national strategies	Actions/initiatives towards PSS	Timeline for implementation
Finland	Yes	Yes	Government resolution outlines the key measures that the ministries have committed to implementing for the period of 2021-2024 (Ympäristöministeriö, 2021)
Romania	Yes	Yes	2024-2026
Spain	No mentioning of PSS providers/models and circular business practices in CE strategies	No data available	No data available

3.2.1 Analysis

Romania

According to Romania's national action plan for the CE, the government supports new circular business models, including PSS models, repair services, and take-back/collection of second-hand products, through economic measures and public funding. It is a priority action for the sectors of electronic equipment (EEA) and textiles. The Ministry of the Environment, Water and Forestry has described initiatives for supporting PSS and circular business models in 2024 to 2026 (Ministerul Mediului, Apelor și Pădurilor, 2022).

Regarding EEA, the Romanian Government prioritises and supports the private sector's development of 'product as a service' schemes - business models that allow customers to lease, rent or pay for the use of products without buying and owning the product. Based on experiences with the model of printers (pay-per-page), electric scooters (pay-per-kilometre), lighting, or the 'car-as-a-service' model, the focus is on encouraging other models to be developed in the CE context. This could include 'Equipment-as-a-Service' or 'Appliances-as-a-Service', where the former is a business model that involves renting equipment to end-users and collecting periodic payments for its use (Ministerul Mediului, Apelor și Pădurilor, 2022).

The government has not yet implemented any specific actions based on the strategy, as was highlighted in an interview with a senior advisor from the Government of Romania's Department for Sustainable Development. The government entities are planning to provide initiatives including:

- To develop a digital platform to track and communicate to the public about the implementation of circular business models/PSS models' and actions.
- Guidelines and practical advice for the implementation of critical actions by private sector entities.
- The government entities responsible and involved in the implementation of the action plan will also develop information, including funding sources and opportunities, a list of training and education opportunities for working in the CE and circular business models and a list of knowledge transfer networks for PSS.

The findings clearly show that the PSS is a priority action within Romania's national CE strategy and includes steps to implementing actions to support its realisation.

Finland

In 2021, the Finnish Government enacted the "Government Resolution on the Strategic Programme for Circular Economy" which sets out key priorities for the area and aims to strengthen Finland's role as a pioneer for the CE. The Resolution has a strong focus on PSS with an emphasis on promoting service models within specific fields and encouraging the use of PSS models by citizens (Ympäristöministeriö, 2021).

The Finnish Innovation Fund, Sitra, which was established by and reports directly to the Finnish Parliament, has created a national road map to a circular economy that, among other things, raises awareness regarding PSS models. Sitra emphasises the role of PSS models in several reports and initiatives going several years back, including by highlighting PSS' ability to "*encourage the production of durable, high-quality products*" and "*enable new business opportunities as a result of after-sale services for products and deeper customer relationships*" (Sitra, 2019). Sitra also highlights examples of successful circular businesses utilising PSS models and encourages the development of a strategic programme to promote a circular economy as an opportunity to promote the rethinking of ownership through PSS models Sitra has also developed resources that aim to help businesses transition to circular business models, including PSS models (Sitra, 2024).

The findings clearly show that there is an inclusion of PSS in Finland's national CE strategy and efforts to implement actions supporting the realisation of the goals and priorities regarding PSS in Finland.

Spain

An assessment of publicly available information on Spain's national strategies for the circular economy was conducted. This research did not result in the identification of any PSS elements. Sectoral strategies for various business sectors were conducted as well, also with no identification of references to PSS models/providers or more generally to relevant circular business practices. In other words, no pertinent data related to this specific indicator were identified when investigating publicly available information.

The relevant Spanish ministry in charge of this area, the Ministry for the Ecological Transition and the Demographic Challenge (Ministerio para la Transición Ecológica y el Reto Demográfico) replied to our request for information but did not wish to provide further information beyond that available on the ministry's website.

Based on this research, the conclusion is that there is no inclusion of PSS in the publicly available strategies of Spain related to the circular economy.

3.2.2 Limitations

The testing of the indicator relies on publicly available information on national circular economy strategies and their inclusion of priorities related to PSS. If, for some reason, a national strategy is not publicly available, it won't be identified by the research, unless interviews with key stakeholders reveal such information. This is not itself a limitation, since a lack of publication of a national strategy will indicate that it is not currently being enforced.

In the case of Spain, we were unable to secure an interview which could have confirmed the results that the country does not include PSS in its national strategy.

3.2.3 Performance

During the Task 4 project phase, a RACER evaluation of the indicator was conducted. Below is the original evaluation and an updated one based on the insights of Task 5. Following in-depth considerations on data collection, the indicator has been changed slightly in Task 5. Below is a brief assessment of each RACER criteria. The rating scale ranges from 1 for low, 2 for medium, to 3 for high.

Table 12. RACER evaluation.

Stage of project	RACER criterion					Score
	Relevance	Acceptability	Credibility	Ease	Robustness	
Task 4 (original RACER assessment)	2	2	2	2	1	9*
After Task 5 (following testing)	2	2	1	3	2	10

* Original indicator: “Countries with PSS strategies or action plans”

Relevance

The indicator offers an opportunity to create a high-level overview of the existence of national priorities on PSS among EU Member States. This is aligned with the overarching objectives of the CEAP as it bridges the EU objectives on PSS with the national strategies on the CE, which may be considered the first step for MSs to give priority to the area. By emphasising the promotion of PSS, the indicator targets a high-value-added area with the potential for systemic change. The indicator does not, however, directly measure true circularity and the methodology does not include systematic data on the extent of implementation of the strategies through concrete initiatives.

Therefore, the indicator lacks relevance in this aspect, which results in a medium score.

Acceptability

The indicator's acceptability score relies on its perceived relevance by stakeholders. It is simple in its design and does not require adherence to detailed criteria on specific areas of PSS integration in national strategies. This implies a low barrier for governments, who are the primary stakeholders, to accept the indicator, but it may also result in a lack of support by governments with high ambitions and specific priorities, as they may see it as too broadly defined. For the EU actors, the indicator can serve as a valuable tool for assessing high-level progress and acceptance of PSS as a priority area on a national level. The scoring has been adjusted from 2 (medium) to 1 (low) due to this rationale.

Credibility

There is no existing methodology for testing this indicator. The trustworthiness and completeness of the public information provided by national authorities on their websites was relied on, which is a credible source of information. If the indicator is implemented on an EU level, self-reporting by governments would provide a simple and even more credible measurement.

However, a greater challenge relates to how to measure PSS inclusion in strategies in a way that balances between the need to identify all sufficiently relevant efforts, while avoiding losing the substance by making it too simple to implement. Such efforts are needed to ensure more objective and, thus, credible measurements that are understandable to all stakeholders.

Ease

There is no existing database to extract data from but collecting data on the indicator through desk study approaches, potentially with interviews to triangulate results, is straightforward. The scoring has been adjusted from 2 (medium) to 3 (high) to due to this rationale. Ease might even be further increased if governments self-report on the indicator. The lack of authoritative definitions on what constitutes inclusion of PSS in national strategies creates ambiguity that resulted in some uncertainty for this testing of the indicator, but such unclarity may easily be reduced by relevant stakeholders defining what metrics to consider.

Robustness

The indicator's robustness reflects its ability to withstand variations and uncertainties in data sources and methodologies. The reliability of the information and data provided on the PSS inclusion in the CE strategies by the national authorities ensures the robustness of the data collection process. The scoring has been adjusted from 1 (low) to 2 (medium) due to this rationale.

The indicator has one simple dimension (yes/no), which increases its robustness, but may also entail a methodological unclarity as it involves conceptual ambiguity, which would reduce the robustness. Because the methodology is not based on a scoring system or other granular and comprehensive data on what constitutes “inclusion of PSS”, it cannot be justified to give a high score on the criterion.

3.3 CHALLENGES AND LESSONS LEARNED

Data collection was conducted through desk research with no significant challenges. Attempts to conduct interviews with stakeholders for the Spain case were unsuccessful, leaving the observation that Product Service Systems (PSS) models are not explicitly incorporated into Spain's CE strategy unverified.

The assessment of CE national strategies to determine the inclusion of PSS was straightforward. Additionally, stakeholder interviews helped validate findings, providing insights into the strategy's role, any updates, actions in place towards PSS models and implementation status, thereby minimising data collection challenges.

The research led to considerations on the usefulness of a systematic scoring model of PSS inclusion in strategies to make results more granular and based on a compound of criteria. The absence of such a scoring system was due to the challenge in predicting the diverse ways national strategies might describe and incorporate PSS elements. Therefore, defining a scoring model prior to data collection involves the risk that it will not cover the elements that governments focus on in relation to PSS. However, without this scoring, there is a risk that any mention of PSS results in a positive score, which would quickly reduce the relevance of the indicator.

Despite these considerations, the overall process remained straightforward, facilitating a comprehensive evaluation of the integration and implementation of PSS principles in the national CE strategies.

3.4 CONCLUSIONS AND RECOMMENDATIONS

It is recommended that this indicator is considered for further development, with minor work required to facilitate its progress.

Final indicator formulation:

No. of countries that have included PSS in their national CE strategies

This indicator remains relevant as it is a valuable tool that assesses the high-level integration of PSS in national strategies by governments, which is a direct measure of national alignment with the CEAP and other EU priorities. Considering ongoing initiatives within the EU to support PSS models, ensuring the existence of relevant national frameworks for accelerating their inclusion and adaptation in national initiatives is important. Having PSS included in national strategies gives an indication of the readiness of governments to do so, which makes it a useful indicator at this early stage of implementation of PSS models.

Therefore, assessing and monitoring this indicator holds significance, as national commitments and strategies are the cornerstone for driving local initiatives and guaranteeing a particular focus on the subject matter. This also highlights the importance of evaluating the indicator, as it directly reflects the foundational principles that guide a country's action plans and priorities in advancing their efforts towards circular business models/PSS.

Recommendations

Collecting data on the indicator through a desk study approach is straightforward, when assuming that publicly available information on national strategies is sufficient to score the various MS’ implementation. However, in case the indicator is implemented across EU, it may be necessary to ask MSs to report directly on the indicator to ensure data quality and clarity. Efforts would then be required to advance the indicator by reducing the

ambiguity around what constitutes the inclusion of PSS in national strategies, so the measurement of the indicator becomes more granular and based on objective criteria.

By instituting a streamlined reporting mechanism, countries can provide authoritative and detailed information on including PSS in their CE strategies, assessing PSS progress or whether it should be more focused on different levels of implementation initiatives. This approach simplifies the data collection process and enhances the robustness of the results obtained related to policies and actions.

Additionally, it should be considered to supplement the indicator with multiple measurements, which not only cover inclusion in the national strategies but also measure the actual implementation, outcomes, and follow-up initiatives. Developing additional measurements would require engagement with key stakeholders to define a standardised approach with the most appropriate and common these used regarding PSS and circular business models in national strategies. The goal could be to develop a scoring system with a more detailed assessment of the national strategies.

Table 13. Summary of recommendations for indicator PSS8.

Type of recommendation	Recommendation	RACER Criteria Addressed	Timeline	Key stakeholders or partners
Stakeholder engagement	Engage with national MS ministries and EU institutions to assess the potential of collecting data on and/or including the indicator in reporting mechanisms to advance the inclusion of PSS in national policies and strategies	Acceptability, Ease and Robustness	Short (0.5 – 1.5 years)	DG RTD to initiate a stakeholder engagement process with MS, Eurostat, the European Economic and/or Social Committee (reg. the CE Stakeholder Platform) to guide further development of the indicator.
Developing a scoring system	Developing a scoring system or a set of criteria to evaluate the depth and breadth of PSS integration into national strategies. This system could consider factors like the specificity of actions outlined, allocated funding, implementation timelines and measurable targets.	Credibility and Robustness	Medium term (1,5 – 5 years)	Responsible: DG RTD Accountable: EC Consulted: DG ENV, EU MS Informed: Business Associations

4. INDICATOR 3 – NO. OF PUBLIC FINANCIAL INCENTIVES DIRECTED AT PSS PROVIDERS/MODELS

Indicator: PSS7 - No. of public financial incentives directed at PSS providers/models

This indicator measures the number of direct public financial incentives concerning Product Service System (PSS) business models in EU countries.

PSS models are crucial in advancing the shift towards a sustainable CE. They offer companies a means to integrate CE principles into their business models to extend the lifespan of products, minimise material usage, and encourage less waste.

Public financial incentives refer to various economic benefits provided by governments, organisations, or other entities to encourage circular business models/PSS. These incentives can take various forms, including grants, subsidies, tax breaks, loans at preferential rates, or other financial support mechanisms. They are often implemented to achieve specific objectives, such as promoting and encouraging sustainable practices and circular business models, fostering innovation, supporting particular industries or sectors, and addressing social and environmental issues. Companies and consumers often lack regulatory and economic incentives to make favourable choices in the CE. This lack of supportive regulations creates a structural lock-in that hampers the growth and uptake of innovative circular business models, including PSS

Collecting data on public financial incentives directed at PSS models can provide the following benefits:

- Contribution to the sharing of insights and best practices across the EU that ultimately promote the transition to a CE and the realisation of the goals and priorities of the EC's Circular Economy Action Plan (CEAP).
- Opportunities may arise from developing economic incentives, including for example tax models that support and promote the widespread use of PSS.

The indicator does not allow for measuring the quality and effect of the financial incentives implemented, because this would be too detailed for the purpose of the indicator and would be difficult to conduct in a standardised manner across the cases.

4.1 KEY METHODOLOGY

4.1.1 Testing method

System boundary

This indicator was assessed at the national level. It was designed to investigate the existence of financial incentives (such as reduced VAT, public funds, or other fee/tax incentives) aimed at supporting PSS business models in EU Member States (MS). The indicator examined the legal framework, economic incentives, sector focus, mechanisms, and data accessibility about implementing direct public financial incentives for PSS models. The objective was to quantify and measure the number of such incentives that have been implemented.

Three EU MS, namely Finland, Romania, and Spain were selected as case studies for testing this indicator and constitute the system boundary for the data collection. The selection of Finland, Romania, and Spain for this case study aimed to capture diverse perspectives on PSS model implementation across different regions/countries within the EU. Finland is generally considered a frontrunner in prioritizing circular economy innovation and will act as a potential best-practice example, where data is expected to be identified. Data availability and proficiency in the national language were additional considerations in selecting these countries.

The specific variances between these countries are of limited importance for any conclusions on the indicator's relevance, but they were also selected for potential synergies when compared with results on the indicator PSS8.

Methodology

The indicator was tested using a desk-based study approach by collecting data from authoritative sources on a national level. Depending on the reliability and availability of the data, stakeholder consultation via interviews was conducted to collect additional insights and understand potential data gaps.

4.1.2 Data collection method

The data collection methods for this indicator involved comprehensive desk-based research from existing authoritative sources and contact with relevant stakeholders via emails and phone calls for interviews. Data was sourced from the government and ministry websites and from other sources with authoritative data on countries such as European Topic Centre - Circular Economy Country Profile (references in sections below). Including diverse sources such as information enhances the credibility and comprehensiveness of the findings. The same method was used for all three MS.

The mapping was carried out after defining keywords/search parameters for the data collection. Findings were stored in a MS Excel sheet with the following columns: keywords, data availability, source, links/websites to the source, description of incentives and how they are implemented, the sector focus, mechanisms, accessed on/date and contact details for stakeholders. See Appendix 5.2 for the data collection framework and results.

Romania

Sources

Data was sourced from the Romanian Government websites including the Ministry of Environment, Water and Forestry,[9] and the Department for Sustainable Development.[10] The research and data collection were conducted in English and Romanian.

Key terms used for exploring, analysing, and interpreting the collected data included:

- ''tax or ''VAT'' reductions for repairs'' or ''product system'' or ''service system'' AND '' PSS models'' or ''PSS providers'' in Romania''.
- ''tax or ''VAT'' reduction for ''PSS models'' or PSS business(es)'' or ''Product Service Systems'' in Romania''.
- ''financial'' or ''economic'' ''incentives'' or ''support'' for ''PSS models'' or PSS providers or ''Product Service Systems'' in Romania''.
- ''tax deductions related to PSS models'' or ''PSS business(es) or ''PSS providers'' in Romania''.
- ''Public funds'' directed at ''PSS models'' or ''PSS providers'' in Romania.

Despite extensive efforts, no relevant data and information about this indicator were found in English. The action plan for the Circular Economy Strategy from the Ministry of Environment, Water, and Forestry was available only in Romanian. [11]

Some of the key terms/words in Romanian central to this specific indicator included:

- ''reducerea TVA-ului'' pentru ''sisteme de produse și servicii'' sau ''afacerile PSS''.
- ''reducerea TVA-ului la reparații in Romania''.
- ''legislative & financial guidance pentru produs ca serviciu privind economia 24ircular in Romania''.

Consultation

An interview was conducted with a senior advisor on sustainable development and CE from the Government of Romania's Department for Sustainable Development. The interview took place in March 2024 and lasted approximately one hour.

[9] The Ministry of Environment, Water and Forestry ((https://www.mmediu.ro/ Accessed on 01-04/2024)

[10] Romania Government Department for Sustainable Development (https://dezvoltaredurabila.gov.ro/economia-circulara-in-romania-16363428)

[11] The Ministry of Environment, Water and Forestry - Circular Economy Strategy (https://www.mmediu.ro/categorie/dezvoltare-durabila/195)

Finland

Sources

The data was sourced from the Ministry of the Environment[12], the Ministry of Employment and the Economy[13], and The Finnish Innovation Fund, Sitra[14]. The research and data collection were conducted in English.

Some of the terms used for exploring, analysing, and interpreting the collected data for this specific indicator included:

- ''financial'' or ''economic'' ''incentives'' or ''support'' for ''PSS models'' or PSS providers or ''Product Service Systems'' in Finland''.
- ''tax or ''VAT'' reduction for ''PSS models'' or PSS business(es)'' or ''PSS providers'' or ''Product Service Systems'' in Finland''.
- ''tax reductions for repairs'' or '' PSS models'' in Finland''.
- ''Circular Economy Financial Incentives in Finland''.

Consultation

An interview was conducted with a senior specialist in CE from the Ministry of the Environment. The interview took place in February 2024 and lasted approximately one hour.

Spain

Sources

Data was sourced from the Directorate for the Circular Economy of the Ministry of Ecological Transition and Demographic Challenge[15], the Ministry of Industry and Tourism[16], the European Topic Centre (ETC) – Circular Economy country profile – Spain[17], and other government websites. The research and data collection were conducted in English and Spanish.

Key terms used for exploring, analysing, and interpreting the collected data include:

- ''tax or ''VAT'' reduction for ''PSS models'' or PSS business(es)'' or ''PSS providers'' or ''Product Service Systems'' in Spain'.
- ''financial'' or ''economic'' ''incentives'' or ''support'' for ''PSS models'' or PSS providers or ''Product Service Systems'' in Spain''.
- ''tax reductions for repairs'' or '' PSS models'' in Spain'.
- ''national strategy'' or ''circular economy strategy'' or PSS model'' in the ''automobile'', ''textile'', ''electrical and electronic equipment'', ''industry'' or ''sector'' in Spain''.
- ''financial'' or ''economic'' support for ''PSS models'' or PSS providers or ''Product Service Systems'' in Spain''.

No pertinent data and information related to the indicator were found in English. The Circular Economy Strategy and other sectorial national strategies are exclusively provided in Spanish. Thus, the research was also conducted in Spanish.

Key terms/words in Spanish central to this specific indicator include:

- ''IVA y fiscalidad en los Sistemas Producto Servicio (SPS) en España'.
- ''IVA y Impuestos en los Sistemas Producto Servicio en España''.

[12] The Ministry of the Environment (https://ym.fi/en/front-page)

[13] Ministry of Employment and the Economy (https://tem.fi/en/frontpage)

[14] The Finnish Innovation Fund Sitra (https://www.sitra.fi/en/)

[15] Directorate for the Circular Economy of the Ministry of Ecological Transition and Demographic Challenge (https://www.miteco.gob.es/)

[16] Ministry of Industry and Tourism – Spain (https://www.mintur.gob.es/en-us/Paginas/index.aspx Accessed on 01-04/2024)

[17] European Topic Centre - Circular Economy Country Profile – Spain (https://www.eionet.europa.eu/etcs/etc-ce/products/etc-ce-products/etc-ce-report-5-2022-country-profiles-on-circular-economy/spain-ce-country-profile-2022_for-publication.pdf (Accessed on 01-04/2024)

- ''Reducciones fiscales en los sistemas de servicio de productos en España''.
- ''Ayudas a los Sistemas de Servicios por Productos para empresas en España'.
- ''estrategia national'' o ''economía circular'' o ''modelo PSS'' en los sectores ''automóvil'', ''textil'', ''equipos eléctricos y electrónicos'' , ''industria'' o ''sector'' en España''.

Consultation

Relevant stakeholders from the Directorate for the Circular Economy of the Ministry of Ecological Transition and Demographic Challenge and the Ministry of Industry were contacted via e-mail and phone but arranging an interview proved to be unfeasible.

4.1.3 Calculations

No calculations were used.

4.1.4 Timeline

Table 14 illustrates the data collection plan using a Gantt chart format, which occurred during January and February 2024, while the analysis and reporting phases occurred in February and March 2024.

Table 14. Gantt chart – PSS7.

WC	01.jan	08.jan	15.jan	22.jan	29.jan	05.feb	12.feb	19.feb	26.feb	04.mar	11.mar	18.mar	25.mar	01.apr
Finalise Data Collection Plan														
Desk research and data collection														
Stakeholder engagement														
Data analysis														
Reporting														
Review period														

Legend

Task progress

Review period

4.1.5 Data gaps and mitigation

Table 15 below shows an overview of identified data gaps, limitations, and mitigation efforts.

There was no existing methodology for testing this indicator and no clear definitions on what constitute financial incentives in the case of PSS. Thus, one notable data gap identified was the lack of publicly available information and the risk of not accurately measuring the number of financial incentives. This gap posed a challenge in comprehensively assessing the landscape of financial support for circular business models/PSS. To address this challenge, stakeholder engagement became crucial, especially in cases where data was not readily available. While accessing relevant stakeholders for interviews may not always be feasible, their insights and perspectives could provide invaluable information regarding the measurement of this indicator. Despite potential limitations in data accessibility, engaging with stakeholders was expected to yield highly relevant information essential for evaluating the effectiveness of financial incentives in promoting CE initiatives.

Table 15. Overview of identified data gaps, limitations and mitigation efforts.

	Description of data gap	Mitigation efforts	Level of confidence
1	Lack of publicly available information on all relevant financial incentives.	Stakeholder engagement in case data was not available. It might not be possible to get access to the relevant stakeholders for interviews, but interviewees were expected to give highly relevant information on the indicator measurement.	Medium
2	Risk of not accurately quantifying and measuring the number of financial incentives implemented.	Stakeholder engagement in case data was not available. It might not be possible to get access to the relevant stakeholders for interviews, but interviews were expected to give highly relevant information on the indicator measurement.	Low

4.1.6 Quality review of analysis

To ensure robust and high-quality results, Norion and Ricardo conducted the following data validation and quality control procedures:

- Prior to the beginning of the work, the Project Director reviewed the proposed research methodology and ensured that the data collection plan was fit for the purpose. Once the research team addressed any comments from the review process, they proceeded to the data collection phase.
- The Project Coordinator oversaw the data collection phase to ensure that the collected data and analysis conducted were of a high standard and provided useful content for the final case study output.
- The Quality Assurance Manager held responsibility for the quality of the final case study output. The Project Manager assisted the Quality Assurance Manager in judging the quality of the output and suggesting ways to improve.

4.2 KEY ANALYSIS RESULTS

4.2.1 Analysis

Romania

The Romanian Government includes PSS business models in their CE strategy as a priority action for electronic equipment and textiles (Ministerul Mediului, Apelor și Pădurilor, 2022). The action plan aimed to create and support operators repairing electronic equipment through subsidies and tax incentives—periodic payments for their use and states that similar arrangements could be developed for electrical appliances, typically with subscription-based business models. In addition to regulating the classifications for preparing electronic equipment products for re-use and repair and the mechanisms by which they were to be returned to the market, the provision of fiscal incentives, such as VAT exemption for repaired products, could be considered.

However, there is no available documentation that these potential financial incentives have been implemented. An interview with a senior advisor on sustainable development from the Government of Romania highlighted that the Romanian Government is slowly taking initiatives towards implementing circular business models/PSS models, but that implementation is still underway.

The following specific incentives are being considered:

- Make publicly accessible a compilation of public funding and aid schemes designed to support the CE and circular business models/PSS.
- Create and support operators repairing Electrical and Electronic Equipment (EEE)/textiles through grants and tax incentives, which are already implemented annually with small grants by the Ministry of Economy, Entrepreneurship and Tourism[18].

Significant direct financial incentives and measures such as reduced VAT and tax incentives for circular PSS models and efforts to promote their adoption have not been enacted yet.

Finland

According to Finland's "Government Resolution on the Strategic Programme for Circular Economy" from 2021, the government wants to support the CE, services such as PSS models, including repair services, leasing of chemicals and similar industrial service models through economic benefits and public funds schemes.

According to the Resolution, as part of preparing the Sustainable Taxation Roadmap, Finland has assessed the possibilities of increasing and extending a waste tax, land tax, mining tax, lowering the electricity tax category for the recycling industry, and possibly other tax models to promote the CE (Ympäristöministeriö, 2021). It is, however, unclear if these taxation initiatives may directly incentivise PSS models and businesses.

An interview with a senior specialist on the CE from the Ministry of the Environment confirmed that there are not a substantial number of financial incentives to support PSS. Two initiatives were highlighted, which have an incentivising function for PSS:

1. Tax-free bike benefits for up to 1,200 Euro per year (100 € / month), which employers can provide to employees as part of their salary or in addition to it. This initiative allows for both purchases of bicycles and leasing (a PSS model), where the latter is the most used option.
2. The Act on Transport Services / Mobility as a Service implemented initiatives and deregulated parts of the transport sector to provide stronger opportunities for shared transportation services to compete with private ownership[19].

However, the first initiative mentioned here is a financial incentive targeting both ownership and PSS models, which makes it difficult to consider it a positive result for this indicator. The second initiative does not provide a financial incentive, even though it promotes PSS models by reducing legislative and operational barriers for PSS providers to grow.

No direct financial incentives were identified.

Spain

The research on Spain resulted in no pertinent data and information in either English or Spanish, and it was not possible to arrange interviews with stakeholders to provide additional relevant information on the indicator.

4.2.2 Limitations

The testing of the indicator relied on publicly available information and since financial incentives were technical and might not result from open political processes, there might be a lack of information accessible. This meant that it would not necessarily be identified through desk-based research and interviews with key stakeholders were necessary to elaborate on the available information.

In the case of Spain, we were unable to secure an interview which could have confirmed the results that the country does not provide financial incentives for PSS.

[18]Ministerul Economiei, Antreprenoriatului si Turismului. https://economie.gov.ro/lista-finala-a-proiectelor-care-se-incadreaza-in-limita-bugetului-alocat/ Accessed on 01-04/2024)

[19]OECD – Innovative mobility services in Finland https://www.oecd.org/climate-action/ipac/practices/innovative-mobility-services-in-finland-bc4ce864/ Accessed on 01-04/2024)

4.2.3 Performance

During the Task 4 project phase, a RACER evaluation of the indicator was conducted. Table 16 below shows the original evaluation and an updated one based on the insights of Task 5. The rating scale ranges from 1 for low, 2 for medium, to 3 for high. Following in-depth considerations on data collection, the indicator was changed slightly in Task 5.

Table 16. RACER evaluation.

Stage of project	RACER criterion					Score
	Relevance	Acceptability	Credibility	Ease	Robustness	
Task 4 (original RACER assessment)	3	1	1	2	1	8
After Task 5 (following testing)	3	2	1	2	2	10

Note: Original indicator's title 'No. of legislative incentives created to support PSS'

Relevance

The indicator offers valuable insights into the extent of national adoption and implementation of financial incentives directed at PSS models by tracking the number of direct public financial incentives towards PSS models. The indicator aligns with the CEAP's overarching objectives by tracking initiatives that promote PSS models as well as other policy initiatives regarding the CE.

For example, the EC adopted a set of policy recommendations in 2023 for EU MS to "improve and incentivise the return of used and waste mobile phones, tablets, laptops and their chargers" (European Commission, 2023). The EC recommends EU MS to implement financial incentives to encourage consumers to let their (un)used equipment be returned for repair and reuse, as well as initiatives to establish partnerships among industry actors supporting the CE for these products (ibid.). Though PSS models are not directly mentioned, these recommendations are directly relevant for encouraging PSS models and, thus, should the EU MS follow them, it would potentially result in financial incentives for PSS. These policy recommendations build on the European Green Deal, the CEAP and regulations on Waste Electrical and Electronic Equipment (WEEE), which highlights the policy relevance of this indicator.

Acceptability

There are no requirements for EU MS to implement financial incentives for PSS models, and even the recent policy recommendations by the EC concerning WEEE, as described in the previous section, mention PSS models specifically. The testing has only identified a limited number of financial incentives, even in Finland which is considered a frontrunner in CE initiatives. Therefore, it is natural to imagine that EU MS across the EU may only have very limited support for an indicator where they have little or no data to present. On the other hand, there are some simple incentives that may be implemented by governments seeking to incentivise the CE and stimulate new businesses, which may provide support for the indicator. Therefore, the scoring has been adjusted from 1 (low) to 2 (medium) due to this rationale.

Credibility

There is no existing methodology for testing this indicator and no clear definitions on what constitute financial incentives in the case of PSS. There may be a lack of publicly available information for EU MS and relevant financial incentives for PSS may differ greatly across countries due to differences in e.g. tax systems and industry structures. This makes it difficult to create a systematic data collection process with clear metrics, and it reduces the ability to compare data across countries. The current indicator formulation and the method of this testing solved this by simply counting the number of financial incentives, but it can be argued that this is too simplistic to provide relevant information and is, thus, not a good or credible definition of the aim of the indicator. Therefore, the rating ws left unchanged at 1 (low).

Ease

The quantification of units for this indicator, specifically the number of financial incentives, posed challenges regarding ease of collection. The intricacies of financial incentives and their functioning proved challenging to grasp through desk-based research alone, given the varied forms these incentives can take depending on each country's economic structure and tax systems. Defining the metric better is required to ease the data collection for identifying financial incentives across EU MS. However, since data can be provided directly by national authorities, which is considered highly reliable, the ease of the data collection possibilities is strengthened. Therefore, the rating ws left unchanged at 2 (medium).

Robustness

Since data can be collected directly from EU MS, the indicator scored medium even though there is a lack of a consistent dataset and methodology. The score is also strengthened by the potential of financial incentives to contribute directly to the strength of the CE rather than being a proxy for its development. Therefore, the scoring has been adjusted from 1 (low) to 2 (medium) due to this rationale.

4.3 CHALLENGES AND LESSONS LEARNED.

The data collection conducted during the testing of this indicator resulted in the identification of challenges related to the diverse forms that financial incentives can assume. Indeed, the unique nature of each country, including their tax systems and structure of their industries, means that financial incentives will also take very different forms.

A viable approach to address this issue could be to require the national governments to directly report on this indicator. Very few examples of financial incentives were identified through the research and therefore it was difficult to establish a data collection process that would allow for systematic data collection, as it was difficult to define standardised questions for the indicator at a granular level.

This approach relies on the premise that direct reporting from national authorities would enhance the accuracy and accessibility of the data, recognising that without proactive efforts from the national governments, obtaining this information may prove challenging for external entities.

Another significant lesson was learned in the cases of Spain and Romania, where relevant data was unavailable in English. This underscores the necessity of constantly refining the search keywords based on updated findings and stakeholder feedback.

Measuring and monitoring the development of financial incentives supporting PSS is an ambitious task, which is ideally supported by indicators relevant to all steps in that process. This indicator should be considered for the EU Circular Economy Monitoring Framework (CEMF) as it may be useful for tracking the integration of economic incentives promoting the implementation of policy objectives related to PSS and circular business models and ongoing monitoring efforts. However, firstly the challenges regarding especially the credibility of the methodology, as explained for the RACER assessment, need to be addressed to ensure that the formulation and methods applied for data collection are systematic and appropriate for tracking progress.

4.4 CONCLUSIONS AND RECOMMENDATIONS

It is recommended that this indicator is considered for further development, with significant work required to facilitate its progress.

Final indicator formulation:

No. of public financial incentives directed at PSS providers/models

This indicator remains relevant because national financial incentives supporting PSS can be a strong method for promoting the transition to the CE and progress towards the priorities of the CEAP. Tracking the number of such incentives across MS may provide a means for advancing further initiatives and knowledge sharing across countries.

It is recommended that the indicator be considered for further development, but its implementation requires significant efforts to clarify the applicability of high-level measures of financial incentives for PSS as well as the potential methodology for collecting such data across EU MS.

Due to the lack of examples of financial incentives for PSS identified in this research, it is recommended that guidance is developed to give EU MS a stronger basis for implementing additional incentives. Despite the indicator's relevance, due to its alignment with policy and priorities, it is irrelevant if no actions are taken by EU MS to implement incentives on PSS.

Such guidance may be similar to the policy recommendations concerning WEEE, adopted by the EC in 2023, which recommends governments to implement financial incentives related to the CE of this sector but without specific reference to PSS models (European Commission, 2023). The guidance could target PSS models more generally and include a variety of sectors or focus on specific sectors with promising PSS models already being promoted. Whereas the WEEE policy recommendations especially target consumer electronics, this guidance may also investigate the potential of providing incentives for the industry. In addition, developing a scoring system or a set of criteria to evaluate the depth and breadth of PSS integration into national strategies. This system could consider factors like the specificity of actions outlined, allocated funding, implementation timelines and measurable targets.

Table 17. Summary of recommendations for indicator PSS7.

Type of recommendation	Recommendation	RACER Criteria Addressed	Timeline	Key stakeholders or partners
Policy Recommendations	Development of policy recommendations for EU MS to increase implementation of financial incentives targeting PSS models.	Acceptability and Credibility	Medium term (1.5 – 5 years)	Responsible: DG RTD Accountable: EC Consulted: DG ENV, EU MS Informed: Business Associations
Development of guidance	Developing a clear guidance for EU MS to investigate the potential for financial incentives for PSS	Acceptability and Ease	Short term (0.5 – 1.5 years)	Responsible: DG RTD Accountable: EC Consulted: DG ENV, EU MS Informed: Business Associations

5. APPENDICES

5.1 APPENDIX 1: PSS4 – DATA COLLECTION RESULTS

See MS Excel document “DGRTD_PSS4_DataCollectionResults_V01.00” provided alongside this report.

5.2 APPENDIX 2: PSS7 AND PSS8 – DATA COLLECTION RESULTS

See MS Excel document “DGRTD_PSS7_PSS8_DataCollectionResults_V01.00” provided alongside this report.

5.3 APPENDIX 3: RACER ASESSMENT MATRIX

Criterion	Description	1 (Poor)	2 (Neutral)	3 (Good)
Relevance	Refers to whether the indicator is closely linked to the objectives to be reached.	Does not support a better understanding of true circularity.	Supports a better understanding of true circularity.	Highly supportive towards gaining a better understanding of true circularity.
		Supports no value-added circular opportunities.	Supports lower value-added opportunities (i.e. metrics related to waste generation, recycling, waste management, etc.)	Supports higher value-added opportunities (i.e. all R-strategies above remanufacturing) and wider systemic change (e.g. indicators that encourage PSS or circular design).
		Not linked to the project objectives and/or European policy objectives (existing or upcoming).	Linked to the project objectives, but not to European policy objectives (existing and/or upcoming).	Fully aligned with project objectives and European policy objectives (existing and/or upcoming).
Acceptance	Refers to whether the indicator is perceived and used by key stakeholders (such as policymakers, civil society, and industry).	Poorly accepted by key stakeholders, e.g. due to the use of confidential data.	Relatively accepted by key stakeholders as the benefits of measuring are clear.	Key stakeholders are motived to report this indicator, due to mandatory legislative requirements (current or upcoming), potential commercial benefit or being in the public interest.
Credibility	Refers to whether the indicator is transparent, trustworthy and easy to interpret.	No defined methodology associated with this indicator and/or interpretation of the indicator is ambiguous.	Methodologies have been proposed or currently existing, but not for this particular indicator (e.g. in a research article).	There is an EU defined methodology.
		Difficult to understand and communicate to stakeholders (e.g. units or measurement of something that stakeholders are not familiar with).	Moderately easy to understand and communicate to stakeholders (e.g. units or measurement of something that stakeholders are aware of but are not confident in practical use).	Easy to understand and communicate to stakeholders (e.g. units or measurement of something that stakeholders already use and are confident in applying).
Ease	Refers to the easiness of measuring and monitoring the indicator.	No defined methodology associated with this indicator and/or interpretation of the indicator is ambiguous.	Methodologies have been proposed or currently existing, but not for this particular indicator (e.g. in a research article).	There is an EU defined methodology.
		Difficult to understand and communicate to stakeholders (e.g. units or measurement of something that stakeholders are not familiar with).	Moderately easy to understand and communicate to stakeholders (e.g. units or measurement of something that stakeholders are aware of but are not confident in practical use).	Easy to understand and communicate to stakeholders (e.g. units or measurement of something that stakeholders already use and are confident in applying).
Robustness	Refers to whether data is biased and comprehensively assesses circularity.	No consistent methodology and dataset are available.	A consistent methodology and dataset available.	A consistent methodology and dataset available.
			A composite/aggregated indicator (based on multiples dimensions).	A one-dimensional indicator.
			A proxy indicator.	

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