INDICATORS AND METHODS FOR MEASURING TRANSITION TO CLIMATE NEUTRAL CIRCULARITY

Task 5: Case-study group PSS1

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

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Ricardo, Gemini Building, Fermi Avenue, Harwell, Oxfordshire, OX11 0QR, UK | +44(0)1235 75 3000 | www.ricardo.com
Registered company no. 08229264 | VAT no. GB 212 8365 24

Customer:
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Ricardo reference:
ED16719

Contact:
Rob Snaith, 18 Blythswood Square, Glasgow, G2 4BG

T: +44 (0) 1235 753 029
E: rob.snaith@ricardo.com

Authors:
Bjorn Bauer, Yunus Kaae Adams

Approved by:
Rob Snaith

Signed

Date:
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1. INTRODUCTION

The transition to a circular economy (CE) needs to 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 and is 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 1 of the Product Service Systems sub-policy area during Task 5 of the project. The main 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 the identification, planning, delivery and analysis of 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 potential to enable a deeper understanding of the 3 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 two indicators outlined in Table 1 below.

Table 1. Overview of case-study group 1 (PSS 1-2)

URN		Indicator name	Methodology	Level of implementation				
				EU	National	City / Region	Companies	Household
PSS1	**1**	Consumer perception of the attractiveness of PSS models	Citizen survey		X	X		X
PSS2	**2**	Percentage of citizens who have used PSS models	Citizen survey		X	X		X

2. INDICATOR 1 – CONSUMER PERCEPTION OF THE ATTRACTIVENESS OF PSS MODELS

Indicator: PSS1 - Consumer perception of the attractiveness of PSS models

This indicator measures consumer perception of the attractiveness of Product-Service Systems (PSS) models. PSS is an integral part of the mix of innovations that move society toward a more sustainable future. PSS plays a prominent role in the EU's Circular Economy Action Plan (CEAP). Reshaping the consumption habits of EU citizens through circular business models, such as PSS, is also part of the EU Strategy for Sustainable and Circular Textiles (European Commission, n.d.).

However, PSS implementation rates are low, and there is a perception in the business community that PSS models do not create sufficient value to overcome a preference among consumers for ownership in Western societies (Catulli et al., 2017). Additionally, research shows that the environmental benefits of various PSS models vary greatly, and the potential for increased circularity depends on several factors that are moderated on a case-by-case basis. Therefore, monitoring progress on consumer perception of PSS models broadly across the EU, and measuring the potential for increased circularity, is inherently challenging.

Nevertheless, because PSS models have potential to increase circularity across industries and product groups, tracking consumer interest becomes relevant and is an important element of monitoring progress towards better models. Companies and experts highlight the need to influence consumer behaviour for businesses to switch to more circular business models. However, attracting consumers to use new solutions depends not only on pricing but also on a range of cognitive consumer biases, including "status quo bias," which increases people's preference for the current situation (Orasmaa et al., 2020). Insight into consumer perceptions of the attractiveness of PSS models will be a vital tool in understanding barriers and developing pathways toward increased PSS implementation.

Over time, the indicator will allow for the following benefits:

- Allowing for tracking changes over time in consumers' interest in PSS as an alternative to the traditional ownership models.
- This may provide valuable insights regarding the potential impact of legislation, incentives, communication efforts and industry provision of PSS models as this develops over time.
- Country-by-country comparison of consumer perception of PSS models, which may be linked with other indicators and data on PSS models in various countries such as the no. of PSS models provided, the market size, no. of government incentives etc.

2.1 KEY METHODOLOGY

2.1.1 Testing method

System boundary

Germany has been selected as the case for testing the indicator and thus serves as the system boundary for the data collection. German citizens are expected to have knowledge of and experience with PSS models, making it a prominent case study. This indicator's original data collection plan intended to collect data from two cities in two countries. However, to increase the reliability of the survey, it was decided to focus on collecting a more comprehensive data basis from one country.

Methodology

A survey covering key aspects of the indicator was created in cooperation with YouGov, an external partner specialising in citizen surveys, which has access to large panels of respondents. The survey was conducted in Germany with the aim of receiving responses from a representative population sample. The resulting data allowed for comparisons across different age groups, genders, regions, income levels, and product groups. The data thus provided a broad insight into the German population's perspectives on the attractiveness of PSS models and internal differences across demographic groups.

The reliability of the collected data depends on the ability of respondents to provide accurate responses to the questions and on the ability of the survey partner and the consultant to ensure a sufficiently high response rate for the data to be representative of the population.

The complexity and large variability of PSS models meant that ensuring a correct understanding of the questions among all respondents was an inherent challenge. The survey included several product groups to give more granularity on which product groups perform well and to increase the likelihood that the questions invoke respondents' recognition of PSS models. Questions have been formulated in short and without technical and complex language for greater consumer recognition. It was decided not to distinguish between various PSS types in the questions, since this would have significantly increased the complexity and length of the survey, presumably resulting in a lower response rate in general and for the specific models for each product group, without guaranteeing more reliable results. Thus, the breadth of responses was prioritised over the depth to provide a scalable methodology across EU countries, where the experience with PSS models varies significantly.

Data availability is considered 'medium' as shown in Table 2 below because no data is currently collected, but data on consumer perspectives can easily be collected using a survey.

Table 2. Source, reliability and availability.

Source	Reliability*	Availability**
Citizen's survey	*Medium*	*Medium*

** **Low =** Some data will likely be missing and incomplete, which may lead to inaccurate conclusions*, ***Medium =** The data will likely be complete but may lack accuracy and quality, **High =** The data will likely be complete, accurate and of high quality.*

*** **Low =** The data is not already collected or readily available and will be difficult to collect. **Medium =** The data is already collected but is not publicly available, OR the data is not already collected but is easy to collect, **High =** The data is readily available and can be accessed easily.*

2.1.2 Data collection method

The survey focused on the consumers' "interest" in using PSS models referred to as "renting, sharing or leasing" within the product groups listed below:

- Transportation and vehicles (e.g. cars, trailers, bikes, scooters, etc.).
- Clothing and textiles.
- Jewellery.
- Electronics (e.g. phones, computers, TV, etc.).
- Machinery (e.g. white goods etc.).
- Outdoor and leisure equipment, including accessories (e.g. power tools, sports gear, camping equipment, etc.).

We developed the draft survey questions that YouGov then reviewed for alignment with best practices for a survey of this type. The key question asked was:

> "[GRP_Q3] **For the following question, please think of existing offers or imagine future options for renting, sharing or leasing products…**
>
> How interested, if at all, would you be in using this option for each of the following? (Please select one option on each row)"

The respondents were asked to rank each product group with one of the following options:

1. Very interested.
2. Fairly interested.
3. Not very interested.
4. Not at all interested.
5. Don't know.

Besides the questions directly related to consumer perception of PSS models within various product groups, the respondents were asked to rate the importance of price, quality, flexibility of use, environmental impact, and accessibility for their considerations when choosing PSS models. This data provides insights that may be used to develop conjectures on the motivations and reasons for the data on consumer perception.

The survey was carried out online through YouGov's panels between 28th February 2024 and 4th March 2024. Upon collection, YouGov weighted the data (considering age groups, gender, regional variables, and income levels) to ensure that the results were nationally representative. The survey outline is provided in Appendix 4.1 and the full data reports in Appendix 4.2.

2.1.3 Calculations

The calculation is a simple average of responses across product groups to each response category.

The averages can be converted to a single score or presented in other ways. This report presents the averages with data variations to give insights into the simple metric and underlying parameters and trends.

2.1.4 Timeline

Table 3 below presents the timeline for the testing of this indicator.

Table 3. Gantt chart - PSS1

	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														
	Develop citizen survey														
	Data collection via external partner														
	Data analysis														
	Reporting														
	Review period														
Legend															
	Task progress														
	Review period														

2.1.5 Data gaps and mitigation

The primary data gaps relate to the granularity of the data to be collected. The indicator refers to consumer perception of PSS models on a general level, so a broadly formulated question would be sufficient to generate data on the indicator. However, in this test, gathering data on consumer perception at the product group level was beneficial. This resulted in a potential data gap due to the exclusion of some potentially relevant product groups. Product groups were selected based on experts' insights, stemming from three years of research into PSS models in the Nordic countries (Egebæk et al., 2022).

Data availability and reliability was another important gap in this study. It depended on the ability of respondents to provide accurate responses and the survey's ability to ensure a sufficiently high response rate for the data to be representative of the population. If sufficient respondents were not secured, this would have posed a severe limitation and data gap for the research to conclude on the indicator meaningfully. Using an external survey agency with large panels, such as YouGov, mitigated these potential issues.

Table below summarises the data gaps and mitigation efforts described above.

Table 4. Overview of identified data gaps, limitations and mitigation efforts.

	Description of data gap	Mitigation efforts	Level of confidence
1	Selection of product groups excluded relevant cases.	• Use of experts' insights on the availability of PSS models within various sectors.	High
2	Sufficient respondents required to extrapolate data to population.	• Use of external survey agency with large panels.	High

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:

- Initially, the Project Director 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.
- Concerning the survey development and dissemination, the Project Coordinator reviewed the questioning for this indicator to ensure that it was clear, followable, and able to generate reliable and robust results. Respondents were required to answer each question before proceeding to ensure data validation of the survey.
- Once the survey closed and the results were analysed, the Quality Assurance Manager conducted a thorough internal quality assurance process on the MS Excel data set which pulled together the data from the survey and subsequent calculations. The incoming data and assumptions were logged, presenting survey data, user inputs, calculations, assumptions, and results.

2.2 KEY ANALYSIS RESULTS

2.2.1 Analysis

Survey responses were received from 2,266 persons across Germany, with a good distribution of respondents on background demographics. Where needed, the data was weighted to ensure representativity. Table 5 below presents an overview of responses across product groups. Appendix 4.2 includes all the tables and results of the survey.

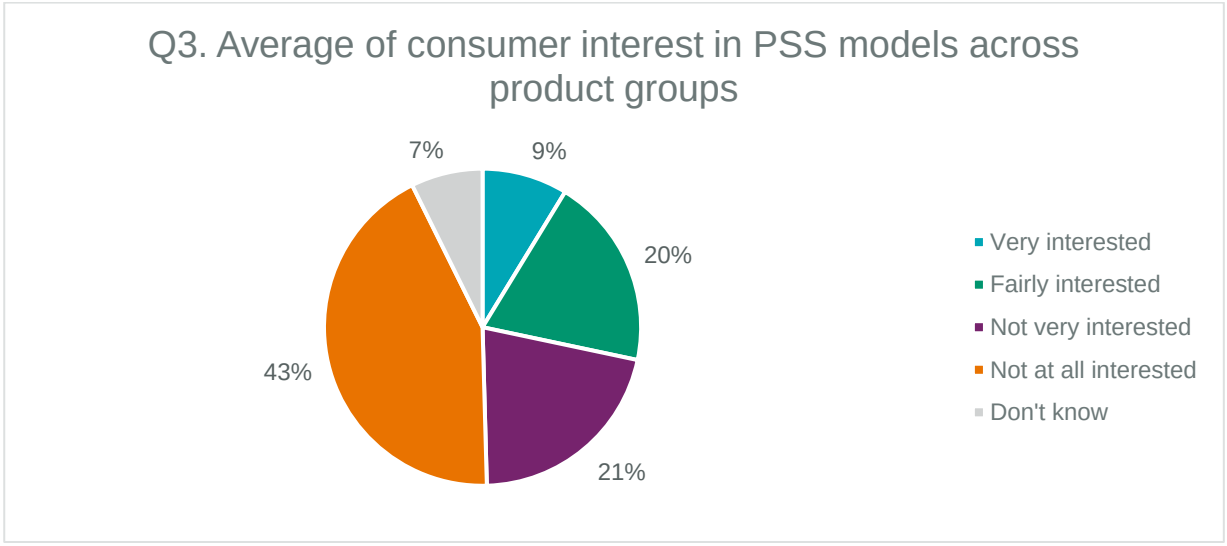
When taking an average of the scores across product groups, 28% were interested and 64% were not interested. There was a stronger selection on the lowest rate 'Not at all interested' (43%) compared to the highest of 'Very interested' (9%), but the responses were not equally distributed.

Table 5. Consumer interest in renting, sharing, or leasing models for various product groups.

Q3. How interested, if at all, would you be in using this option [rent, share or lease] for each of the following?	**Transportation and Vehicles**	**Clothing and Textiles**	**Jewellery**	**Electronics**	**Machinery, outdoor and leisure equipment**	**Average**
Very interested	14%	6%	5%	8%	10%	**9%**
Fairly interested	32%	13%	10%	17%	25%	**20%**
Not very interested	24%	19%	14%	25%	23%	**21%**
Not at all interested	22%	54%	63%	42%	34%	**43%**
Don't know	8%	7%	7%	7%	8%	**7%**
Net. Interested	46%	20%	15%	26%	35%	**28%**
Net. Uninterested	47%	73%	78%	67%	57%	**64%**

Notes: Full question: Q3. "For the following question, please imagine that the option to rent, share or lease products from businesses in the following industries was available to you… How interested, if at all, would you be in using this option for each of the following? (Please select one option on each row)". The Unweighted base and Weighted base are both 2.266 respondents.

Figure 1. Q3. Average of consumer interest in PSS models across product groups



Variations between product groups

The survey reveals a significant variation in consumer interest in PSS models within the different product groups, as seen in Table 5 – with 'Transportation and vehicles' being the most well-established (46%) and 'Jewellery' the least (15%).

These differences may be explained by factors discussed in the literature, demographics, and other underlying factors. For example, there may be a greater preference for ownership and other cultural barriers to adopting PSS concerning jewellery and clothing compared with the top scorer of vehicles. In this context, research shows that consumers prefer the security provided by ownership of clothes due to the role of everyday clothing in constructing and maintaining a consistent and coherent identity (Kerkelä, 2018).

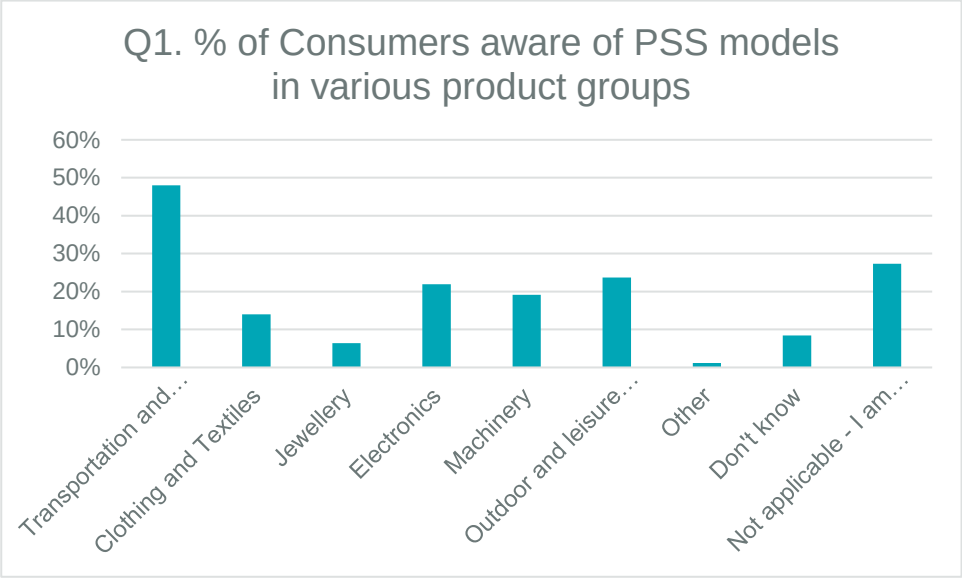
Another important factor can be the consumers' knowledge of existing PSS models. As shown in Table 6, 48% of respondents know of PSS models within 'Transportation and Vehicles' and only 6% for 'Jewellery'.

Table 6. Consumers' knowledge of existing PSS models in their country.

Q1. For which, if any, of the following product groups are you aware of companies in Germany offering consumers to rent, share or lease products without a purchase commitment?	
PRODUCT GROUP	**% OF CONSUMERS**
Transportation and Vehicles	**48%**
Clothing and Textiles	**14%**
Jewellery	**6%**
Electronics	**22%**
Machinery	**19%**
Outdoor and leisure equipment	**24%**
Other	**1%**
Don't know	**8%**
Not applicable – I am not aware of businesses in any industry that provide the option for consumers to rent, share or lease products without a purchase commitment	**27%**

Notes: Full question: Q1. Thinking about companies that allow consumers to rent, share or lease products without a purchase commitment…For which, if any, of the following product groups are you aware of companies in Germany offering consumers to rent, share or lease products without a purchase commitment? (Please select all that apply). The Unweighted base and Weighted base are both 2266 respondents.

Figure 2. Q1 - Consumers' knowledge of existing PSS models in their country.



It is expected that there is a direct correlation between awareness of existing PSS models within a product group and positive perception of these, but it can also be speculated that there might be some relationship between the presence of PSS models and the consumer preference for these. Similarly, we may speculate whether the difference in percentages (positive or negative) between preference for and awareness of existing models, for the specific product groups, indicates an over- or under-supply of PSS solutions for those products. For example, 15% of consumers show interest in PSS models for jewellery, but only 6% are aware of existing offers. Considering the entire population size of Germany, this variation holds substantial numbers that may indicate an unmet market potential despite the low ranking among product groups.

Demographic variations and factors influencing consumer perception

To provide insights that may be helpful in future analysis regarding this indicator, the survey included background questions related to consumer demographics as well as questions concerning the importance of various factors in influencing consumer perception. The results for these questions do not respond directly to the indicator but may provide useful insights.

The results for the background questions showed a higher positive interest in PSS models among residents of the Berlin region compared to all other regions of Germany. There was also greater awareness of PSS models in Berlin, compared to other regions. We cannot determine the exact reasons for this variation. Berlin was much more densely populated compared to other regions (Statistisches Bundesamt Deutschland, 2023), since it does not include rural areas. Therefore, had it been possible to consider the results of other larger cities within other regions, it would have been possible to compare the results between cities and rural areas. For now, we can only highlight that the region of Berlin generally has a higher interest and awareness of PSS models, which may indicate greater support in large cities.

The results were generally similar for men and women across product groups, but with some differences regarding there 'Electronics' category, where 29% of men, compared to 22% of women, are *very interested* or *fairly interested* in PSS models. Generally, the age group of 25-34 showed the strongest positive interest in PSS models across product groups, and the positive response rates went down for each older age group.

The survey asked respondents to rate how much different factors would influence their interest in using PSS models. Most factors were rated equally important (considering the sum of *very important* and *fairly important*), since 'low prices', 'high quality', 'flexibility of use', 'accessibility', and 'ease-of-use' all scored between 69% and 75%. Meanwhile, the 'reduced environmental impact' associated with PSS models scored the lowest in terms of importance, as it was chosen by 56 % of consumers, with respondents of the region of Berlin as an outlier (rating at 71 %).

See Appendix 4.2 for full results on the demographic questions and factors influencing consumer perception.

2.2.2 Limitations

The high number of respondents and spread in demographic parameters meant that the data was representative of the national population. There were only a few examples of small bases for the various metrics, and these generally concerned specific subsets of demographic groups, which did not impact the overall results or conclusions.

It would be relevant to consider weighing the product groups since an average across very different groups in terms of their market size (turnover, number of customers, or transactions) might skew the results either positively or negatively depending on the relative usage frequency of these various product groups in normal situations. This can be considered in future research, but for this report, it may be mitigated by looking at the results on both a product group level and an aggregate level.

The use of surveys inherently includes the risk of biases due to the reliance on self-reported data by consumers. The data on consumers' perceptions of the attractiveness of the various PSS models may therefore be influenced positively or negatively by biases.

As highlighted in section 2.1.1, the survey design did not include questions specifically on the different types of PSS-models within each product group. Instead, the questions refer to "renting, sharing or leasing" as a whole. If instead there had been detailed sub-questions for each model and product group, the results would have had greater nuance on how various PSS models within each sector are perceived. This, in turn, would have allowed the results to be compared with data on what PSS models have the greatest potential for environmental benefits and increased circularity.

The advantage of the reduced number of questions is that this will likely generate a higher response rate and allow for representative results. Separating the terms would have required further elaboration of each model for each sector, making the questions more complex and potentially reducing the ability of consumers to identify and recognise the models in their habits.

Additionally, the environmental benefits and potential for increased circularity of PSS models in various sectors are very context-specific and will likely vary across EU member states. Thus, cross-examining the perception of various PSS models in relation to environmental benefits etc. is unlikely to provide reliable and useful results. This further justifies the methodological choices.

2.2.3 Performance

Table 7 below presents the performance of this indicator against the RACER criterion.

Table 77. RACER evaluation.

Stage of project	RACER criterion					Score
	Relevance	Acceptability	Credibility	Ease	Robustness	
Task 4 (original RACER assessment)	3	2	2	1	1	9
After Task 5 (following testing)	3	3	2	2	2	12

Note: The original indicator's title was "Consumer perception of renting vs. buying products"

Relevance

The CEAP highlights products-as-a-service and other circular business models in relation to their potential for creating and facilitating more circular and sustainable product lifecycles within various product sectors such as electronics, textiles, and transportation. Several legislative initiatives aim to incentivise and improve the conditions necessary to enable circular business models, such the Proposal for a Directive on common rules promoting the repair of goods (European Commission, 2023) and the EU strategy for sustainable and circular textiles (Directorate-General for Environment, 2022).

Policymakers and businesses alike are interested in understanding how consumers regard the PSS models, so the insights gained from measuring this indicator can be utilised to target and prioritise future initiatives and innovations (Mostaghel & Chirumalla, 2021). Therefore, it is highly relevant to track consumer perception on this topic, even on a general level as is proposed, since it will provide a basis for monitoring progress over time, which may supplement more detailed research and analysis on specific PSS models.

Acceptability

The information on consumer preferences for circular solutions is useful and necessary for businesses and public authorities engaging with this sector and the indicator is presumed to be broadly well accepted.

Credibility

Using professional providers of citizen surveys guarantees the credibility of the data collected. However, the selection and description of product groups may to some extent impact the credibility of the methodology and data when applied across EU Member States.

Ease

There is no authoritative data collection on this indicator, but it is simple to collect via common survey methodologies. The cost of surveys is relatively low, and it may be reduced by combining the questions needed with existing data collection nationally. Therefore, the score was raised from 1 to 2.

Robustness

Citizen surveys are a very commonly used practice with transparent and well-established data collection methodologies. External providers can be engaged to ensure representativeness and the EC already conducts annual surveys regarding consumer attitudes (Directorate-General for Economic and Financial Affairs, n.d.). The limitations regarding consumer self-reporting and the lack of a standardised weighing of various product groups may challenge the robustness of data collection across countries. Therefore, the score was raised from 1 to 2, but not given a full score.

Facets of CE

The original indicator formulation was regarded as relevant for the CE facets of “Transition/Progress over time” and the “Social” dimension of the CE. If this indicator was implemented in monitoring frameworks and if surveys were conducted regularly (e.g. annually), it might be a good measure of consumers’ perception of PSS models over time. This would help shed light on the progress of the CE transition and the potential sustainability for circular business models.

2.3 CHALLENGES AND LESSONS LEARNED

The data collection for this indicator was straightforward since we utilised the panels and expertise of an external provider for the surveys. Ensuring sufficiently high amounts of respondents and diversity in demographic characteristics is always a challenge when conducting consumer surveys. The external provider had high expertise in this regard, which mitigated the challenge and ensured representative overall data with few limitations on the overall conclusions.

Conducting surveys also involves other challenges related to the formulation of the questions and limitations of self-reporting by consumers. These include the risk of not overcoming selection bias, social desirability bias, as well as confirmation and reporting bias. We were not able to assess to what extent our research addressed these challenges and future surveys that seek to measure this indicator should seek to address them in detail.

2.4 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:

Consumer perception of the attractiveness of PSS models

Citizens play a critical role in the value networks of the CE transition, and their perspectives on circular business models provide important information on the transition's progress.

The results presented in the testing showed that the perception of PSS models was not homogenous across product groups and consumer demographics. When taking an average across product groups, 28% were 'very interested' and 'fairly interested', compared to 64% who were 'not very interested' or 'not at all interested'. Of the people interested in PSS models, their average ranking ranges from 15% - 46% for various product groups.

Background and supplementary questions to the primary focus of the indicator showed that respondents living in the Berlin region have a much higher interest in PSS models than respondents outside Berlin, and younger population segments show more interest than the older ones. Of the factors determining the respondents' interest in PSS, 'reduced environmental impact' was of significantly lower interest than all other factors.

The indicator performs well against the RACER criteria, especially on the parameters of Relevance and Acceptability. It is argued that tracking consumer preferences is very relevant for providing insights on progress towards the goals of the CEAP and various regulatory initiatives targeting consumer uptake of circular business models, including PSS. The data collection method scores medium on credibility, ease, and robustness with some manageable challenges to overcome if the indicator were to be implemented across the EU.

Recommendations

The potential cost of data collection via surveys across EU MS could pose a potential challenge for applying the indicator in future. The Directorate General for Economic and Financial Affairs (DG-EFA) of the EC already conducts regular harmonised surveys, targeting various sectors and involving both industry and consumers (DG-EFA, n.d.). However, the national questionnaires to consumers do not currently cover topics related to sustainability or the perception of aspects related to the CE.

Considering the prominence of the EU's CE policy priorities, it would be appropriate to integrate such aspects into these regular surveys or consider adopting separate surveys related to sustainability and the circular economy. The EU CE Monitoring Framework would benefit from indicators related to the presence, uptake, and perception of circular business models such as PSS, and results from EU-wide surveys on this indicator would be relevant to include as a metric in this context.

Table 8. Summary of recommendations for indicator PSS1.

Type of recommendation	Recommendation	RACER Criteria addressed	Timeline	Key stakeholders or partners
Research and stakeholder engagement	Initiate a research and stakeholder engagement effort to progress towards implementing consumer surveys concerning perception of PSS models, and other CE topics, across EU Member States. Required efforts include defining products and product groups to survey and clarifying the potential of integrating surveys in existing systems or the need for new efforts.	Credibility, Ease and Robustness	Medium (1.5 – 5 years)	Responsible: EC Accountable: EU Member States Consulted: Research institutions and international organisations (e.g. EEA) Informed: Business associations

3. INDICATOR 2 – PERCENTAGE OF CITIZENS WHO HAVE USED PSS MODELS

Indicator: Percentage of citizens who have used PSS models

This indicator allows for monitoring the share of citizens who have had concrete experience with using PSS models. Over time, the indicator is expected to show the trend for consumers' use of PSS solutions as an alternative to traditional ownership models.

PSS is an integral part of the mix of innovations that move society toward a more sustainable future. PSS plays a prominent role in the EU's CEAP and reshaping the consumption habits of EU citizens through circular business models, such as PSS, is part of the EU Strategy for Sustainable and Circular Textiles (Directorate-General for Environment, 2022). However, PSS implementation rates are low, and there is a perception in the business society that PSS models do not create sufficient value to overcome a preference among consumers for ownership in Western societies (Catulli et al., 2017). Additionally, research shows that the environmental benefits of various PSS models vary greatly, and the potential for increased circularity depends on several factors that are moderated on a case-by-case basis. Therefore, monitoring progress on consumer experience with PSS models broadly across the EU, and measuring the potential for increased circularity, is inherently challenging.

Nevertheless, because PSS models have potential to increase circularity across industries and product groups, tracking consumer-related data becomes relevant and is an important element of monitoring progress towards better models. Companies and experts highlight the need to influence consumer behaviour as key for businesses to switch to more circular business models. However, attracting consumers to use new solutions depends not only on pricing but also on a range of cognitive consumer biases, including "status quo bias," which increases people's preference for the current situation (Orasmaa et al., 2020).

Over time, the indicator will allow for the following benefits:

- Insight into citizen experience with PSS models may inform efforts in the EU to support the transition to more sustainable and circular economies.
- By gaining EU-wide insights on use-rates across product groups, it may help highlight opportunities for supportive action and market development, which could be useful for multiple stakeholders.
- It allows for tracking consumer use of PSS models over time as a tool for policy makers on a national- and EU-level.
- It may provide valuable insights on how legislation, incentives, communication efforts and industry provision of PSS models influence use rates over time.
- Country-by-country comparison of consumer use-rates of PSS models may be linked with other indicators and data on PSS models in various countries such as the no. of PSS models provided, the market size, no. of government incentives etc.

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Germany with the aim of receiving responses from a representative population sample. The resulting data allowed for comparisons across different age groups, genders, regions, income levels, and product groups. The data thus provided a broad insight into the German population's perspectives on the attractiveness of PSS models and internal differences across demographic groups.

The reliability of the collected data depended on the ability of respondents to provide accurate responses to the questions and on the ability of the survey partner and the consultant to ensure a sufficiently high response rate for the data to be representative of the population.

The complexity and large variability of PSS models meant that ensuring a correct understanding of the questions among all respondents was an inherent challenge. The survey included several product groups to give more granularity on which product groups performed well and to increase the likelihood that the questions invoked respondents' recognition of PSS models. Questions have been formulated in short and without technical and complex language for greater consumer recognition. However, a distinction between various PSS types was not included in the questions, since this would have significantly increased the complexity and length of the survey. This would likely have resulted in a lower response rate in general and for the specific models for each product group, without guaranteeing more reliable results. Thus, the breadth of responses was prioritised over the depth to provide a scalable methodology across EU countries, where the experience with PSS models varies significantly.

Data availability was considered 'medium', because no data was being collected at the time, but data on consumer perspectives can easily be collected using a survey in future.

Table 9. Source, reliability and availability.

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Citizen survey	*Medium*	*Medium*

** **Low** = Some data will likely be missing and incomplete, which may lead to inaccurate conclusions, **Medium** = The data will likely be complete but may lack accuracy and quality, **High** = The data will likely be complete, accurate and of high quality.*

*** **Low** = The data is not already collected or readily available and will be difficult to collect. **Medium** = The data is already collected but is not publicly available, OR the data is not already collected but is easy to collect, **High** = The data is readily available and can be accessed easily.*

3.1.2 Data collection method

The survey focused on the consumers' use of PSS models referred to as "renting, sharing or leasing" within the product group listed below:

- Transportation and vehicles (e.g. cars, trailers, bikes, scooters, etc.).
- Clothing and textiles.
- Jewellery.
- Electronics (e.g. phones, computers, TV, etc.).
- Machinery (e.g. white goods, etc.).
- Outdoor and leisure equipment, including accessories (e.g. power tools, sports gear, camping equipment, etc.).

Questions

We developed the draft survey questions that YouGov then adjusted to fit with best practices for a survey of this type. The respondents were first asked the question:

> ***[GRP_Q1] Thinking about companies that allow consumers to rent, share or lease products without a purchase commitment…***
>
> *In which, if any, of the following industries were you aware that consumers could rent, share or lease products without a purchase commitment in Germany? (Please select all that apply)*

Based on their choice of categories for the previous question, for which they could choose all the product groups where they were aware of PSS models, the respondents were asked whether they had used a PSS model within each of those product groups:

> **[*GRP_Q2] You previously said that you are aware that consumers can rent, share or lease products from businesses in certain industries within Germany…***
>
> *Which, if any, of the following industries have you ever rented, shared or leased products from? (Please select all that apply. If you have never done this, please select the "Not applicable option)*

Besides the questions directly related to citizen experience with PSS models, data from another dataset on households' experience with peer-to-peer use and sharing models across product categories has been used to inform the present indicator.

The survey was carried out online through YouGov's panels between 28th February 2024 and 4th March 2024. Upon collection, YouGov weighted the data (considering age groups, gender, regional variables, and income levels) to ensure that the results were nationally representative. The survey outline is attached in Appendix 4.1 and the full data reports in Appendix 4.2.

3.1.3 Calculations

The indicator's measurement was the total share of the population who have used one or more PSS models. Data on the use of PSS models was collected in Q2, but the answer categories for this question were only visible to those who selected awareness of specific product groups in Q1. This meant that the respondents for Q2 were a subset of the total group of respondents.

Since respondents were able to select multiple product groups, only the totals for the answer options "Not applicable" and "Don't know" represented a correct share of the group of respondents.

To infer the results of Q2 to the entire population, the share of respondents for Q2 who selected "Not applicable" and "Don't know" ("Q2 respondents with no PSS use") was multiplied with the share of respondents for Q1 that answered "Not applicable" and "Don't know" ("Q1 respondents with no PSS use"). This gave the share of the population that have not used PSS models ("Share of population with no PSS use") and includes both those unaware of PSS models and those aware of PSS models, who have not used any before. The remaining share of the population represents those who have experience using one or more PSS models.

$$\text{Q1 \% of respondents with no PSS use} \times \text{Q2 \% of respondents with no PSS use} = \text{Share of population with no PSS use}$$

3.1.4 Timeline

Table 10 below presents the timeline for the testing of this indicator.

Table 10. Gantt chart - PSS2

	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														
	Develop citizen survey														
	Data collection via external partner														
	Data analysis														
	Reporting														
	Review period														
Legend															
	Task progress														
	Review period														

3.1.5 Data gaps and mitigation

The primary data gaps relate to the granularity of the data to be collected. The indicator refers to consumer use of PSS models on a general level, so a broadly formulated question would be sufficient to generate data

on the indicator. However, in this test, gathering data on consumer use at the product group level was beneficial. This resulted in a potential data gap due to the exclusion of some potentially relevant product groups – and due to different interpretations of the product coverage of each product group. Product groups were selected based on experts' insights, stemming from three years of research into PSS models in the Nordic countries (Egebæk et al., 2022).

Data availability and reliability was another important gap in this study. It depended on the ability of respondents to provide accurate responses and the survey's ability to ensure a sufficiently high response rate for the data to be representative of the population. If sufficient respondents were not secured, this would have posed a severe limitation and data gap for the research to conclude on the indicator meaningfully. Using an external survey agency with large panels, such as YouGov, has mitigated these potential issues.

Table 11. Overview of identified data gaps, limitations and mitigation efforts.

	Description of data gap	Mitigation efforts	Level of confidence
1	Selection of product groups excludes relevant cases.	• Use of experts' insights on the availability of PSS models within various sectors	High
2	Sufficient respondents required to extrapolate data to population.	• Use of external survey agency with large panels	High

3.1.6 Quality review of analysis

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

- Before work begins, the Project Director will review the proposed research methodology and ensure that the data collection plan fits the purpose. Once the research team has addressed any comments from the review process, they will proceed to the data collection phase.
- In relation to the survey development and dissemination, the Project Coordinator will review the questioning for this indicator to ensure that it is clear, followable, and able to generate reliable and robust results. Respondents will also be required to answer each question before proceeding to ensure data validation of the survey.
- Once the survey has closed and the results have been analysed, the Quality Assurance Manager will conduct a thorough internal quality assurance process on the Excel data set which will pull together the data from the survey and subsequent calculations. Any incoming data and assumptions will be logged, presenting survey data, user inputs, calculations, assumptions, and results.

3.2 KEY ANALYSIS RESULTS

3.2.1 Analysis

Survey responses were received from 2.266 persons across Germany, with a good distribution of respondents on background demographics. Where needed, the data was weighted to ensure representativity. Table 12 presents an overview of responses to the question on citizen awareness of PSS models (Q1), and Table 13 presents the percentages of respondents aware of PSS models in specific product groups, who have used PSS models for products in those same groups (Q2). The total calculated share of the population who have used PSS models is presented in Table 14 and illustrated in Figure 3.

The results in Table 12 revealed that 35% of the population in Germany *were not* aware of any PSS models being offered[1] and the remaining 65% *were* aware of PSS models offered in at least one of the product groups

[1] Includes those who selected "Not applicable" and "Don't know" to Q1

in the survey. Out of the respondents who *were* aware of at least one PSS model, as shown in Table 13, 37% of them *have not* used any PSS models[2], while the remaining 63% have used at least one PSS model.

Based on these figures, it was calculated that 40% of the population has used at least one PSS model as shown in Table 14. The figures indicated that a substantial share of the population is aware of PSS models, and many of those also have experience using such models.

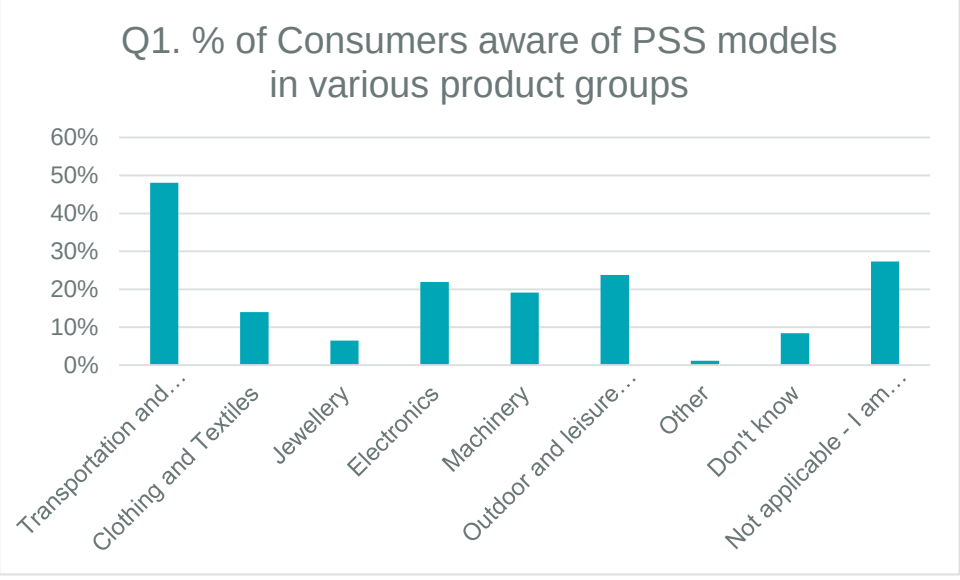
The following sections will elaborate on how the responses were distributed.

Table 12. Population awareness of PSS models for various product groups – Germany

Q1: For which, if any, of the following product groups are you aware of companies in Germany offering consumers to rent, share or lease products without a purchase commitment?	
PRODUCT GROUP	**AWARENESS OF PSS MODELS (% of respondents)**
Transportation and Vehicles	48%
Clothing and Textiles	14%
Jewellery	6%
Electronics	22%
Machinery	19%
Outdoor and leisure equipment	24%
Other	1%
Don't know	8%
Not applicable - I am not aware of businesses in any industry that provide the option for consumers to rent, share or lease products without a purchase commitment	27%

Notes: Full questions - Q1: Thinking about companies that allow consumers to rent, share or lease products without a purchase commitment…For which, if any, of the following product groups are you aware of companies in Germany offering consumers to rent, share or lease products without a purchase commitment? (Please select all that apply). The Unweighted base and Weighted base of Q1 are both 2,266 respondents.

Figure 3. Q1 - Consumers' knowledge of existing PSS models in their country.



[2] Includes those who selected "Not applicable" and "Don't know" to Q2

Table 13. Respondents' use of PSS models for various product groups – Germany

Q2: For which, if any, of the following product groups have you used the services of companies in Germany offering consumers to rent, share or lease products without a purchase commitment?	
PRODUCT GROUP	**USE OF PSS MODELS (% of those who selected the same product group in Q1)**
Transportation and Vehicles	53%
Clothing and Textiles	33%
Jewellery	42%
Electronics	32%
Machinery	29%
Outdoor and leisure equipment	40%
Other	86%
Don't know	2%*
Not applicable - I have not used any service model	35%*

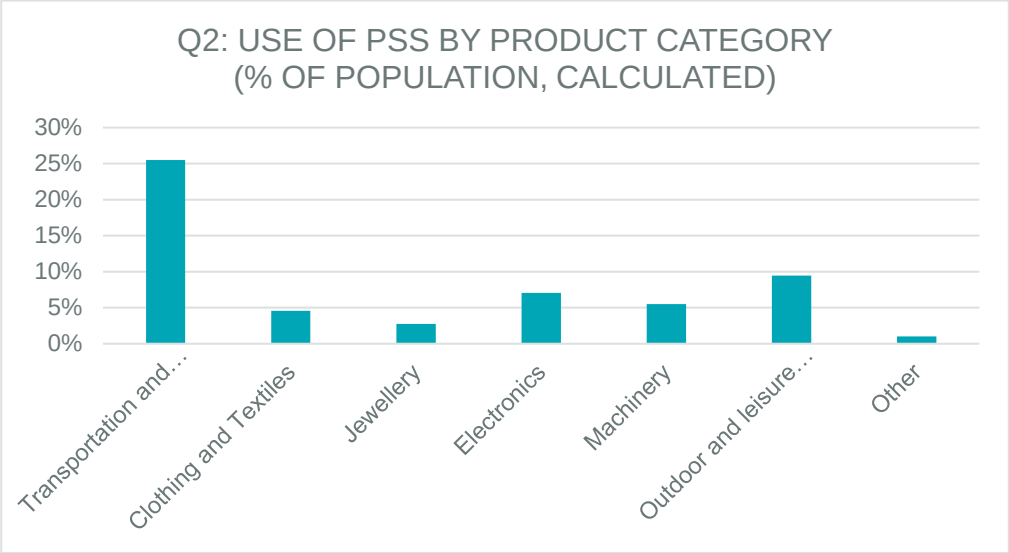
*Notes: Full question - Q2: You previously said that you are aware that consumers can rent, share or lease products from businesses in certain industries within Germany...Which, if any, of the following industries have you ever rented, shared or leased products from? (Please select all that apply. If you have never done this, please select the "Not applicable" option). The Unweighted base is 1,474 and Weighted base is 1,456 respondents. *Calculated based on the percent of respondents in the Weighted Base for Q2, whereas the other rows are calculated based on the total no. of selections for the same product group in Q1.*

Table 14. Population use of PSS models for various product groups (calculated) – Germany

Calculated total of population who have used PSS models for each product group and in total	
PRODUCT GROUP	**USE OF PSS MODELS (% of those who selected the same product group in Q1)**
Transportation and Vehicles	25%
Clothing and Textiles	5%
Jewellery	3%
Electronics	7%
Machinery	6%
Outdoor and leisure equipment	9%
Other	1%
TOTAL – Have used at least one PSS model	**40%***
TOTAL – Not used any PSS model	**60%***

*Notes: The Unweighted base is 1,474 and Weighted base is 1,456 respondents. *Calculated by multiplying the share of the respondents for Q2 that answered "Not applicable" and "Don't know" with the share of respondents for Q1 that answered "Not applicable" and "Don't know".*

Figure 4. Population use of PSS models for various product groups (calculated) – Germany



Variations between product groups

The survey reveals a large variation in citizen awareness of PSS models within the different product categories (Table 12). The highest score was 48% for the ´Transportation and vehicles' sector, confirming that renting and leasing cars is an established sector in Germany. The lowest scoring sector is 'Jewellery', with only 6% awareness of PSS models.

When it came to the use of PSS models, the share of citizens aware of models within certain categories did not necessarily reflect on how big a share of those aware of the model have used it (Table 13). In fact, a larger share of those aware of PSS models for 'Jewellery' and 'Clothing and textiles' have used those models as well, compared to 'Machinery' and 'Electronics'.

Table 15 below shows variations between men and women concerning the use of PSS models. The product groups shows are those where the difference is more than ten percentage points between the genders.

Table 15. Use of PSS models for selected product groups (Q2) by Gender

PRODUCT GROUP	% Total	% of Men	% of Women
Transportation and Vehicles	**53%**	59%	47%
Jewellery	**42%**	36%	49%
Electronics	**32%**	36%	25%
Outdoor and leisure equipment	**40%**	45%	35%
Not applicable - I have not used any service model	**35%***	29%*	40%*

*Notes: *Calculated based on the percent of respondents in the Weighted Base for Q2, whereas the other rows are calculated based on the total no. of selections for the same product group in Q1.*

3.2.2 Limitations

The high number of respondents and spread in demographic parameters meant that the data was representative of the national population. There were only a few examples of small bases for the various metrics, and these generally concerned specific subsets of demographic groups, which did not impact the overall results or conclusions.

It would be relevant to consider weighing the product groups since an average across very different groups in terms of their market size (turnover, number of customers, or transactions) might skew the results either positively or negatively depending on the relative usage frequency of these various product groups in normal situations. This can be considered in future research, but for this report, it may be mitigated by looking at the results on both a product group level and an aggregate level.

The use of surveys inherently included the risk of biases due to the reliance on self-reported data by consumers. The data on consumers' perceptions of the attractiveness of the various PSS models may therefore be influenced positively or negatively by biases.

As highlighted in section 3.1.1, the survey design did not include questions specifically on the different types of PSS-models within each product group. Instead, the questions refer to "renting, sharing or leasing" as a whole. If instead there had been detailed sub-questions for each model and product group, the results would have had greater nuance on the experience of consumers with various PSS-models within each sector. This, in turn, would have allowed the results to be compared with data on the PSS-models with the greatest potential for environmental benefits and increased circularity.

The advantage of the reduced number of questions is that this will likely generate a higher response rate and allow for representative results. Separating the terms would have required further elaboration of each model for each sector, making the questions more complex and potentially reducing the ability of consumers to identify and recognise the models in their habits. Additionally, the environmental benefits and potential for increased circularity of PSS models in various sectors is very context-specific and will likely also vary across EU member states. Thus, cross-examining the experience of consumers with various PSS models in relation to their individual environmental benefits etc. would be difficult and unlikely to provide reliable and useful results. This further justifies the methodological choices.

3.2.3 Performance

Table 16 below presents the performance of this indicator against the RACER criterion.

Table 16. RACER evaluation.

Stage of project	RACER criterion					Score
	Relevance	Acceptability	Credibility	Ease	Robustness	
Task 4 (original RACER assessment)	3	2	1	2	1	9
After Task 5 (following testing)	3	3	2	2	2	12

Note: The original indicator's title was "Percentage of citizens who have used sharing or rental systems instead of buying new products at a national/regional or city level"

Relevance

The CEAP highlights PSS models for their potential to facilitate more circular and sustainable product lifecycles within various product sectors. Several legislative initiatives aim to incentivise and improve the conditions necessary to enable circular business models, including the EU strategy for sustainable and circular textiles (Directorate-General for Environment, 2022). There is currently no comprehensive framework for tracking citizen use of PSS models on the national or EU level, so this is why this indicator is highly relevant.

Acceptability

The information on consumer preferences for circular solutions is useful and necessary for businesses and public stakeholders, and the indicator is presumed to be broadly well-accepted.

Credibility

Using professional providers of citizen surveys guarantees the credibility of the data collected. The selection and description of product groups may, to some extent, impact the credibility of the methodology and data

when applied across EU Member States. The concept of “use of PSS models” is low in complexity and easier to measure than when trying to compare PSS models with purchase situations. Therefore, the score was raised from 1 to 2.

Ease

There is no authoritative data collection on this indicator, but it is simple to collect via common survey methodologies. The cost of surveys is relatively low, and it may be reduced by combining the questions needed with existing data collection nationally. Therefore, the score was left unchanged at 2.

Robustness

Citizen surveys are a very commonly used practice with transparent and well-established data collection methodologies. External providers can be engaged to ensure representativeness and the EC already conducts annual surveys regarding consumer attitudes (Directorate-General for Economic and Financial Affairs, n.d.). The limitations regarding consumer self-reporting and the lack of a standardised weighing of various product groups may challenge the robustness of data collection across countries. Therefore, the score was raised from 1 to 2, but not given a full score.

Facets of CE

The original indicator formulation was regarded as relevant for the CE facets of “Transition/Progress over time” and the “Social” dimension of the CE. If the indicator was implemented in monitoring frameworks and surveys were conducted regularly (e.g. annually), it might be a good measure of citizens’ use of PSS models over time. This would help shed light on the progress of the CE transition and the quality of circular business models.

3.3 CHALLENGES AND LESSONS LEARNED

The data collection for this indicator was straightforward since we utilised the panels and expertise of an external provider for the surveys. Ensuring sufficiently high amounts of respondents and diversity in demographic characteristics is always a challenge when conducting consumer surveys. The external provider had high expertise in this regard, which mitigated the challenge and ensured representative overall data with few limitations on the overall conclusions.

Conducting surveys also involves other challenges related to the formulation of the questions and limitations of self-reporting by consumers. These include the risk of not overcoming selection bias, social desirability bias, as well as confirmation and reporting bias. We were not able to assess to what extent our research addressed these challenges and future surveys that seek to measure this indicator should seek to address them in detail.

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:

Percentage of citizens who have used PSS models

Citizens play a critical role in the value networks of the CE transition, and their use of circular business models provides important information on the transition's progress.

The results have shown that 40% of the population of Germany have used PSS models at least within one product group, but that the use and awareness of PSS models is not homogenous across product groups and demographic factors. It provides a good foundation for recommending that similar surveys are considered for all EU Member States in order to compare the results and be able to track the use and awareness of PSS models over time. This may be of interest to both governments, seeking to promote circular business models, and the industry, which may use it to develop and provide the PSS models to consumers.

The indicator performs well against the RACER criteria, especially on the parameters of Relevance and Acceptability. It is argued that tracking consumers’ experience with using PSS models is very relevant for

providing insights on progress towards the goals of the CEAP and various regulatory initiatives targeting consumer uptake of circular business models, including PSS. The data collection method scores medium on credibility, ease, and robustness with some manageable challenges to overcome if the indicator were to be implemented across the EU.

Recommendations

The potential cost of data collection via surveys across EU Member States poses a potential challenge for applying the indicator in future. The Directorate General for Economic and Financial Affairs of the European Commission (DG-EFA) already conducts regular harmonised surveys, targeting various sectors (DG-EFA, n.d.). National questionnaires to consumers do not currently cover topics related to sustainability or the perception of aspects related to the CE.

Considering the prominence of EU's CE policy priorities, it would be appropriate to integrate such aspects into these regular surveys or consider adopting separate surveys related to sustainability and the circular economy. The EU CE Monitoring Framework would benefit from indicators related to the presence, uptake, and perception of circular business models such as PSS, and results from EU-wide surveys on this indicator would be relevant to include as a metric in this context.

Table 17. Summary of recommendations for indicator PSS2.

Type of recommendation	Recommendation	RACER Criteria addressed	Timeline	Key stakeholders or partners
Research and stakeholder engagement	Initiate a research and stakeholder engagement effort to progress towards implementing citizen surveys concerning use of PSS models, and other CE topics, across EU Member States. Required efforts include defining products and product groups to survey and clarifying the potential of integrating surveys in existing systems or the need for new efforts.	Credibility, Ease and Robustness	Medium (1.5 – 5 years)	Responsible: EC Accountable: EU Member states Consulted: Research institutions and international organisations (e.g. EEA) Informed: Business associations

4. APPENDICES

4.1 APPENDIX 1 – PSS1 AND PSS2 SURVEY OUTLINE

See MS Word document “DGRTD_PSS1_PSS2_Survey Outline_V01.00“ provided alongside this report.

4.2 APPENDIX 2 – PSS1 AND PSS2 SURVEY RESULTS

See MS Excel document “DGRTD_PSS1_PSS2_Survey Results_V01.00“ provided alongside this report.

4.3 RACER ASSESSMENT 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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T: +44 (0) 1235 75 3000

E: enquiry-ee@ricardo.com

W: www.ricardo.com