



BUSINESS-DRIVEN SYSTEMIC SOLUTIONS
FOR SUSTAINABLE PLASTIC PACKAGING
REUSE SCHEMES IN MASS MARKET APPLICATIONS

STARTING DATE OF THE PROJECT: 01/09/2022 - DURATION: 42 MONTHS

POLICY BRIEF
SUSTAINABILITY AND CIRCULARITY
ASSESSMENT OF REUSABLE PACKAGING



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This policy brief, based on the work of the European Buddie-pack project (Horizon Europe), presents the gaps and barriers identified in the project to present a robust and comprehensive circularity and sustainability assessment of reusable packaging. This document presents the existing data gaps and method discrepancies to model reusable packaging and compare them to single use. It proposes public policy recommendations to perform circularity analyses and communicate the results.

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THE CHALLENGE

Over recent years, numerous Life Cycle Assessments analysing reuse systems and comparing them to existing single-use systems have been published. Whilst useful for assessing when and how switching to a reusable system can be a better option to tackle issues such as global warming or resources depletion, it is difficult to draw conclusions from them in the short and long term to make strategic decisions on the regional or national adoption of reuse, as they suffer from a lack of real operational data and methodological reference frames. For the example of reusable packaging, the scientific community has even published a letter warning the European Parliament about the insufficient scientific rigour and transparency of comparative LCAs used to influence decisions for the Packaging and Packaging Waste Regulation (1). To ensure the LCAs for reuse systems are robust in identifying which use-case reusable systems should be adopted, several methodological points must be addressed.

WHY IT MATTERS

LCAs comparing reusable and single-use packaging often try to define IF one solution is better than the other, whereas the question should be WHEN. Reusable systems are still immature, and many parameters used in LCA (transport distances, washing consumptions, return rate...) are expected to change in the future and should be prospectively studied in the results interpretation. The LCAs should then be reports giving the number of uses necessary to achieve environmental improvement (Break-Even Point) depending on parameters evolution, enabling decisions-makers to know when it is relevant to switch to reuse.

The aim of the BUDDIE-PACK project is to develop business-driven systemic solutions for sustainable plastic packaging reuse schemes in mass market applications. To assess their sustainability, a two-step (screening study and full assessment) environmental, economic and social Life Cycle Assessment is performed on the five reusable use-cases developed in the project.

POLICY RECOMMENDATIONS APPLICABLE TO THE WHOLE EU

1 POLICY RECOMMENDATION 1: ESTABLISH ISO-BASED GUIDELINES FOR PACKAGING LCA, COMPLEMENTING EXISTING PEF MODELLING RECOMMENDATIONS

- An LCA should be conducted using the ISO 14040:2006 (2) and ISO 14044:2006 (3) standards. The ISO standards give recommendations on the different steps to follow – goal and scope, life cycle inventory, impact assessment and results interpretation – and how to perform them. For example, the scope definition should clearly define the functional unit and reference flows, i.e. what are the performances needed for the packaging? Is the study focused on one use of the reusable packaging or a system?
- When reading an LCA, some simple information enables to assess if the study presented is robust: if it states it has been performed according to ISO 14040 and 14044 standards, if it has been performed by an independent party, and ideally if it has been peer-reviewed.
- The ISO standards are generic and do not give specific recommendations on how to model life cycle steps and which data to use. Several reference frameworks advise LCA practitioners on packaging modelling. The most well-known frameworks are the Product Environmental Footprint (PEF)(4) and the ADEME framework for packaging comparative LCAs (5). The PEF has a general framework and Product Category Rules. Packaging modelling is included in recommendations for life cycle steps modelling but has not got its own category rule. For instance, formulas to calculate the reuse rate of reusable packaging and generic reuse number for specific types of packaging are given. The ADEME framework gives specific recommendations for each step of life cycle assessment and each step of the packaging life cycle. Some of the modelling advice is sourced from the PEF, for example, the formulas to calculate transport impact allocation, reuse rate, or the impact and benefits of packaging waste valorisation. The ADEME framework also gives reference data to use in the inventories, for instance to model transports or end-of-life, but some of them are specific to France.

2 POLICY RECOMMENDATION 2: CONSIDER THE EVOLUTION OF IMMATURE REUSE SYSTEMS IN LCAS BUILD COMPREHENSIVE AND PROSPECTIVE ANALYSES

- The assessment should be comprehensive as possible, by including the full life cycle of the product reviewed, and as much environmental indicators as possible.
- As the business models around reuse are still immature, it is important to consider different scenarios, especially for the use and end-of-life phases. Indeed, companies that provide reusable packaging, return systems, washing services and so on, are still on a small scale and the model they adopted may not be the one that will work and spread in the future.

- Several decisive parameters on the reuse system should be clearly defined, by sourcing the values and data used and explaining when it is a hypothesis or an assumption. The parameters that are most contributing to the reusable packaging impact, and should be carefully defined, are for example the packaging weight, the number of uses (calculated with the return rate and the breakage rate), the consumer and return loop transports, the washing consumptions, and the end-of-life scenarios.
- The parameters based on assumptions or lower quality data should be subject to sensitivity analyses in the results interpretation.

PERFORM DYNAMIC RESULTS CALCULATIONS

- Comparative assessments usually give the relative difference on all impact categories selected, between the studied systems. As the reuse vs single-use assessments compare a developing model to a well-established one, it is interesting to add dynamic comparisons. It means evaluating the evolution of the relative difference depending on decisive hypotheses, like the number of reuses, and to give the Break-Even Point (BEP), here the number of uses for which the reusable packaging becomes less impactful than the single-use one.
- The Break-Even Point analysis should be used for sensitivity analysis, and instead of just concluding on which packaging solution is better than the other one, show what evolution to look for to make the reusable packaging better than the single-use one.

3 POLICY RECOMMENDATION 3: EXPAND ASSESSMENT TO OTHER TYPES OF STUDIES

- LCA only assesses the environmental impact of packaging, whereas reuse can be beneficial on many other aspects. Other assessments can be included, to give a comprehensive perspective of reuse potential benefits.
- When assessing the sustainability, presenting several environmental impacts is not sufficient. Sustainability, by its definition, is the conjoint association of environmental, social, and economic improvements. In order to fully assess sustainability, one must add Social Life Cycle Assessment (SLCA) and (LCCA) and analyse trade-offs between them. Their integration will depend on greater methodological maturity and uptake.
- Concerning circularity, the definition of circular economy given by ISO 59004:2024 (6) is “an economic system that uses a systemic approach to maintain a circular flow of resources, by recovering, retaining or adding to their value, while contributing to sustainable development”. A circularity assessment should at least associate a circular flow indicator to the sustainability assessment. One of the most well-known indicators that could cited is the Material Circularity Indicator (MCI) (7) developed by Ellen McArthur.

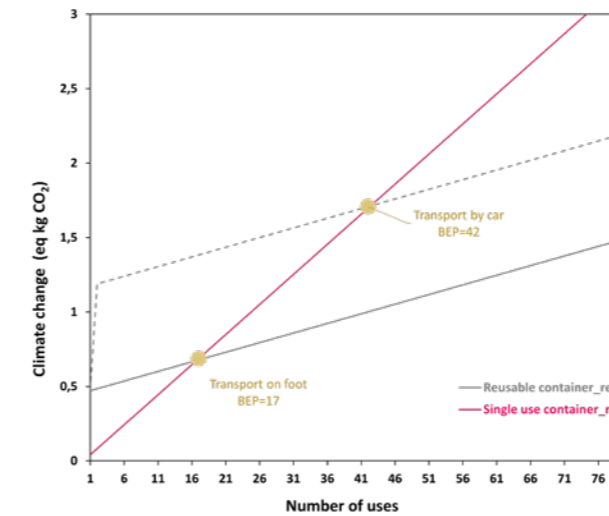
EVIDENCE AND CONTEXTS

The previous policy recommendations are based on existing recommendations of scientific community (1) and environmental associations (8) on the requirements of a good comparative LCA including reusable packaging.

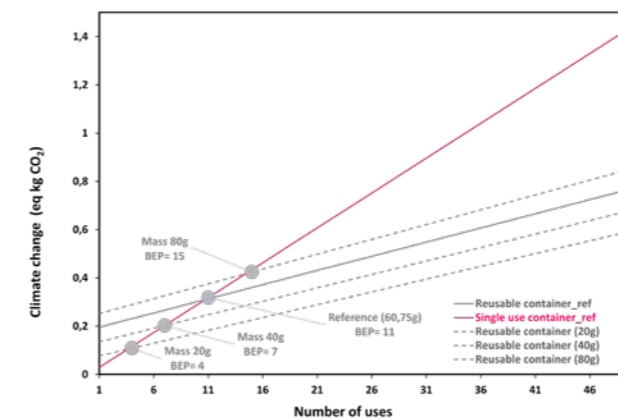
Within the BUDDIE-PACK project, several deliverables have enabled assessing the methodologies to perform reusable packaging circularity assessments. The first deliverable D7.1 (9) compared LCA, LCCA and SLCA methodologies given by standards and frameworks to select the most relevant ones for studies performed in the other deliverables.

Deliverable 7.2 (10) performed sustainability screening studies on all the use-cases developed within BUDDIE-PACK. For LCA, the method has been based as much as possible on the PEF and the ADEME reference framework. Recommendations to calculate transport impact allocation or reuse number could not be applied

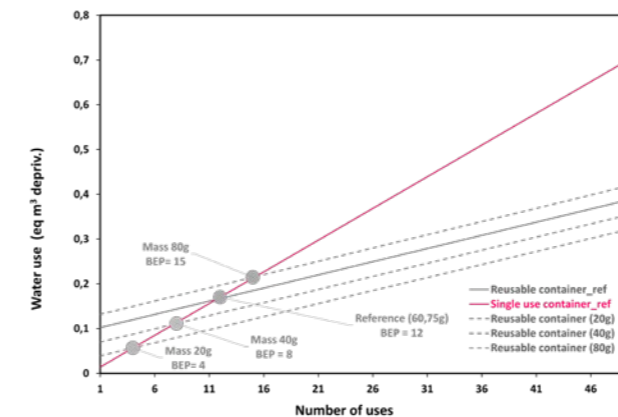
because data was lacking at this stage of the project. Results are available for all EF3.0 impact categories but thorough sensitivity analyses based on Break-Even Point (BEP) have been performed on Climate change and Water use. It showed the big impact of hypotheses change on BEP can have for packaging weight, consumer and return loop transports, washing consumptions and end-of-life scenarios.



Effect of customer transportation on BEP for climate change and environmental impacts categories for reusable container



Climate change & Water use BEP evolution depending on container mass



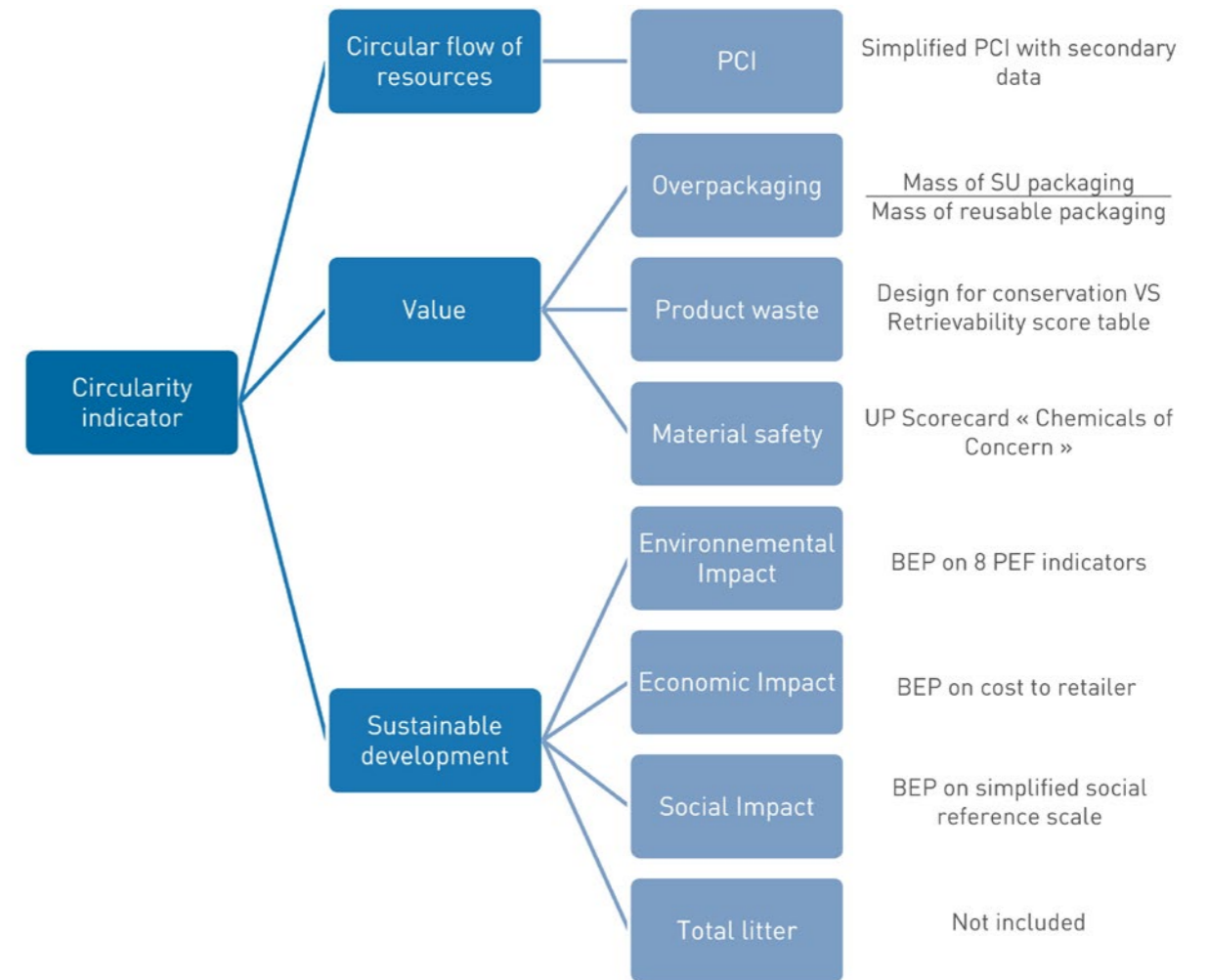
Coincidentally, the main contributors are also the parameters and life cycle steps for which quality data is hard to get because of systems immaturity. That's why sensitivity analyses and effect on BEP should always be performed on parameters based on hypotheses and low-quality data.

| USE-CASE | MAIN CONTRIBUTORS TO CLIMATE CHANGE AND WATER USE | DATA GAPS |
|--|---|--|
| Take-away food container | Container production Consumer transport | PBT production Consumer transport |
| Refillable system for laundry detergent | BiB and reusable bottle production | Detergent distribution machine Recycled plastic content BiB volume |
| Semi-rigid catering tray for schools and nursing homes | Tray production Transport | PBT production Cost of RPP production Industrial washing |
| On-the-spot food consumption container | Container production Washing | PBT production Industrial washing Reverse vending machine |

Summary of main contributors and data gaps per use-case

Due to methodological development, environmental results could not be put in front of economic and social results to identify trade-offs, but the conjoint analysis of the three sustainability pillars is considered for the full assessment of packaging used on a large scale in BUDDIE-PACK project.

Finally, Deliverable 7.3 (11) studied the development of a circularity tool for reusable packaging. The aim of the circularity indicator is to give a simplified evaluation on the adequacy of the reusable packaging with circular economy definition. To do so, the tool proposes a circularity indicator structure that fits the ISO 59004 definition of circular economy (i.e. an economic system that uses a systemic approach to maintain a circular flow of resources, by recovering, retaining or adding to their value, while contributing to sustainable development), based on the triad of Circular flow of resources, Value and Sustainable development.



Summary of circularity tool structure in D7.3

Circularising the material flows can improve sustainability but not necessarily. That's why they are presented separately and not aggregated in a single score.

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