

FEFCO studies on recycling and reuse of packaging Executive summary

EU policies place a strong emphasis on the role of packaging in the circular economy and its design to be recycled and/or reused. This approach often neglects the purpose of packaging and examines it solely from a waste generation perspective. Packaging has a significant role to protect its contents from damage and becoming waste and therefore packaging functionality, sustainability and overall performance should always be considered first. Additionally, it is critical to point out that expressing a clear preference solely for reusable packaging versus recyclable packaging is a narrow-minded approach. Legislative proposals must ensure that any packaging placed on the EU market is 'fit for purpose', environmentally friendly and prevents unnecessary waste which is the ultimate objective of policymakers ensuring innovation for even more functional and circular packaging solutions.

The following is an executive summary of three studies aiming at better understanding the role and impact of packaging solutions in the Green Deal context commissioned by FEFCO and conducted by an independent consultancy (Ramboll) and a research institute (VTT). The studies evaluate the impact of corrugated board packaging compared to reusable plastic packaging:

- A peer-reviewed **comparative life-cycle assessment** for packaging solutions for the food segment comparing the environmental impacts of corrugated boxes and plastic crates.
- **A hot spot analysis** of the e-commerce logistic chain evaluating single use versus reusable solutions.
- A white paper providing a **critical view** on packaging recycling and reuse in the European Circular Economy.

Comparative life cycle assessment

The study compared business to business (B2B) transport of fresh food within the EU using two packaging solutions: corrugated boxes (CBs) and reusable plastic crates (RPCs). The study was conducted by an independent consultant (Ramboll) according to ISO 14040 and ISO 14044 standards and peer reviewed by a dedicated panel of three independent peer-reviewers. It evaluated a basic scenario for fifteen Environmental Footprint (EF) impact categories selected in line with the EU PEF methodology. Data was collected from both primary sources, including manufacturers and industry, and secondary ones, such as literature or LCI databases. The study includes extensive 14 comparative scenario assessments, increasing its credibility.

The functional unit used for this study was 1 tonne of fresh produce (vegetables) over a transport distance of 840km from producer to retailer within the EU-27 (+UK), allowing the study to be representative of average food transport systems in the EU.

An end-of-life baseline scenario (a representative case study used as an average scenario to identify parameters, data and potential implications on B2B transportation in Europe) was used in the study. This baseline scenario used Eurostat data for packaging (paper & board: 83% recycling / 17 % incineration with energy recovery; plastic: 42% recycling / 58% incineration with energy recovery).

The aggregated total impacts of the baseline systems were calculated for both packaging solutions. Below are some key findings extracted from the study by FEFCO:

- The corrugated board system was more beneficial in 10 out of 15 impact categories, including *Climate change, total*; *Resource use, fossils*; *Resource use, mineral and metals* (see below).
- The baseline scenario considers a return rate of 24 times for RPC based on available scientific data and 1 use for CB.
- The break-even analysis showed that RPCs would need to reach a minimum of 63 rotations to outperform CBs in the Climate Change impact category.

Life cycle impact assessment results of the baseline comparison of the single-use and multiple-use systems

EF Impact category	Avoided burdens (baseline)	
	Corrugated (single use)	Reusable plastic (24 rotations)
EF Climate Change, total [kg CO2 eq.]	34,70	47,94
EF Particulate matter [Disease incidences]	3,04E-06	8,00E-07
EF Resource use, fossils [MJ]	238,37	476,23

- In the extensive sensitivity analyses considering 14 different scenarios for all impact categories, CB outperformed RPC in most cases.
- CB outperformed RPC in key impact categories, including climate change + resource use, fossil category + water use + ozone depletion + ecotoxicity and many others.
- Only 1 scenario (0:100 cut off) out of 14 had better results for RPCs.

Hot-spot analysis

This study focused on the e-commerce supply chain in the context of business to customer (B2C) e-commerce of small and personal items delivered within Europe using corrugated or plastic packaging. It identifies hot-spots, or life cycle stages which account for a significant proportion of the environmental impact of the packaging within this supply chain.

The analysis evaluated 48 relevant scientific and commercial papers.

51 hot-spots were identified and grouped in 9 thematic categories. The independent consultant (Ramboll) then identified possible actions for innovation and improvement of the top 15 highest ranking ones to improve the current e-commerce system. The top 5 highest hot-spots identified by the study are below with further elaboration by FEFCO:

- Real number of uses for multiple use solutions – probably the most important parameter, as it was cited in 1/3 of the analysed sources (17 studies); the real number of uses for reusable packaging is still debated as official EU data does not exist and primary company data is often not transparent.
- Logistics parameters – these include storage, transport distances, number of packages in each delivery and need for sorting – it the second most important hot spot cited by 15 of the analysed studies. Transport distances have a significant impact on emissions and will continue influence the life cycle of the entire product as production sites are not always close to consumer markets. The further a package is being transported the higher the potential emissions related to backhauling.

- Percentage of recycled material used in production is cited in 11 sources, making it the third most important hot spot. The data for recycled content of reusable packaging is unclear and generally unavailable, making comparison difficult. On the contrary, it is well-established that corrugated packaging contains on average 89% recycled content¹.
- Quantity of material used for packaging – cited by 8 sources. There is a physical limit to material reduction because the packaging must still perform good mechanical properties and functionality.
- Number of recycling/composting and washing facilities available – cited by 8 sources. The hot-spot is more relevant for reusable plastic packaging, as the paper & board supply chain has a well-developed and functional system for collection and recycling of paper packaging.

Other hot-spots:

- Return rate: A low return rate can cause an increase in emissions due to the need for producing new items to replace the unreturned ones. If this parameter is low, it means that some items do not immediately go back to the reuse cycle if ever. This can lead to a shortage of packaging products and thus either lead to an increase in emissions due to either the purchase of new packaging or a delay in delivery caused by lack of packaging.
- Theft rate: For example, according to the American Bakers Association, this phenomenon has caused 30% loss of reusable plastic trays each year, generating \$10 million annual replacement costs.

Critical view on reuse of packaging

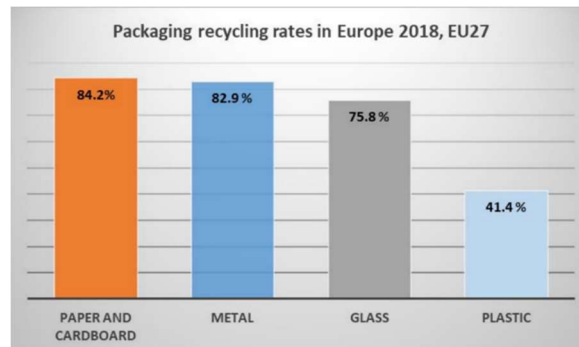
The white paper, prepared by a research institute (VTT), provides a comprehensive review of existing arguments, literature, and policy on the issue of packaging recycling versus reuse. The findings of the study stress the importance of making packaging functional and sustainable as opposed to simply trying to avoid waste production through reuse or light-weighting. If packaging functionality is disregarded, the product it protects runs a higher risk of being damaged. This not only creates more waste than the packaging alone but also creates a higher negative environmental impact as the environmental footprint of packaging is substantially lower than that of the packed product.

The study conclusions (summarised by FEFCO) are as follows:

- The concept of 'fit for purpose' packaging should be central in the Commission's proposal as it contributes to sustainability goals while reducing waste.
- Both recyclable single-use and reusable packaging solutions should increasingly be considered from a sustainability perspective and less from a waste prevention perspective by the European Commission when proposing legislation.
- The waste hierarchy should be improved based on life cycle thinking as reusable packaging is not always the most sustainable solution.
- Reusable packaging must also be recyclable (Eunomia, 2020) as it will eventually become waste due to losses, breakage or deterioration.
- Environmental impacts may simply shift, not disappear, as a result of scaled-up reuse systems.
- Existing studies identified that there is no obvious best choice when selecting between recyclable and reusable packaging solutions as results vary significantly on a case-by-case basis.

¹ [LCA Report 2019 revised_p 37.pdf \(fefco.org\)](#)

- The shift to reusable systems involves substantial initial economic investments and creates new costs related to washing, repairing, etc. with no guarantee that the system will succeed. As a result, less than 2% of major brands' plastic packaging was reusable in 2019, while many companies choosing to continue using single-use.



Conclusion

The EU policies should focus on incentivising sustainable packaging that contributes to waste prevention. The aim to scale up the reuse of all packaging might lead to an unintentional increase of the environmental impact. The studies commissioned by FEFCO show that both recyclable and reusable packaging play a valuable role in the circular economy. Renewable and recyclable corrugated packaging is 'fit for purpose' and should be considered as a viable solution to support the EU Green Deal ambitions.