ENVELOPMENTAL BENEFITS:
TRADITIONAL VS INNOVATIVE PACKAGING FOR OLIVE OIL

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Problem definition
Plastic represents the engineering material of our ages, it has been using to substitute traditional materials like wood, glass and metal, in different shapes. The largest part of plastics currently used in the food sector, as packaging applications, are made out of petroleum-derived materials. The non-renewable nature of these materials drives the packaging market to new and renewable alternatives, in line with the increasing consumers’ demand for disposable, potentially biodegradable, and recyclable solutions. Bio-based plastics could be one of the most promising solutions to the impacts of non-renewable resources.

Goal
The aim of this study was to investigate the environmental performance of two different packaging solutions for extra virgin olive oil (one traditional and one innovative solution)

Method
Life cycle assessment (LCA) (ISO 14040:2006) was used as a tool to:
- Identify the environmental profiles of the two packaging.
- Highlight the most environmental damaging phases throughout the production.
- Make comparisons between the two packaging.

Results
Figure 2 shows the environmental impact of the production of the traditional packaging. The main hotspot of the innovative packaging is the production of the aluminium film, ascribed mostly to the impact category Mineral Resource Depletion (MRD, 93%). This incidence is due to the extraction (also called mineral exploitation) of the aluminium. Another hotspot is the PET production chain; its incidence is related to all the impact categories, with particular high values for the climate change (CC, 34%). The electricity required by the transformation machines is the third hotspot from 8.8% Human Toxicity (HT-C) to 62% Water Resource Depletion (WD). The high demand of electricity is due to the machines dimension and the type of processing.

Figure 3 represents the impact assessment related to the production of the innovative packaging. The main hotspot of the innovative packaging is the PLA film production; the high level of incidence of this material is explained by the composition of the innovative packaging, the PLA film represents more than 70% of the total weight. The incidence and high level of impact in all the impact categories are due to the process activities to obtain the bio-based polymer. The PLA undergoes a fermentation phase that requires a high quantity of water, thus reaching the 85% of incidence in the impact category WD.

Figure 4 shows a comparison of the environmental profile of the two packaging materials for the most relevant impact categories. A comparison of the two products is fundamental to identify what packaging is better in each impact category. In the LCA study, at the same time it can be defined the incidence and the gap between the two packaging related to each impact category. Regarding the CC, the innovative packaging production release 44% less of kg CO₂ eq. (0.96 g) respect to the traditional packaging (1.71 g). The same positive observation can be done for the impact category HT-C. The categories related to the ecosystem quality, as Feco (Freshwater Ecotoxicity) and WD, present higher values for the innovative packaging than for the traditional packaging.

Conclusion
A final comparison of the environmental profiles of the two single-dose plastic packaging helped to clarify that there is no overall better solution. The innovative packaging, even if it is made of bio-based raw materials, shows better profile only in some of the impact categories (CC and HT-C). As for the ecosystem quality, the innovative packaging has the worst environmental performance (+78% Feco and +14.6% WD) due to the activities necessary along the production chain (cultivation of the maize, production of the starch; machines for farming activities; fermentation and chemical processes for polymers production).