

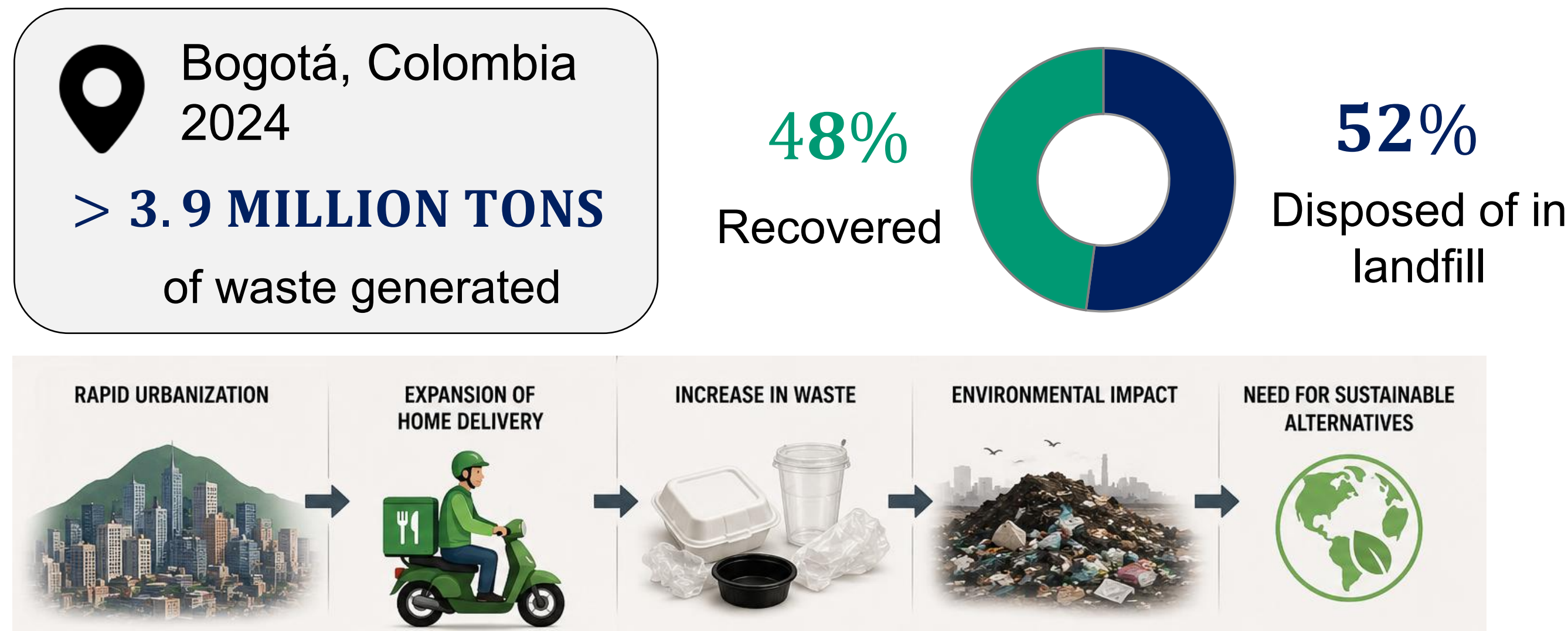
Case study of alternatives for closing the cycle of food delivery service within the circular economy in Bogotá, Colombia.

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Introduction



Law 2232 of 2022 (Colombia)

TRANSITION TO ALTERNATIVE PACKAGING

EXPANDED POLYSTYRENE (EPS) → PE-COATED KRAFT PAPER | COMPOSTABLE MATERIALS | REUSABLE SYSTEM

Limited evidence on whether these substitutions achieve real environmental improvements or shift impact to other life cycle stages

Methodology

The life cycle assessment (LCA) conducted in this study was carried out in accordance with ISO 14040/44

Goal and scope definition

This study comparatively evaluated the environmental performance of four food-delivery container alternatives: polyethylene-coated kraft paper, expanded polystyrene (EPS), sugarcane bagasse (compostable), and stainless steel (reusable), considering the conditions and realities of Bogotá, Colombia. The assessment was conducted to support decision-making among stakeholders involved in home delivery services. A delivery of a meal served in a container with a capacity of 32 ounces (~1000 ml) was defined as a functional unit.

Limits of the system

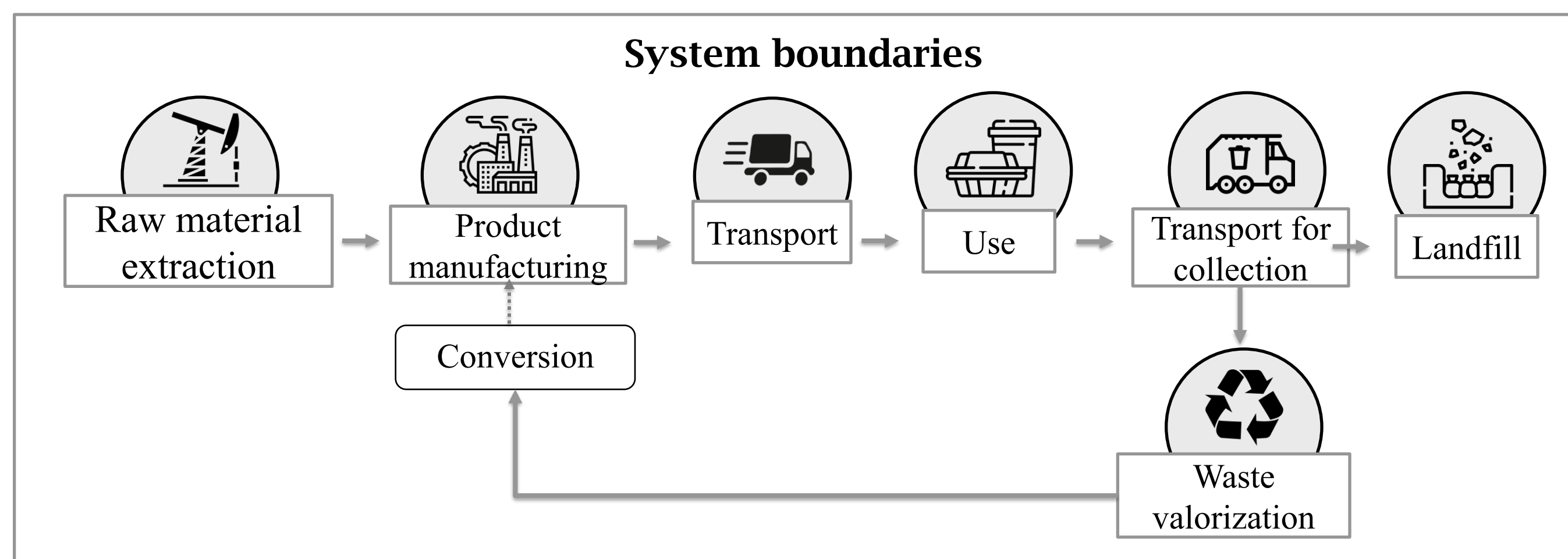


Figure: System boundaries

Life Cycle Inventory Analysis

This analysis was conducted in accordance with the guidelines established by the standard, using the openLCA and SimaPro software, along with the ecoinvent 3.7.1 and ecoinvent 3.10 databases, respectively. The ReCiPe 2016 methodology, specifically its H (Hierarchical) perspective, was selected as the primary tool for the assessment

The impact categories that repeatedly exceeded the admissible range across more than one case were identified. **Terrestrial ecotoxicity, freshwater eutrophication, and carcinogenic human toxicity** were the categories that most consistently fell outside the established threshold. Consequently, these categories were excluded from the interpretation

Life Cycle Impact Assessment

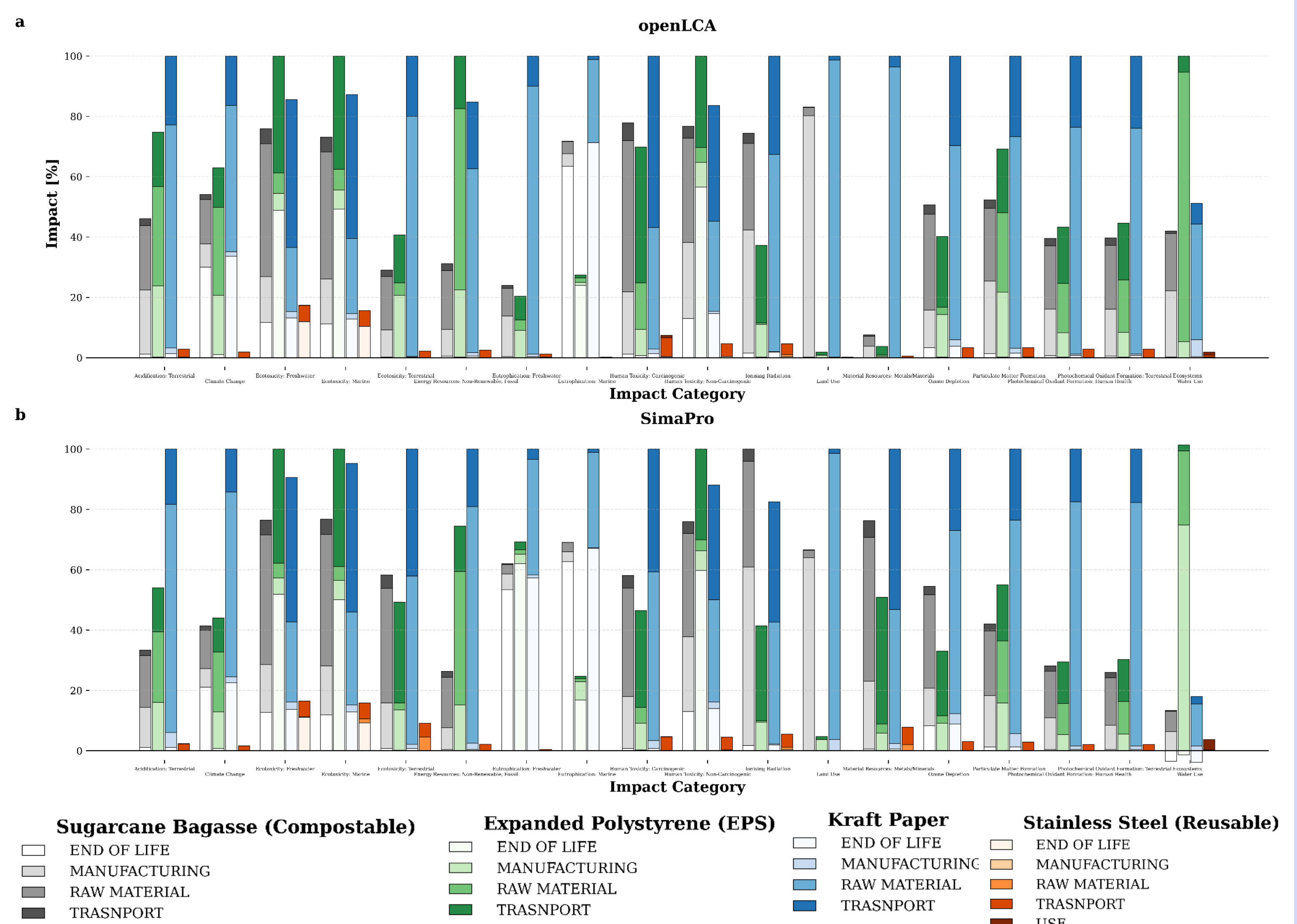


Figure: Impact category results. a) OpenLCA results. b) SimaPro results

- Kraft paper presented the highest environmental burdens in most categories, mainly driven by raw material production and landfill biodegradation, while EPS showed lower impacts due to its lower material demand despite its petrochemical origin.
- Sugarcane bagasse showed intermediate impacts, strongly influenced by agricultural production and end-of-life processes, whereas reusable stainless steel containers demonstrated potential environmental advantages when high reuse rates are achieved.

Results & Discussion

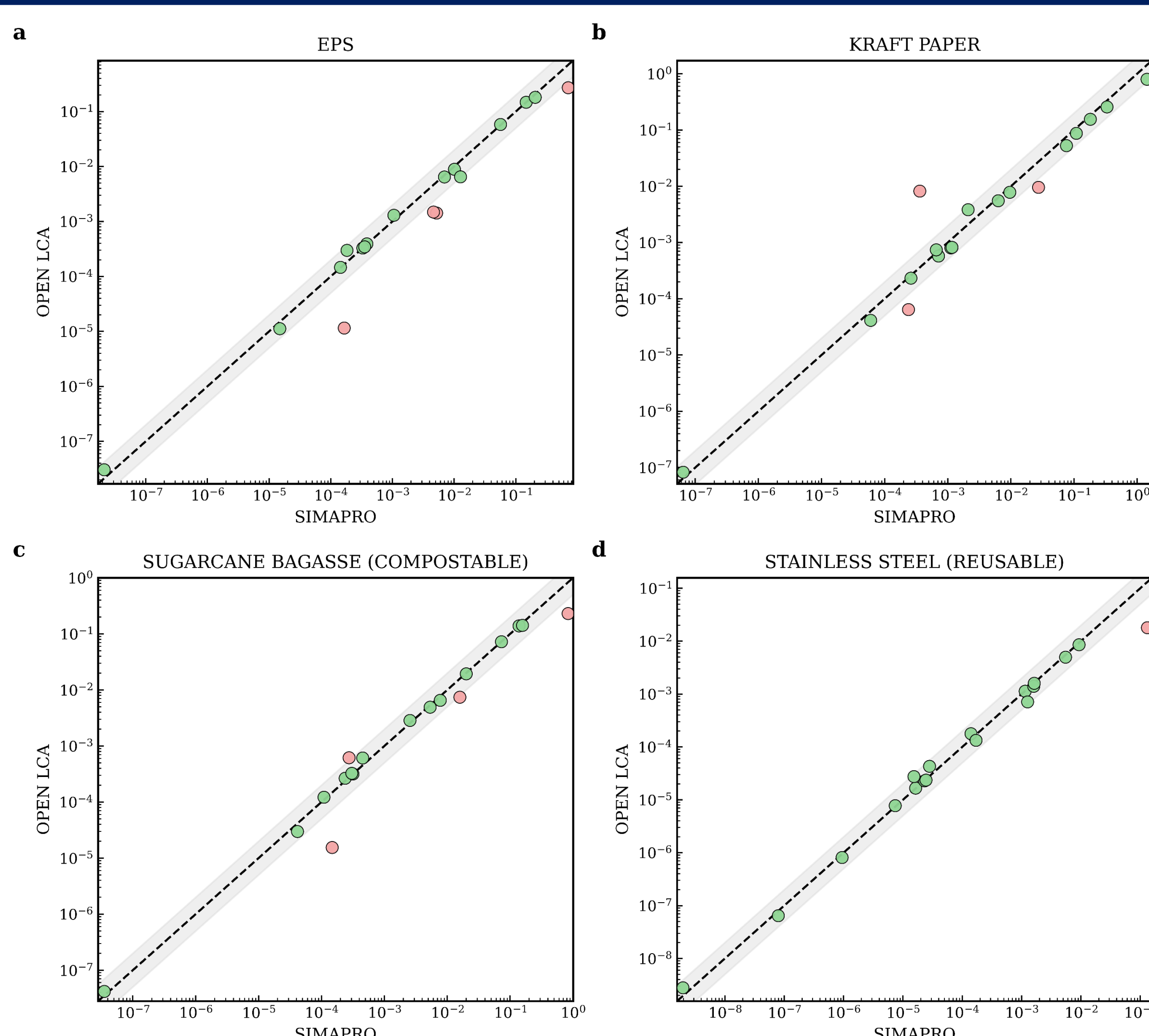


Figure: Comparison of SimaPro and OpenLCA Results

Conclusions

- SimaPro and OpenLCA showed no major differences in overall environmental impacts, highlighting the need for further research on discrepancies between software platforms and database versions.
- Although PE-coated kraft paper is commonly perceived as the more sustainable alternative, EPS showed lower impacts due to its substantially lower material demand. Sensitivity and uncertainty analyses also identified key parameters and impact categories requiring cautious interpretation.
- Lower-impact alternatives require coordinated stakeholder action, including operational changes by restaurants and active consumer participation.

References



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