COMPARATIVE LIFE CYCLE ASSESSMENT OF BEVERAGE PACKAGING MATERIALS: IMPLICATIONS ON CONSUMER RESPONSIBILITY AND SUSTAINABILITY

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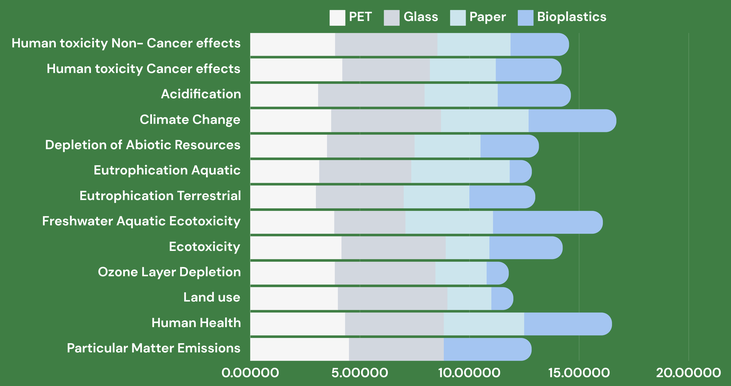
IMPACT CATEGORIES



80%

Bioplastics has the lowest score for terrestrial & aquatic eutrophication compared to paper and glass

90%

Glass consistently receives **high scores**

90%

Paper has **lower carbon emissions** to glass

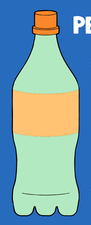
57%

Plastic products **use more energy** than glass packaging systems

PACKAGING MATERIAL: IMPACTS

Paper Carton

- Paper disposed of in landfills takes 2-5 months compared to glass and plastic.
- Largest municipal solid waste material deposited in landfills - Need for more responsible recycling



PET Bottle

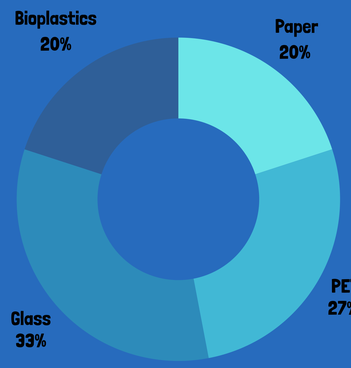
- Plastic production process uses steam, which significantly lowers energy emissions.
- Plastic produces 61% more greenhouse gas emissions than alternative packaging systems.
- High impact on human toxicity due to carcinogenic heavy metals such as chromium, nickel, lead, and cadmium.

Glass Bottle

- It is primarily produced from silica, which results in high carbon emissions due to its high melting point.
- A non-recycled glass bottle is more carbon-intensive - 22 coal-fired power plants.
- Glass is the heaviest, which increases costs and carbon footprint and makes it unattractive.

PLA Bottle

- Lower Greenhouse gas emissions than traditional PET bottles due to its bio-based composition
- Biodegradation as an end-of-life scenario can be converted to water, carbon dioxide or biomass.
- It poses a high risk of microplastic development, which can negatively impact sediments and preparation rates for aquatic species.



- Glass is the **most significant environmental impact** due to its **energy-intensive life cycle** processes.
- Paper emerges as the **most environmentally sustainable material** with **lower energy and resource consumption** through its life stages.

METHODS

Life Cycle Assessment: Journal Database

1. **Literature Review of LCA Studies:** Exploring sustainability, circular economy principles, and environmental impacts.
2. **Multi-Criteria Analysis:** Conduct a comprehensive assessment of each packaging material, quantifying and weighting factors to reflect their relative importance.
3. **Systematic Evaluation:** Employ an approach to determine the percentages of each packaging material's sustainability, enabling the ranking of materials from most to least sustainable.

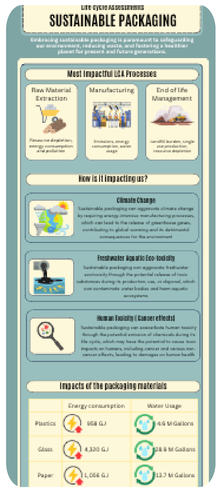
Consumer Behaviour: Survey Analysis

1. **Distribution:** Survey 600 undergraduate students to explore attitudes and behaviours regarding beverage packaging.
2. **Survey Questions:** Evaluating sustainable behaviours and understanding perceptions shifts from knowledge dissemination about LCA
3. **Utilizing R Studio:** Use statistical tools to generate bar plots, pie charts, and tables and conduct correlation analysis, facilitating the identification of associations and relationships between variables.

ANALYSIS: CONSUMER BEHAVIOUR SURVEY

- **21%** of young consumers are **very aware of their impact** and thus **choose sustainable packaging during their daily shopping**
- **38.13%** of young consumers who are **aware of the environmental impact** of their **usage of sustainable packaging material** also tend to **set personal sustainability goals**
- **Positive correlation** between **familiarity with sustainability** and the **influence of packaging material on beverage choice**
- **Weak but positive relations** between people prioritizing **waste reduction** are more likely to consider **packaging when shopping.**

Sustainability ranking: Before and after infographic (education stimuli)



LCA Infographic

- Consumers with **positive attitudes and a high familiarity** with sustainability and LCA impacts are likelier to take **pro-environmental actions** and **choose sustainable packaging materials** for their consumption.
- Young consumers' a**ttitudes toward sustainability are positive**. They feel **a sense of obligation and responsibility** toward the environment, which leads them to set sustainability goals.
- **High cost** is an **influencing factor** that prevents young consumers from making sustainable choices.

LCA AND CONSUMER BEHAVIOUR

Integrating science with behavioural science allows real-time snapshots of consumer attitudes combined with scientifically proven facts that can help visualize the operations and impacts of the entire system, facilitating the development of innovative solutions toward carbon neutrality and advancements in sustainability within the packaging industry.