HSLU Hochschule Luzern

Technik & Architektur

Master thesis MSE Engineering Energy & Environment

A critical assessment of lifecycle emission estimation methods, including the impact of circularity approaches:

A case study analysis of beverage cup materials.

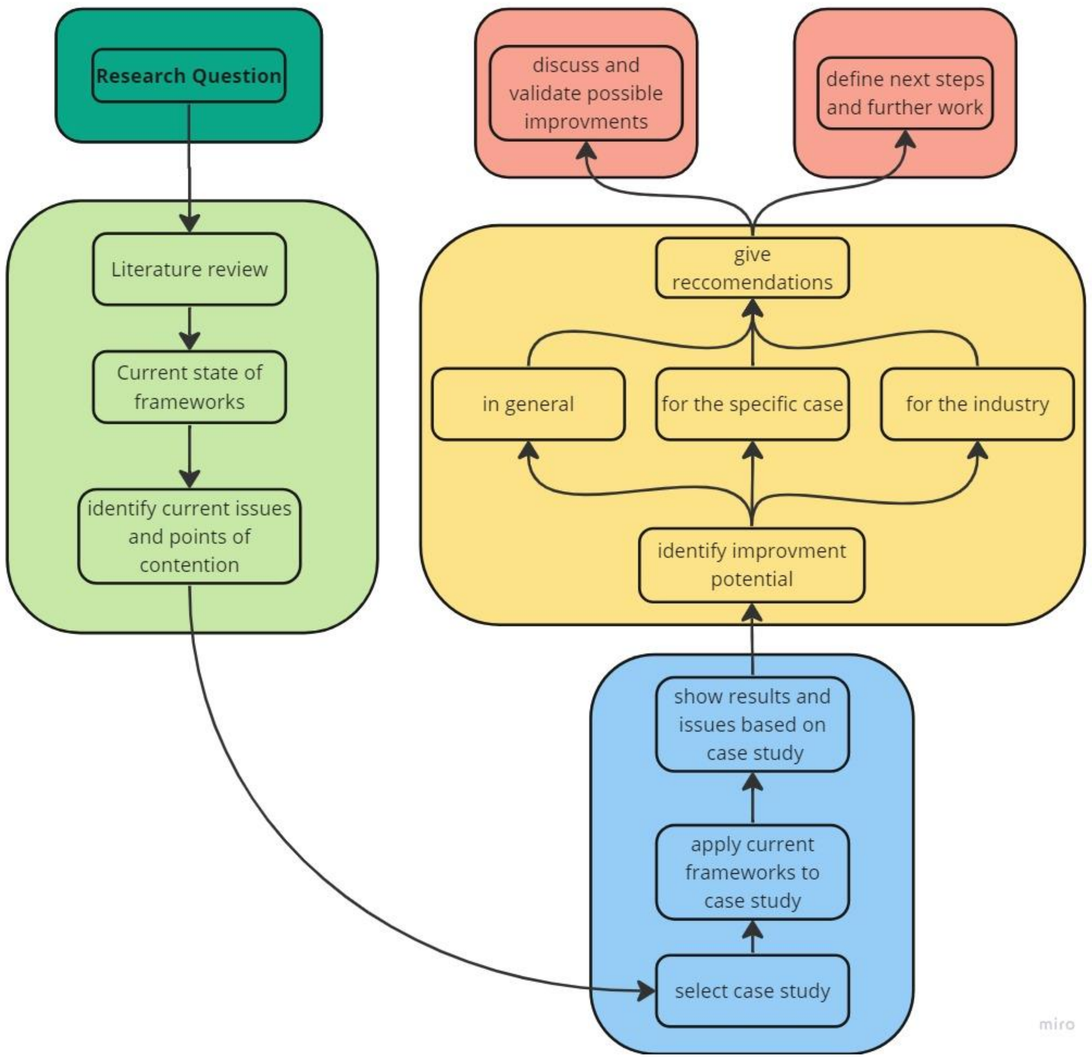

Figure 1: Applied methodology within this thesis, structured into different phases

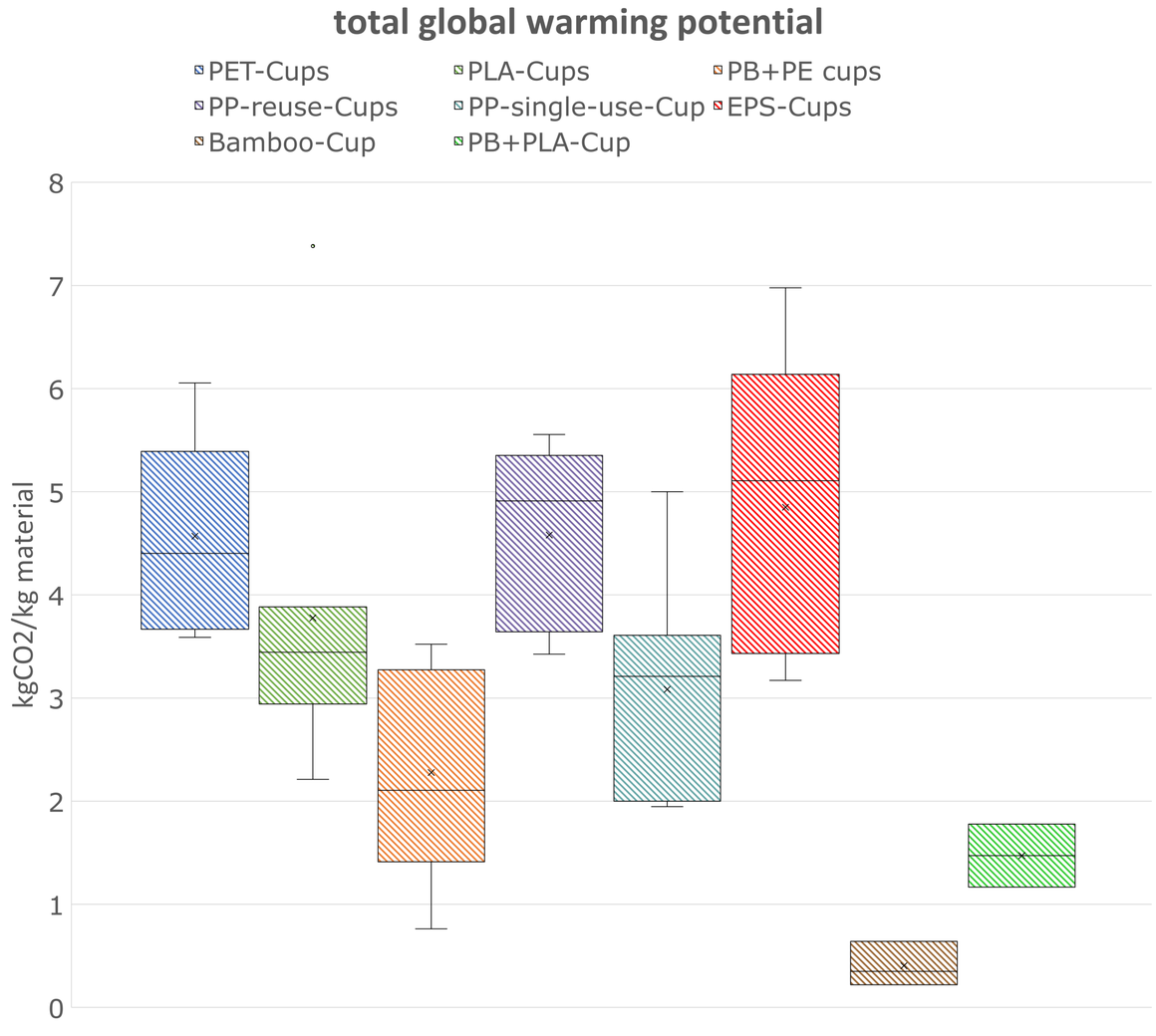

Figure 2: Ranges of the global warming potential within the investigated LCA studies, highlighting the issue of comparability

Research Question

Currently, there are no comprehensive frameworks available to assess beverage container materials. Due to the variation in scoping, system boundaries and definition applying the same frame-works can yield different results depending on internal assumptions and applied methodologies. This increased the difficulty of providing products and services, decreasing the transparency and usefulness of these assessments.

To enable a step towards a more unbiased and universal comparison, these frameworks are introduced, applied, and assessed by using the case of beverage container materials. Based on this issue, the research question to be answered within this thesis is:

How practical are the current approaches to evaluating emissions, and to what extent can and are the effects of circularity approaches integrated?

Methodology

The applied methodology, illustrated in Figure 1, is structured within different stages. To highlight the application of Life cycle Assessments (LCA) and circular metrics, an example is provided within a case study, developing and showcasing the current state of the art and focusing on the benefits and issues regarding the everyday use of LCAs and circular metrics.

Results

While significant progress has been made in evaluating emissions and integrating circularity approaches, there are still challenges to overcome. Variability in LCA results, as shown in Figure 2, necessitates developing and implementing industry-specific best practices to reduce inconsistencies. Streamlining circularity approaches through standardised metrics, and frameworks is essential for reliable assessments.

Moving forward, continued research, collaboration, and adopting standardised practices will contribute to the improvement and reliability of emission evaluation and circularity integration efforts.

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