Investigating the link between life cycle assessment and circularity indicators: a SETAC/ACLCA working group

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1. Introduction

Improving the circularity of resources is important to the sustainability of consumer goods. Current research has indicated that circularity practices and circular economy (CE) methods do not always reduce environmental impacts. The aim of this research is to investigate the adoption of life cycle assessment (LCA) methods to improve the environmental impacts of circularity practices.

As part of the Society for Environmental Toxicology And Chemistry (SETAC) forum, an interest group (IG) on Circularity & LCA was formed in partnership with the American Center for Life Cycle Assessment (ACLCA) to tackle methodological and technical issues related to circularity in LCA. This IG started in July 2020 and is expected to be completed by June 2022. The membership structure is intended to be a good balance between academia, industry and government/environmental agencies.

2. Materials and methods

The IG's research approach is summarized in four key steps: Defining Goals & Objectives, Literature Review & Gap Analysis, Ideation, and Experimentation, as described in Table 1. To meet the mission of this SETAC/ACLCA IG Circularity & LCA, we have organized into four sub-working groups (sub-WGs) so that complementary tasks can be completed concurrently in an effective manner. The goals, initial accomplishments and findings of each sub-WG are described below.

Defining Goals & Objectives	Literature Review & Gap Analysis	Ideation	Experimentation
IG workshop on current gaps and challenges with circularity in the private sector, academia, NGOs, and pubic sector. How can the IG fill the gaps and mitigate challenges? What would be a successful outcome.	Conducting state-of- the-art and critical literature reviews on circularity indicators and EoL allocation approaches in LCA; circular indicator implementation in LCA; and linkage between LCA results, sustainability, and circularity indicators.	IG workshops to propose solutions to fill gaps and mitigate challenges. Discussion of insights and gaps with participants, external survey, other groups with research developments. Creation of mind maps, decision trees, and research summaries to provide insights.	Development of case studies to implement proposed solutions for validation and revision. Dissemination of case study results to interested parties for feedback and refinement.

Table 1: Research approach of SETAC/ACLCA Interest Group Circularity and LCA

3. Results

3.1. Sub-WG 1: Pool of circularity and LCA-based indicators

In Sub-WG 1 a literature review is developed in order to clarify the existing circularity and LCA end-of-life indicators. In addition, the current status of the implementation of CE indicators by companies is assessed.

3.2. Sub-WG 2: Evaluation of CE loops performance through LCA

Sub-WG 2 investigates the existing approaches to evaluate the environmental impact of circularity through LCA. In a survey and expert discussion, a list of "pain-points" and methodological gaps is collected and analyzed.

3.3. Sub-WG 3: Trade-offs between circularity and sustainability

Sub-WG 3 delivers a mapping of the trade-offs between environmental benefits and circularity performance throughout the product life cycle and its resource loops.

3.4. Sub-WG 4: Business/industrial cases

In Sub-WG 4, use cases based on the outcomes of the other Sub-WGs are developed. The main goal is to identify successes, challenges and opportunities when applying CE models and standards.

4. Conclusions

Recap of the key challenges:

- LCA methods and software do not provide clear guidance and approaches to including CE pathways, measuring impacts, and defining system boundaries.
- There are an increasing number of circularity indicators and a lack of clear guidance on how to assess the CE.
- Circularity indicators do not always provide insight into the environmental savings or benefits of implementing circular economy principles.

In this context, an ISO Technical Committee (ISO/TC 323) on CE has been established, with the objective to develop standards to define and describe general implementation approaches and to identify metrics for CE. A standardized CE evaluation method should support strategic decisions and monitor the progress towards sustainable development [1]. In future work, one can imagine a guiding flowchart or logigram to help a user (whether a designer, engineer, or manager) to navigate between these indicators, as well as to aggregate existing and relevant approaches into an ad hoc integrated solution [2, 3].

5. References

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