Life cycle assessment and Artificial Intelligence for long-term sustainability in Circular Economy.

Life Cycle Assessment (LCA) is a powerful methodology used to evaluate the environmental impacts of products, processes, and services throughout their life cycle, from raw material extraction to end of life, i.e. from cradle to grave. When applied to the circular economy (CE), LCA helps identify the most sustainable strategies by assessing the environmental benefits and trade-offs of different circular practices. In the context of a circular economy, LCA can be used to evaluate resource efficiency by analyzing the entire life cycle, helping companies to determine how efficiently resources are used, and identifying opportunities for improvement. LCA is used to quantify the environmental impact of different circular strategies, such as recycling, reuse, and remanufacturing, supporting decision-making, policymakers, and businesses.

Despite the potential benefits, conducting LCA for CE practices comes with several challenges e.g. complexity and cost of LCAs, lack of data quality and data availability, inconsistent guidelines and standards, etc. Artificial intelligence (AI) can reduce data gap challenges, enhancing more relevant and accurate LCA results due to more computationally guided parameterized models enabled by AI and machine learning (ML) methods. AI-driven LCA models are more precise and offer more depth of CE impact assessment due to leveraging extensive datasets.

In this special session, we also welcome submissions delving into innovative approaches of: AI-based methods, their challenges, and best practices related to leveraging meaningful LCA (good data, better models, sustainable decisions) with a focus on bolstering the circular economy practices

Topics of interest include, but are not limited to:

- LCA and LCC for Eco-design and design for recycling for Circular Economy
- Ex-ante and Prospective LCA. Traditional LCA relies on current data and often fails to account for future technological, material, and supply chain changes, necessary for long-term sustainability and Circular Economy.
- Techno-economic analysis for Circular economy.
- LCA and Digital Product Passport for Circular Economy.
- Application of AI to enhance the replicability, reliability, and transparency of LCA methodologies for Circular Economy
- AI-based LCA methodologies in a supply chain context.
- The challenges of implementing AI-based LCA models in a supply chain context.

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