Conceptual Model for Life Cycle Sustainability Assessment

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Introduction and Objectives

Life cycle sustainability assessment is a new field of application of life cycle costing together with life cycle costing and social life cycle assessment. The purpose of the study was to identify and to make a review of literature relevant to formulate a conceptual model for life cycle sustainability assessment (LCSA). The purpose of the model is to systematize and illustrate approaches to LCSA results calculation on the basis of the purpose of the assessment, the number of decision-makers, the level of assessment (micro, meso or macro), etc. The LCSA is understood according to the following formula:

\[ \text{LCSA} = \text{LCA} + \text{LCC} + \text{S-LCA} \]

Materials and Methods

The study began with identifying the science fields, which could contribute both to the implementation and the development of a consistent methodology for LCSA. The following areas of interest were identified as relevant to contribute to the implementation and the methodology development for an integrated assessment of environmental, economic and social aspects in a life cycle perspective:

- utility theory and valuation of preferences (contingent valuation, willingness to pay, etc.),
- decision analysis,
- mathematics (including scoring, weighting, aggregation functions, composite indexes, game theory etc.),
- social choice theory,
- planning in the supply chain, etc.

The study relies mainly on secondary sources of information: books and articles and is based on a literature review of those.

Results & Discussion

The Supply Chain Planning Matrix (adapted from Fleischmann et al. in Stadtler et al, 2008)

**GOAL & SCOPE DEFINITION:** Ideally System Definition the Same for LCA, LCC and S-LCA

**LIFE CYCLE INVENTORY (LCI):** LCI, Supply Chain Analysis and Advanced Planning

- Raw materials -> Procurement
- Production
- Distribution
- Use stage

**LCA Decision Context Classification (EU, 2008)**

- Long-term: Situation A: Micro-level decision-support
- Mid-term: Situation B: Macro leve decision
- Short-term: Situation C: Accounting

The Supply Chain Planning Matrix (adapted from Fleischmann et al. in Stadtler et al, 2008)

**INTERPRETATION of LCSA, LCC and S-LCA results depending on the goal of the LCSA and the area of application**

- **Micro-level DM**: Product development & improvement;
- **Company’s sustainability performance improvement (eco-and socio-efficiency)**;
- **Other**

**Meso-level DM**: Strategic planning;
- **Public policy-making (municipalities, cities, sectors, etc.)**;
- **Other**

**Macro-level DM**: Strategic planning;
- **National/EU policy-making**;
- **Other**

**IMPACT ASSESSMENT:** Environmental and Social Life Cycle Assessment, no LCC LCA (Swarr et al, 2011) **FOCUS:** Social

**Type 1 Indicators Selection:**
- Top-down: Bottom-up

**Type 2 Indicators Selection:**
- Social impact pathways

**Characterization:**
- Company performance assessment:
  - Arithmetic aggregation of results/impact per stakeholder/impact

**Supply chain assessment:**
- Arithmetic aggregation of company performance per stakeholders/impact

**Conclusion**

The results from the analysis show that several methods and tools can be used to strengthen the implementation of LCSA and serve as a basis for the development of a robust LCSA methodology. When applying these methods or tools, the purpose should be to take advantage of their strengths and avoid or reduce the occurrence of their weaknesses, when applied to the field of life cycle assessment.

**References**


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