Challenges in Implementing Life Cycle Sustainability Assessment (LCSA) and in an LCSA-based Decision-making

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1. Introduction

Life Cycle Sustainability Assessment (LCSA) has been proposed to be a combination of three assessments: environmental, economic and social (incl. socio-economic). In this way LCSA tries to make a bridge between the traditional environmentally oriented and generic life cycle assessment (LCA) and the more site- and time-specific sustainability assessment (SA), which takes into account all three generally accepted pillars of sustainability (economic, social and environmental). In the process of trying to bridge and to draw from the strong characteristics of SA and LCA, LCSA encounters its own challenges.

These issues and challenges are being treated within the EU FP7 project *Advanced Technologies for the Production of Cement and Clean Aggregates from Construction and Demolition Waste* (C2CA) with application to LCSA for innovative technologies.

2. Materials and methods

A brief review of the challenges in implementing LCSA and interpreting their results is made on the basis of literature review and from a case study. The case study is on innovative technologies for the production of high-grade concrete from construction and demolition waste and address the needs of the construction industry. A brief review on methods for aggregation and interpretation of results is made. The analysis is put in the context of the transdisciplinary integration framework for LCSA proposed by Guinee et al. (2011) (Figure 1).

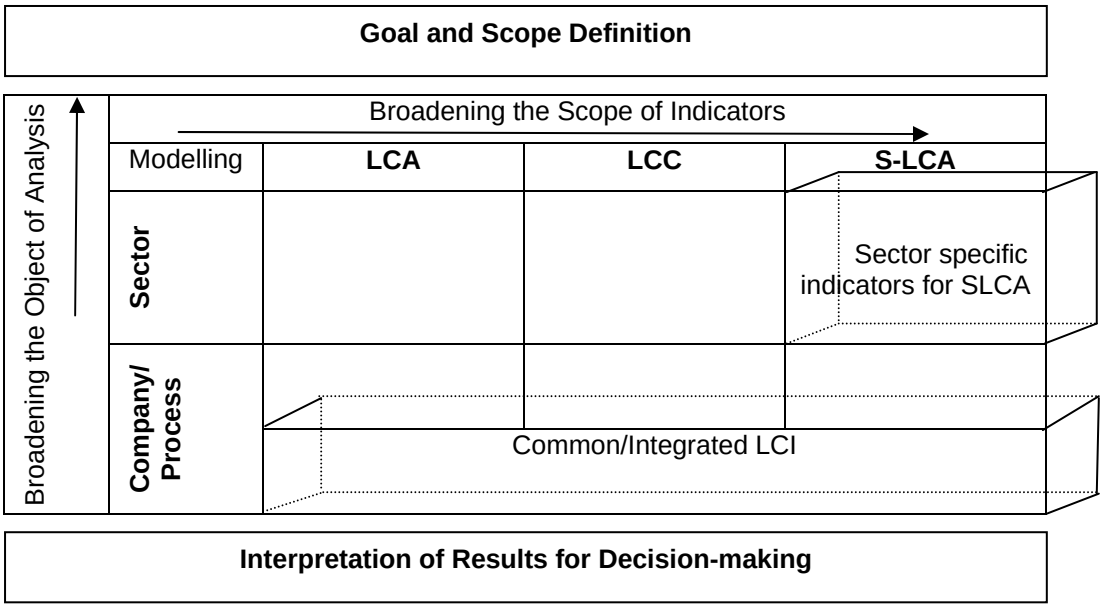

Figure 1: Possibilities for Broadening and Deepening in the LCSA Framework (adapted from Guinée et al., 2011).

3. Results and discussion

LCSA has been recognized to be the trend in the coming decade (Guinee et al. 2011). As a new and multi-disciplinary assessment, it faces certain challenges, which can be classified as methodological and interpretational.

3.1. Methodological challenges

The methodological challenges come from the nature of life cycle impacts assessment and in turn cause the challenges in interpretation because in order to make decision on a basis of the three assessments, the results of each assessment have to be based on a robust methodology. And while the methodology for the environmental LCIA has been developed for years, and there are already different approaches to LCC, it is recognized that more research is necessary before a robust methodology for SLCA is developed,

For the case study a set of indicators has been selected specifically for the construction sector from the indicators suggested by the *Guidelines for Social Impact Assessment of Products.* The challenges at the stage of indicator selection and definition arise both from the inability of some indicators to refer to the functional unit and from the validity of the indicator to be used as a measure for a certain impact. An advantage of the current selection process is the high relevance of the selected sector specific indicators for the project stakeholders. A drawback for the current selection process is that these stakeholders may not be representative for the whole sector. Therefore, it is necessary to assess the validity of the selected set of indicators for the construction sector according to different criteria and by a broader range and larger number of stakeholders.

The challenges in the process of data collection refer mainly to data availability and data confidentiality. These challenges are valid for both the foreground and background processes, which involve a supply chain perspective, and lead to the question of whether it is possible for a SLCA to be implemented for the same system boundary as the ELCA. At the stage of impact assessment the challenges come mainly from the need to find an appropriate method for characterization and normalization. The state-of–the-art in SLCA's methodology is neither advanced, as in the ELCA, nor are indicators measured in a common unit, as in the ELCC. It is therefore a difficult task to come up with SLCA results, which would not be subject to discussion.

Another challenge in the case study comes from the need for aggregation of qualitative, semi-quantitative and quantitative indicators and the interpretation of the SLCA impact results and the applicable approaches to weighting. A possible way to interpret the SLCA results is the multi-criteria assessment, which can account for both different types of indicators (quantitative and qualitative) and various stakeholders (Qureshi,1999).

3.2. Interpretational challenges

Even if the methodological challenges behind the SLCA results are solved and results from the three assessments are available, the issue of how to support decision-making on the basis of these assessments arises. According to Kloepffer (2008), the three assessments are equal, and this is in line with the concept of strong sustainability. But there is the concept of weak sustainability, as well, where the underperformance in one pillar can be compensated by a better performance in another pillar. In any case, the assessments in LCSA are measured in different units, and depending on where we are in the cause-effect chain, there may be many mid-point or a few end-point categories in each assessment. The challenge then is on the basis of what method to aggregate and interpret the results from these assessments and what is the validity of interpretation for the decision-making.

4. Conclusions

While implementing LCSA for a case study two main types of challenges have been met: methodological and interpretational. The methodological challenges come mainly from the SLCA. In our case the focus on sector-specific indicators is identified as a useful approach for dealing with the recognized site-specificity of SLCA. In regions like Europe, where regulations and policies are unified to a great extent, regional sector policies may facilitate the transition from site-specific to region-specific SLCA indicators, depending on the variation of their implementation across countries and regions.

According to the literature review, a good approach to validate the work with indicators from one or different fields, from their selection to their aggregation and interpretation, has been recommended to be the multi-criteria assessment method, which can also be combined with other methods.

5. References

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