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SCOPING OF LIFE CYCLE ASSESSMENT STUDIES: A MISSED OPPORTUNITY?

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ABSTRACT

A distinction is commonly made between analytical and procedural tools when evaluating LCA against other environmental assessment approaches, and LCA is described as an analytical tool. However, this distinction is somewhat blurred. In this paper, it is argued that the procedural aspects to LCA should given more attention in LCA guidelines and standards. In particular, more guidance should be given regarding the procedures for defining system boundaries, choice of quantitative versus qualitative LCA, subjective modelling decisions, and choice of impact assessment method. This will increase the relevance and usefulness of LCA in different decision situations.

INTRODUCTION

In the literature evaluating LCA against other environmental assessment approaches, a distinction is commonly made between analytical and procedural tools. Analytical tools focus on the quantitative assessment of the studied object, and procedural tools focus on the process for undertaking a study (e.g. Baumann and Cowell, 1999; Wrisberg et al., 2002; Finnveden and Moberg, 2005). LCA is generally described as an analytical tool whereas approaches such as Environmental Impact Assessment are described as procedural tools.

However, the distinction between analytical and procedural tools is somewhat blurred. In this paper, it is argued that there are procedural aspects to LCA and that they should given more attention in LCA guidelines and standards. It follows from work by Cowell (1998) who suggested that one way of emphasising the importance of the procedure in LCA is to describe LCA as a **process** rather than as a **tool** in environmental management. Cowell et al. (1997, p.7) defined a tool as “a means of combining information in a form which can be used in decision-making processes,” and a process as “a way of using and integrating different tools with stakeholder expectations and other decision parameters to meet one or more of the requirements for a decision.”

LCA AS A TOOL OR PROCESS?

Perhaps the most tangible expression of recognition of the procedural aspects of LCA can be found in the ILCD Handbook, the first authoritative guide to LCA methodology to provide detailed guidance on how an LCA study should be shaped by its decision context. It defines four types of LCA study according to the decision situation: micro-level decision support

(Situation A), meso/macro-level decision support (Situation B), accounting including interactions with other systems (Situation C1), and accounting without interactions with other systems (Situation C2). The ILCD Handbook goes on to provide guidance about use of attributional versus consequential modelling, and short- and long-term marginal processes, depending upon which situation is under analysis (European Commission, 2010a, p.36-48).

However, as well as decisions about choice of attributional versus consequential modelling, and use of marginal processes, a number of other decisions are made during the execution of an LCA study that may significantly affect the final results – and where the procedures for making those decisions have yet to be defined in detail. These include: system boundary definition, quantitative versus qualitative modelling, subjective modelling decisions, and choice of impact assessment method. The importance (or not) of defining a procedure for making each of these decisions in an LCA study is discussed below.

System boundary definition

There is relatively little guidance in the LCA standards and guidebooks on how to define the appropriate system boundary for a study. The ISO 14040 standard states that the system boundary should be defined by “the goal and scope definition of the study, its intended application and audience, the assumptions made, data and cost constraints, and cut-off criteria” (ISO, 2006, Section 5.2.3). It further states that, “The criteria used in setting the system boundary are important for the degree of confidence in the results of a study and the possibility of reaching its goal” (ISO, 2006, Section 5.2.3).

However, the flexibility in defining the scope of an LCA study may result in identification of limited options for improvement by a company. Coelho and McLaren (2013) discuss the process of undertaking LCA studies with six manufacturing firms as part of a Life Cycle Management project in New Zealand. For three of the companies, the system boundaries for the LCA studies were expanded during the process of undertaking the LCA studies and this led to identification of quite different improvement options for the company products. They concluded that, “the process of defining an LCA study’s scope in cooperation with the commissioners of that study deserves further consideration in future research” (Coelho and McLaren, 2013, p.880).

There is a tension, then, between the role of LCA in highlighting the (un)expected hotspots in product life cycles by expanding the system boundary, and the potential usefulness of such information in a decision situation. A procedure for defining the system boundary in relation to different decision situations would clarify this aspect.

Quantitative versus qualitative LCA

In some decision situations, particularly in product design where decisions have to be made on short timescales, more qualitative forms of LCA may be used to support decisions. And the importance of applying the concept of life cycle thinking – as opposed to using Life Cycle Assessment in its analytical tool “mode” – has been asserted by Heiskanen (2002). She discusses the use of life cycle thinking and LCA in two Finnish companies, suggesting that formal LCA had a relatively marginal role in their decision-making. However, the life cycle concept provided a way for employees in the companies to legitimise their concerns - and rationale for taking action - regarding environmental impacts in the upstream and downstream supply chain associated with the companies’ products.

This issue has been highlighted recently by Baitz et al. (2013) who suggest that, prior to undertaking an LCA in industry, questions should be asked about when the results are needed, to whom the results are to be communicated, and whether all the information is available internally or needs to be sourced with external support. This information should then guide the execution of the LCA study in order to provide results that are timely and relevant whilst providing “as much precision as needed to get good answers while avoiding irrelevant complexity” (Baitz et al., 2013, p.13).

Of course, there is a tension here because “you don’t know what you don’t know.” For this reason, it would be helpful to provide more guidance on the procedure for defining the level of detail required in an LCA study.

Subjective modelling decisions

It is recognised that LCA frames problem situations based on a positivist (or “rational”) worldview (e.g. Bras-Klapwijk, 1998; Tukker, 2000), and that its methodology omits consideration of some environmental aspects such as assessment of environmental risks, ability to manage environmental impacts, and unknown impacts (e.g. Hofstetter, 2000; Tukker, 2000). If these aspects are not consciously articulated in a decision-making process that involves use of LCA-based information, the LCA results may bias the processes because “the apparent objectivity gives LCAs too much authority and neglects that they are based on a specific frame and specific environmental goals” (Bras-Klapwijk, 1998, p.340).

Therefore a procedure for making the underlying assumptions in LCA more explicit when LCA studies are used to support decision-making, and arguably adapting LCAs to be more responsive to different decision contexts, may increase the credibility of LCA to support decision-making.

Impact assessment method

The choices to be made in an LCA study related to Impact Assessment, and within the framework of the ISO 14040 and 14044 standards, include: number of impact categories to be addressed, assessment method (which may be at midpoint or endpoint level in the cause-effect chain), and inclusion or exclusion of normalisation and weighting steps.

The ILCD Handbook (European Commission, 2010a, p.109) provides a default series of impact assessment categories. It also provides a set of criteria and a procedure for the evaluation of different characterisation models addressing midpoint and endpoint levels (European Commission, 2010b). The aim is to identify the best practice among existing characterisation models for each impact category; however, it does not address the question of how to choose between alternative models that may meet all these criteria. Also, detailed guidance on normalisation and weighting is not included in the ILCD Handbook (European Commission, 2010a, p.113).

Given the importance of impact assessment methods in defining the results of LCA studies, it may be advisable to extend the guidance provided in the ILCD Handbook to cover procedures for managing (at least) these choices at Impact Assessment.

DISCUSSION AND CONCLUSIONS

All of the choices outlined in this paper are choices that are made during the Goal Definition and Scoping phase of an LCA study (albeit that they are revisited in an iterative way throughout the study). This suggests that more attention should be given to the procedure for making such choices at Goal and Scope Definition, and in particular to how the choices are related to different decision contexts. Definition of appropriate procedures has the potential to increase the usefulness and relevance of LCA studies.

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