

GAPS IN ASSESSING SUSTAINABILITY AND PROPOSAL OF A TIERED APPROACH

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ABSTRACT

Sustainability is one of the important topics in nowadays societies, but the assessment of sustainability is still in its early stage. This is partly substantiated by the lack of a consistent framework. Besides that available indicators are often on different levels within the three dimensions. Another problem occurs with regard to the data availability. Although for the environmental dimension usually sufficient data are available, gaps are identified for the social and economic dimension. The experience shows that dealing with environmental or sustainable impacts is a continuous process. Thus a tiered approach is proposed starting with “basic” indicators for all sustainability dimensions. Different levels are defined including indicators according to the background, available data and trade-off between theory and practice.

INTRODUCTION

Sustainability is one of the important topics in nowadays societies since it was brought up in 1987 from the Brundtland Commission (United Nations, 1987). However the assessment of sustainability is still in its early stage. Most of the already existing methodologies only focus on some aspects but do not cover all three dimensions of sustainability (social, environmental, economic) comprehensively. This is substantiated by three problems mainly: the lack of a consistent framework, the lack of sufficient data and the lack of consistent impact indicators (Finkbeiner, Schau, Lehmann, & Traverso, 2010).

Although for the environmental dimension sufficient data are available at least for the common impact categories, e.g. Climate Change, Acidification, inter alia due to existing databases (e.g. GaBi, ecoinvent (UNEP & SETAC, 2011)). For the social and economic dimension gathering data is harder, which sometimes is more related to a lack of knowledge and common understanding than to a real data gap. Databases so far only exist on country or sector level, e.g. the Social Hotspot Database (“Social Hotspot Database,” 2013).

In case of impact assessment the environmental dimension has already well-established indicators (e.g. ReCiPe (Goedkoop et al., 2009)), but within the social dimension inventory and impact indicators are mixed up and for the economic dimension so far only inventory indicators are used.

As a result sustainability assessment studies do not consider the complete life cycle of a product in every detail. Although the environmental dimension on behalf of LCA is reaching a more complete assessment level, the economic and the social dimension neglecting parts, as lacks of data and/or knowledge occur.

METHODS

One of the most common methods for assessing sustainability is the Life Cycle Sustainability Assessment (LCSA), even if the mentioned problems still remain. However it can be seen as the foundation for assessing sustainability and will serve as the basis for this study.

Life Cycle Sustainability Assessment

Life Cycle Sustainability Assessment (LCSA) is covering all three dimensions by integrating Life Cycle Assessment (LCA) (Finkbeiner, Inaba, Tan, Christiansen, & Klüppel, 2006), Life Cycle Costing (LCC) (Hunkeler, Rebitzer, & Lichtenvort, 2008) and social Life Cycle Assessment (sLCA) (Benoit & Mazijn, 2009).

The assessment of the environmental dimension is the most advanced procedure within the LCSA framework, as LCA is a standardized method (ISO 14044, 2006) and widely used to investigate the potential environmental impacts of products (Klöpffer & Grahl, 2009). Environmental Life Cycle Costing (LCC) is proposed for the assessment of the economic dimension. However, it is relatively new within sustainability assessment (Hunkeler et al., 2008) and indicators on the impact level are so far missing. Social Life Cycle Assessment (sLCA) assesses the potential social impacts of products and pays great attention to workers, societies/communities and consumers affected by the products (Benoit & Mazijn, 2009), but it is still under development as a clear framework is so far missing.

In a first step LCSA was adopted for assessing the life cycle of different types of bikes (normal bikes and Pedal Electric Cycles (Pedelec)). Within the LCA mid-point as well as end-point indicators were achieved. The economic dimension (LCC) was modeled for the consumer and manufacturer perspectives. Within the sLCA it was focused on workers, wherefore the Social Hotspot Database serves as a basis complemented by additional data and literature research.

In connection with the bikes production different countries are included, as bike parts are produced all over the world. Data were gathered due to sufficient databases, producer contacts and literature research. For the environmental dimension all bike parts, e.g. frame, could be modeled in a consistent way. For the social and economic dimension data were mainly available on country level and hardly all steps of the life cycle could be considered. It was recognized that environmental data are often easier collectable, as most people already have a good understanding. But especially, social data are difficult to gather as the insight is missing and no internal data are available beyond contracted working hours or law requirements.

RESULTS

Based on the performed case studies and further research it was found that assessing all three sustainability dimensions equally is still a challenge. Therefore a tiered approach for assessing sustainability is proposed to tackle this challenge.

A tiered approach for assessing sustainability

The experience as an LCA practitioner shows that customers mostly starting with a carbon footprint and often perform a full LCA afterwards. Consequently it can be concluded that dealing with environmental impacts or sustainable impacts is a continuous process. Thus a tiered approach is suggested beginning with assessing “basic” impacts in terms of sustainability. Therefore different levels of sustainability assessment are defined including several indicators according to the background information and available data.

Level 1: In a first step screening criteria are included, under consideration of the two limiting factors data and time. For the environmental dimension Climate Change impacts are proposed to be included measured in kg CO₂eq. Therefore the complete product life cycle is to be considered. For the economic dimension material and labor costs in connection with the direct production (intermediate products and the final product) as well as consumer costs in terms of purchase measured in e.g. € are to be considered. Within the social dimension the stakeholder group worker is in the main focus. This includes in a first step the wage level for workers for the direct production compared to the non-poverty wage and the existence of labor laws on the country and/or sector level.

Level 2: A more complete picture should be derived by considering mandatory criteria to assess sustainability. Therefore direct and also indirect product data are to be included. For the environmental dimension at least the most common impact categories (climate change, eutrophication, acidification, ozone depletion and photooxidant formation (European Union, 2010)) has to be considered. Within the economic dimension beside the direct costs indirect costs for transportation and energy supply are to be included by meaning of labor costs, but also costs for transportation and energy supply from a consumer perspective. For the social dimension further stakeholder groups are to be considered, e.g. consumer and community, as they might be affected by the product or production of the product.

Level 3: Additional criteria are used to assess advanced sustainability. This includes the consideration of indirect effects for all three dimensions, as so far they are not assessed for the social dimension, e.g. working condition in energy and transport processes. Further specific criteria are to be included, like impacts on biodiversity for the environmental dimension, impacts on self-actualization for the social dimension and indicators describing external effects due to crime, accidents or environmental damages in connection with the product for the economic dimension.

DISCUSSION

Even if the proposed levels are on a very early stage, they might serve as a guide for how to proceed when assessing sustainability. Besides that they can help to increase the awareness of sustainability assessment, as important indicators are named specifically.

One might think that further indicators are to be included, but this first version is more serving as a starting point as it is to be seen as a fixed approach. Over time all levels are to be specified in more detail and developed due to improvements in data and knowledge. It has been noticed that of course this is depending on proper indicators and that a general discussion about the proper framework was so far avoided.



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CONCLUSIONS & OUTLOOK

Based on the developed approach assessing sustainability might become easier, as it becomes more understandable and tangible. Further a trade-off between theory and practice was achieved, as one criterion for the used indicators is practicality.

The proposed approach is easily adaptable to new findings and additional or better indicators can be included. Therefore more research will be done by the investigation of established methodologies, e.g. Cost Benefit Analysis, to enhance the existing indicators particularly for the economic dimension targeting the development of impact indicators. In addition indicators are to be developed to consider e.g. regional or product specific problems.

Further, inquiries are under progress to differentiate more precisely between the different indicator levels. Thus, the proposed levels of the tiered approach are adjusted and improved based on the findings within the development of a new sustainability framework.

REFERENCES

- Benoit, C., & Mazijn, B. (Eds.). (2009). *Guidelines for social life cycle assessment of products*. UNEP/SETAC Life Cycle Initiative.
- European Union. (2010). *ILCD Handbook - Analysis of existing Environmental Impact Assessment methodologies for use in Life Cycle Assessment*. Ispra.
- Finkbeiner, M., Inaba, A., Tan, R. B. H., Christiansen, K., & Klüppel, H. (2006). The New International Standards for Life Cycle Assessment: ISO 14040 and ISO 14044. *International Journal of Life Cycle Assessment*, 11(2), 80–85.
- Finkbeiner, M., Schau, E. M., Lehmann, A., & Traverso, M. (2010). Towards Life Cycle Sustainability Assessment. *Sustainability*, 2(10), 3309–3322. doi:10.3390/su2103309
- Goedkoop, M., Heijungs, R., Huijbregts, M., Schryver, A. De, Struijs, J., & Zelm, R. Van. (2009). *ReCiPe 2008 - A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and the endpoint level*. Den Haag.
- Hunkeler, D., Rebitzer, G., & Lichtenvort, K. (2008). *Environmental Life Cycle Costing*. CRC Press. doi:10.1201/9781420054736
- ISO 14044 Umweltmanagement - Ökobilanz - Anforderungen und Anleitungen (2006). Deutsches Institut für Normung e.V.
- Klöpffer, W., & Grahl, B. (2009). *Ökobilanz (LCA): Ein Leitfaden Für Ausbildung und Beruf* (p. 56). John Wiley & Sons. Retrieved from <http://books.google.com/books?id=5kqxzNYoXKgC&pgis=1>
- Social Hotspot Database. (2013). Retrieved May 3, 2013, from <http://socialhotspot.org/home-about-shdb/>
- UNEP, & SETAC. (2011). *Global Guidance Principles for life cycle assessment databases*. Paris.
- United Nations. (1987). *Report of the World Commission on Environment and Development - Our Common Future*. (World Commission on Environment and Development, Ed.). Oxford, New York, Toronto: Oxford University Press.