



Definition and application of activity portfolio and control/influence approaches in organizational life cycle assessment



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ABSTRACT

Recently, following an increasing demand from companies to understand and monitor the potential environmental impacts of their activities, from a life cycle perspective, organizational life cycle assessment has been introduced. Only a few instances of its application have been published in the literature, and they mainly focus on one single environmental aspect. The application of organizational life cycle assessment in the case of a special purpose entity, created to build a tourist village in Italy, is presented and discussed in this paper. Requirements of ISO/TS 14072 and the guidelines published by the UNEP were considered. To overcome the limits related to the goal and scope Definition that have emerged from the literature, the activity portfolio concept was introduced along with the control and influence approach, according to ISO 14001. Sensitivity analysis was performed in order to discuss different energy use profiles of the village and the application of control and influence approach to the special purpose entity. The environmental impacts were concentrated in the first two years because of the importance of executive design activities; this included the impacts of the use stage that are mostly influenced by the decisions of the organization. The construction activities also contributed significantly in most of the impact categories. Results of the study proved the applicability of the introduced methodological proposals to special purpose entities in the construction sector and that results of organizational life cycle assessment can be consistent with results of product-based life cycle assessment. The activity portfolio concept and the representation of control and influence were useful for understanding the environmental hotspots and the activities of the organization that needed improvement in order to minimize environmental impacts.

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1. Introduction

In recent times, the number of organizations showing an interest in the assessment of potential environmental impacts related to their activities has increased (Martinez Blanco et al., 2015a). The reasons for this interest are manifold. In some countries (e.g., in France and Italy), comprehensive management of environmental impacts is recognized as a strategic tool that can support the success of an organization (UNEP, 2015). In others, such as in Italy, the quantification of potential environmental impacts is currently rewarded in public procurement (Italian Ministry of Environment, 2013). Moreover, together with the increased attention of the

international community, as regards to environmental issues such as climate change, also the behaviour of the consumers has begun to change: they have started to ponder the environmental impact of the products and services (Manzardo et al., 2015). To the light of these considerations it is important for an organization to appraise the opportunity to introduce tools to reduce the environmental impacts of products and organizations effectively (Hellweg and Milà i Canals, 2014).

One of the tools that can provide reliable information on potential environmental impacts at the organizational level is organizational life cycle assessment (OLCA) (Martinez Blanco et al., 2015a). According to ISO 14072 (ISO, 2015), OLCA is defined as the “compilation and evaluation of the inputs, outputs and potential environmental impacts of the activities associated with the organization as a whole or portion thereof adopting a life cycle perspective.” This reference includes requirements and guidelines

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for the application of life cycle assessment (LCA) to organizations. The UNEP Life Cycle Initiative has published a guidance document on OLCA (UNEP, 2015; Martínez Blanco et al., 2015b). Another initiative called organization environmental footprint (OEF), launched by the European Commission (EU, 2013), presents a method to address environmental impacts of organizations from a life cycle perspective. However, even if OEF can be seen as a type of OLCA, some of the principles and requirements have been identified to be not in complete alignment with the constitutional documents of LCA such as in the case of comparative assertion related to organizations, weighting and reporting (Finkbeiner, 2014); to be in line with ISO standards on life cycle assessment, OLCA according to ISO 14072 is used in this research.

Because of the recent introduction of this methodology only a limited number of studies have reported on OLCA applications and related challenges. Martínez Blanco et al. (2015a), within the UNEP guidance, reported on 11 companies, referred to as first movers, that performed a Life Cycle Assessment to monitor their environmental performances over time. However, most of these studies focused only on climate change impacts. Manzano et al. (2015) presented an application of the OLCA of a beverage company based on ISO 14072 that examined the environmental performance of a specific division (bottled water). Resta et al. (2016) proposed a decision-making process to help textile companies fulfill environmental, economic, and competitive benefits built upon the OLCA methodology from a cradle-to-grave perspective. Lo-Iacono-Ferreira et al. (2016) analyzed an application of Life Cycle Assessment (LCA) to address the ecological footprint of universities. Recently, UNEP has published the results of a road-test application (UNEP, 2017) of UNEP guidelines on OLCA (UNEP, 2015) presenting 12 case studies of organizations acting in different industrial sectors with different goals. In all these case studies, the following main challenges have been identified: defining the reporting unit, also referred to as the reporting organization and the reporting flow in the UNEP guidance on OLCA (UNEP, 2015), and defining the system boundaries along with the classification of direct and indirect activities (UNEP, 2017), especially when a product portfolio is delivered by the organization under study (Martínez Blanco et al., 2015b; Manzano et al., 2015). In this context, to verify the general applicability and improve the OLCA methodology, UNEP encouraged the application of OLCA in real case studies by different sectors and under specific conditions (Martínez Blanco et al., 2015a).

Because of its major environmental impacts (e.g., climate change, energy consumption, and pollution) and the growing demand for environmentally friendly solutions, one of the sectors that can benefit greatly from the application of LCA tools is the building sector (Sharma et al., 2014; Peng, 2016). Recent studies, in fact, determined that buildings worldwide are responsible for 30–40% of energy use and 40–50% of world greenhouse gas emissions (Rashid and Yusoff, 2015). Moreover, regulations related to the lifecycle environmental performance of buildings and construction are becoming more compelling (EU, 2010). Several applications of LCA at the product level (e.g., building components) have been reported in recent years in this sector (Sharma et al., 2014; Frischknecht et al., 2015), yet a limited number of quantitative applications of OLCA has been published in the literature (Cabeza et al., 2014; Huang et al., 2017; Islam et al., 2015). One study from Neppach et al. (2017) attempted to apply an OLCA approach, based on the OEF methodology, to construction companies in Germany, confirming the obstacles in the Definition of the reporting unit and system boundaries because of the heterogeneity of the products released over time. UNEP (2017) presented the case of AKZO Nobel, a company producing building materials, which is appointed by UNEP to be the first company to perform OLCA in the building

sector. The results confirmed the potential of OLCA applications in this sector but also the need for further development of the definition of the reporting unit to operatively facilitate performance tracking and the definition of system boundaries with reference to the classification of direct and indirect activities and its influence on the interpretation of results. The building sector and its companies could benefit from the application of OLCA in identifying the processes, activities, and lifecycle stages with the largest contribution to the overall environmental impacts (hotspots). They could set environmental impact reduction strategies but the solutions to overcome limits related to the reporting unit and system boundaries are yet to be investigated.

The main objective of this research is to propose a method to overcome the limitations in the Definition of reporting units and system boundaries (Martínez Blanco et al., 2015b; Manzano et al., 2015; Neppach et al., 2017; UNEP, 2017) in the construction sector for determining the environmental profile and performance tracking of a company by:

- adapting the goal and scope Definition phase introducing the activity portfolio concept and the control/influence approach,
- verifying the applicability of the proposal in a real case study.

2. Materials and methods

2.1. Methodological proposal

The OLCA performed in this research was applied to determine the environmental profile and to track the environmental performances of an organization in the construction sector following the requirements of ISO/TS 14072 (ISO, 2015) and the guidelines from UNEP (UNEP, 2015). This OLCA study was divided into 4 phases that perfectly matched with the structure of product-LCA studies based on ISO 14040 (ISO, 2006a): the goal and scope Definition, inventory analysis, impact assessment, and interpretation stages. According to Finkbeiner (2014), most of the requirements of ISO 14044 (ISO, 2006b) can be directly applied to OLCA, however some key points specifically focused on the goal and scope definition phase, need to be adapted to deal with the peculiarities of an organizational application. These points are very important in the application of OLCA (UNEP, 2015) because they significantly influence and affect all the phases of the study (Martínez Blanco et al., 2015b). These points comprise the definitions of the organizational boundaries, reporting unit, reference period, and system boundaries.

The Definition of the organizational boundaries is intended to determine who the organization is, by adopting one of two possible consolidation approaches: operational/financial control or equity share. These concepts have been widely discussed in the literature, and their applicability has been confirmed in several contexts (Manzano et al., 2015; UNEP, 2015).

The Definition of the reporting unit is intended to replace the functional unit in product-LCA and represents the quantified performance of the organization under study to be used as a reference (ISO, 2015A). The UNEP guideline gives additional specification on the reporting unit by defining the concept of reporting organization and the reporting flow that quantifies the product portfolio. Definition of reporting flow is critical (UNEP, 2015), specifically in companies for which the product portfolio is composed of heterogeneous products that change over time, such as in the case of construction companies (Neppach et al., 2017). Consequently, performance-tracking capabilities of the organization can be limited.

In this study, to overcome the issues related to the reporting unit Definition, the concept of reporting flow was adapted, assuming

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