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Enhancing environmental management in the textile sector: An Organisational-Life Cycle Assessment approach

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ABSTRACT

An increasing number of textile firms are adopting sustainability strategies for achieving long-term competitive advantage. In this paper, a new decision-making process for the textile sector, exploiting the Organisational Life Cycle Assessment methodology, is proposed. It provides a management system able to support companies in monitoring and evaluating environmental performances with a dynamic perspective and identify which activity and/or mechanical plant needs to be improved or changed in order to reduce the environmental impact, enabling cost savings, and at the same time, developing the business case for sustainability. In particular, for each Organisational Life Cycle Assessment phase, an operational tool was established. The tools were developed both by reviewing specific literature and by conducting in-depth semi-structured interviews in six textile companies. Across firms, informants included the Managing Director, the Plant Manager, shop floor supervisors and workers, and representatives from Corporate Social Responsibility Committee, Manufacturing, Quality, and Accounting. Additionally, direct observation (e.g., plant tours) was also used as data collection method. A case study of a spinning company reveals the potential benefits of this decision-making process.

1. Introduction

The textile and clothing industry is one of the biggest industries, globally worth over $450 billion, in terms of nominal sales (Euler Hermes Economic Research, 2016), and, at the same time, one of the most polluting (Eryuruk, 2012). The major environmental burden caused by this sector is associated with: i) energy consumption in the production of man-made fibres, in yarn manufacturing, in finishing processes, and in the use phase for washing and drying clothes; ii) water and chemicals consumption associated with fibre growth, wet pre-treatment, dyeing and finishing activities, and laundry; iii) solid waste arising from textile and clothing manufacturing and, mostly, from the disposal of products at the end of their life; and v) direct CO_2 emissions, particularly related to transportation processes within globally-dispersed supply chains (Beton et al., 2011; DEFRA, 2008; Draper et al., 2007; Fletcher, 2008; Gardetti and Torres, 2013; Gwilt and Rissanen, 2011; Kocabas et al., 2009; Vajnhandl and Valh, 2014).

During the last twenty years (Gardetti and Torres, 2013), the demand for environmental-friendly textiles and clothes, manufactured and distributed minimising negative impacts on the environment, has vigorously emerged from a plethora of stakeholders, including consumers (Casadesus-Masanell et al., 2009; Goswami, 2008), renowned brands and retailers (such as Levi's, Gap, H&M, and Wal-Mart), non-profit organisations, public attention and mass-media (i.e., Detox by Greenpeace, Clean Clothes Campaign, Roadmap to Zero Discharge of Hazardous Chemicals, etc.), regulatory bodies and public authorities (EU REACH regulation). Therefore, sustainability principles, approaches and strategies have then become vital for textile and clothing companies to stay competitive in the market (Smith, 2003).

However, there is an inconsistency between companies opportunities to leverage sustainability and its actual implementation: while many companies commit to sustainability, only few put their commitment into actions (Chi, 2011; Deloitte, 2013). As demonstrated by Berns et al. (2009), there are many reasons why companies experience difficulties in tackling sustainability more decisively; in particular, the authors point out three root causes: i) companies often lack the right information upon which to base decisions; ii) companies struggle to define the business case for value creation; and iii) when companies do act, their execution is

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often flawed. These three main issues entail a critical need for structured decision-making approaches to execute companies' sustainability strategies. This paper aims at partially filling this gap by developing a decision-making process, based on the Organisational Life Cycle Assessment (O-LCA) approach, in order to support management in making environmentally and economically sound choices among the best available practices (BATs) at a technical level (i.e., more efficient production equipment), suppliers' level (i.e., use of recycled materials) and management level (i.e., introduction of lean production techniques for waste minimisation). In particular, the goal is to give specific guidance, methods and tools for the identification and the assessment of life cycle environmental impacts of a company, from the definition of the functional unit to the selection of the best environmental alternatives. This process will help textile and clothing companies integrate environmental objectives into corporate management control and decision system in order to achieve, at the same time, environmental and economic advantages. A management system able to support companies in monitoring and evaluating environmental performances with a dynamic perspective will be proposed. Such management system will rely on the systematic identification of hotspots that need to be managed in order to reduce the corporate environmental footprint, enabling cost savings, and at the same time, developing the business case for sustainability.

The remainder of the paper is organised as follows. Section 2 presents the theoretical background related to approaches and methods for supporting and improving decision-making towards sustainability. Section 3 describes the proposed decision-making process for the textile sector, while Section 4 introduces an application to an illustrative real case. A discussion of the results precedes the conclusions (Section 5).

2. Theoretical background

As argued by Waite (2009), Life Cycle Thinking (LCT) (Frankl and Rubik, 2000) is one of the approaches that can support companies in making the manufacturing industry, including the textile and clothing sector, more sustainable and less damaging to the environment, while at the same time remaining competitive (Waite, 2009). Life Cycle Management (LCM) makes LCT "operational for businesses through continuous improvements of product systems" (Remmen et al., 2007, p. 5). LCM is defined as "an integrated framework of concepts, techniques and procedures to address environmental, economic, technological and social aspects of products and organisations to achieve continuous environmental improvement from a life-cycle perspective" (Sonnemann et al., 2001, p. 325), from raw material acquisition, through manufacturing, use and final disposal. LCM is a management framework that supports firms to minimise the environmental burdens related to their value propositions, while maximizing the economic value generated (UNEP/SETAC, 2012). Within the LCM framework, sustainability goals are achieved using life cycle approaches and techniques, analytical and procedural tools, programs, strategies and policies (Sonnemann et al., 2015).

In particular, Life Cycle Assessment (LCA) is one of the most prominent techniques for the systematic evaluation of the potential environmental aspects of a product or service system through all stages of its life cycle (Rebitzer et al., 2004). The science of LCA methodology has grown and developed significantly in the last decade, as broadly reviewed in Klöpffer (2014). Despite its relevance for the scientific field, the influence and application of LCA for business decision-making are still limited (Choi et al., 2008). This aspect is reflected into a predominance of model and tool development, and a lack of focus on the use of LCA method in everyday management practice (Frankl and Rubik, 2000). It could partially be due to the traditional focus of LCA on environmental impacts and effects only (Reap et al., 2008), that does not take into consideration the important relationships and potential trade-offs between the environmental and economic performance (Norris, 2001; De Benedetto and Klemeš, 2009). The consequences of not integrating environmental and economic assessments can be missed opportunities or limited influence of LCA for decision-making, especially in the private sector (Shapiro, 2001). Consequently, various scholars have started to study ways to integrate LCA with other approaches for building a robust support to product-related decision-making (e.g. cost-benefit analysis, material flow analysis, social LCA, life cycle costing, and input–output analysis) (Manfredi et al., 2011), and synthetizing all the information into a decision vector (Nowack et al., 2012). However, while LCA was originally developed for products and services, enlarging the unit of analysis at organisational level is becoming a relevant stream of research (Guinée et al., 2011; Hellweg and Canals, 2014). To this extent, a flagship project named "LCA of organizations" was launched in 2013 by the UNEP/SETAC Life Cycle Initiative to explore the applicability of a life-cycle-perspective to an organisation (O-LCA) (Martínez-Blanco et al., 2015a). According to ISO/TS 14072 (ISO, 2014), O-LCA is "a compilation and evaluation of the inputs, outputs and potential environmental impacts of the activities associated with the organisation adopting a life cycle perspective". This methodology is able to meet multiple corporate needs: i) identification of environmental hotspots throughout the entire value chain; ii) monitoring and control of environmental performance; iii) strategic decision support; and iv) provide information for corporate sustainability disclosure (UNEP/SETAC, 2015). Overall, O-LCA empowers organisations to both define their sustainability strategy and improve their operational activities, facilitating the change into more sustainable consumption and production patterns, towards a resource-efficient and circular economy.

Most of the requirements and guidelines specified in standards for product LCA (ISO 1404x series) are suitable also for O-LCA (Finkbeiner, 2014). In particular, O-LCA implementation is based on the same four-phase methodology used for product LCA. The main differences between the two approaches refer to the scope and inventory phase, as the object under study is different (Martínez-Blanco et al., 2015c). Moreover, O-LCA should not be used for comparative analyses between organisations and their communication to the public (e.g., corporate ranking), but rather for addressing improvements in the given organisation (ISO, 2014).

Similarly to the UNEP/SETAC initiative on O-LCA, at European level DG Environment has worked together with the European Commission's Joint Research Centre (JRC IES) and other European Commission services towards the development of a technical guide for the calculation of the environmental footprint of organisations. The methodology, called Organisation Environmental Footprint (OEF), is grounded on a multi-criteria measure of the environmental performance of an organisation from a life cycle perspective (European Commission, 2013). Although OEF can be considered as a particular type of O-LCA, it is not fully coherent with some principles and requirements of product LCA as standardised by ISO (ISO, 2006) (Finkbeiner, 2014).

Even if the interest around O-LCA is rapidly increasing and significant explorative experiences are emerging, complete and rigorous applications of O-LCA are not yet a common practice (Martínez-Blanco et al., 2015b) and substantial research is still needed in order to understand how O-LCA should be implemented by companies. Moreover, no case applications have been published in the textile and clothing sector.