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Comprehensive life cycle assessment by transferring of preventative costs in the supply chain of products. A first draft of the Oiconomy system

Pim R. Croes*, Walter J.V. Vermeulen

Utrecht University – Copernicus Institute of Sustainable Development, Utrecht, Netherlands

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ABSTRACT

A major part of global unsustainability is embedded in consumption and the processes involved in the lifecycle of products, but there is currently no comprehensive and objective method for product sustainability measurement, including both environmental and social issues. This requires a life cycle approach. Current life cycle assessment (LCA) systems, developed to compare environmental performance of products and production alternatives, have many shortcomings if used to comprehensively measure product sustainability. The most important shortcomings are: the lack of a measuring standard, the top-down approach, the weighting of different issues, the very laborious procedures of addressing specific supply chains, limitation to environmental aspects, the very complex nature of impact based data, and difficult database maintenance. This article presents a new type of "bottom-up" and "product-specific LCA" for the comprehensive measurement of the hidden environmental and social costs of products. Every supply chain actor collects the upstream supply chain hidden costs, calculates and adds its own contribution and transfers the result to the next link by means of a monetary unit, the "Eco Social Cost Unit" (ESCU). Every ESCU allocation is the product of a quantitative factor for an issue and a price factor. The uniform measurement of the quantitative factor, their transfer through the supply chain, and the creation of a self learning database of the price factors is achieved by means of a standard.

The price factor represents the marginal preventative costs for the relative impact category of sustainability issues. For initial determination of the price factor this article extends the EcoCost/Value ratio system, developed by Vogtländer et al., to social issues, discusses implications of the system, its principles, advantages, research challenges and limitations and proposes system boundaries for application of the system and future research contributions to the project.

1. Introduction

Issues like climate change, pollution, depletion of biodiversity, mineral resources and fresh water, land degradation, poverty, corruption, inequality, human population growth and financial irresponsibility present serious threats to humanity. Because these issues are strongly interrelated to the economy and the current way of producing, selling and using of products, there is an increasing need for a comprehensive method for the measurement of the sustainability of products. In the current version of the free market mechanism, considerable costs of damage to the environment and people are not included in the economy and therefore, are called "externalities".

A frequently proposed solution is the internalization of the externalities, e.g. by taxation, already proposed by (Pigou, 1920, p.129–179; Mishan, 1967). Recent authors, (e.g. Bithas, 2011; Van den Bergh, 2010) argued that internalization is indeed effective. Bithas, like Pigou before, based his arguments on damage based externalities and made the observation that monetary externalities are time and location dependent and therefore, are extremely difficult to determine.

To date, some form of Environmental Tax Reform (ETR) is already widely practiced (OECD, 2011), although mostly limited to energy use and carbon emissions. In the Netherlands and in the UK, some consulting companies are specializing in promoting "true costs" (True Price, 2015; Trucost, 2015). But also large financial

* Corresponding author.
E-mail address: p.r.croes@uu.nl (P.R. Croes).

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advisers like Price Waterhouse Cooper, Deloitte and Ernst& Young are involved (Sipkens et al., 2014). The World Business Council for Sustainable Development envisions business based on true prices for 2050 (WBCSD, 2010), and the CEO's of companies like Patagonia and Blu Skye argue that successful business is synonymous with sustainable business, leading to true pricing (Chouinard et al., 2011).

The idea of internalization is that, in a free, full price economy, consumers and producers will automatically make sustainable choices and create a sustainable economy. Internalization actually is nothing other than a correction of the malfunctioning of the free market regarding currently excluded goods and services. Therefore, the magnitude of the externalities, representing the cost distance to sustainability, provides a perfect measure of unsustainability. However, to date, no system exists for the comprehensive measurement of the externalities related to the world's millions of products.

In this article we present the “Oiconomy project”. Its objective is to develop a new type of “bottom-up” and comprehensive LCA, for measuring the distance to sustainability of specific products by their currently externalized preventative costs. A long-term goal is to provide the data for potential future internalization of product related externalities.

In this article “Oiconomy” is used for “a sustainable full price economy, “comprehensive” refers to integrating environmental, social and economic aspects, “product” is defined in its widest sense; it may be tangible or a product-service, intended for consumers or for organizations. “Specific products” refers to the end products as they are presented to the consumer/user. “Preventative costs” are defined by the precautionary costs necessary to prevent damage. “Bottom-up” refers to data determination and transfer through the supply chain from cradle-to-grave by the supply chain actors themselves, and “top-down” refers to a LCA where the practitioner takes the initiative to investigate the supply chain”. Note that our concept of “top-down” is very similar to the more common LCA concept of “background systems”, but “bottom-up” is not exactly the same as “foreground systems”, that refers more to the nature of the data than to the route of transfer (JRC, 2010, p.97).

Taking preventive measures brings both costs and benefits. The systems of eco-efficiency (Schmidheiny and Zorraquin, 1998) and environmental management accounting (e.g. Jasch, 2006) have been developed to measure and base decisions on a balance of costs and benefits. There are many examples where even the internal benefits equal or even exceed internal costs (Henson, 2008). A quarter of a century of experiences in pollution prevention practices has shown that systematic attention to environmental impacts in the design of products and processes generate savings rather than additional costs (Allen and Rosselot, 1994; Ochsner et al., 1995; Durfee, 1999; Miller et al., 2008; Bartholomew et al., 2008; Granek, 2011; Sam, 2010). Often these benefits are analysed from the perspective of a single firm and they are limited to environmental impacts. Internal costs and benefits are easier to measure by single companies involved in improving their sustainability performance. As we will show in this article, accurate measuring of external costs and benefits throughout the value chain is far more difficult or even impossible, surely for the involved company itself. In Section 5.5 we will address how to deal with the benefits of preventative approaches.

2. Methods and structure of this article

To date, the methods closest to the proposed comprehensive measuring system of product sustainability are life cycle assessment methods (LCA) and life cycle sustainability assessment (LCSA) (UNEP & SETAC, 2011).

We therefore, extensively reviewed the literature, based upon searches via Google Scholar, Picarta and Scopus. We extensively used previous reviews, and bi-directionally followed references and citing of papers on the strength and weaknesses of current methodologies of LCA and LCSA and assessing these on their use for the comprehensive sustainability measurement of specific products.

We found that current damage assessments based LCA and LCSA have major shortcomings if used for this purpose, including: their damage based character, the lack of considering social issues, the lack of standardization of the system boundaries, measurement and methods of transfer of verified data through the supply chain.

Because successful global certification systems exist on a wide spectrum of issues, which can support the standardization, verification and transfer of data through supply chains, we proceeded to develop a model for a product sustainability measuring standard and system (Croes, 2013). For this purpose we searched literature for existing conventions, standards, guidelines and initiatives for the creation of a comprehensive selection of sustainability criteria. We used the issues found in LCA system boundaries for supporting our proposed approach for standardized system boundaries.

In Section 3 the strengths and weaknesses of current LCA, if used for the comprehensive sustainability measurement of specific products are discussed. In the Sections 4 And 5 we presented a new type of LCA, which is designed to overcome most of the found shortcomings and discuss the system properties and boundaries. In Section 6 we discussed the next steps of the project and reflected on its research challenges and limitations.

3. Strength and weaknesses of current LCA

Currently LCA is widely used by companies, governmental bodies and scholars. The ISO standards 14040 and 14044 present a framework for LCA systems (ISO, 2006b; ISO, 2006a). LCA was developed as an assessment tool to compare the environmental impact of different alternatives and has proven to be a useful tool for assist in making management decisions. It is also useful for helping to provide a life cycle focus and to increase scientific knowledge on the environmental impact of products and processes.

However, for the purpose of seeking to achieve comprehensive sustainability measurement of specific products, current LCA systems suffer from some fundamental shortcomings, which are discussed in the following sections. Subsequently, we described how the proposed system might help to overcome those shortcomings.

3.1. Inadequate consideration of social issues

LCA is currently limited to environmental sustainability issues. Social LCA is under development (Benoît and Vickery-Niederman, 2011), but thus far a functional system is not available (Guinée et al., 2011). Without considering social issues, LCA's may lead to seriously incomplete conclusions, because many environmental and social issues are causally interrelated. E.g. neglecting social issues means that a seemingly environmentally sound product may be made using child labour or inadequately remuneration of members of the supply chain. Such a product may cause poverty and illiteracy, a social sustainability issue by itself, but also one that may cause future land degradation and climate issues, e.g. by unsustainable harvesting of timber and home biomass cooking emissions (Smith et al., 2000). On the other side, decreasing poverty may, result in increased meat consumption and consequently have impacts upon land use and upon climate related issues.