



Review

Social life cycle assessment of biodiesel production at three levels: a literature review and development needs

Catherine Macombe^{a,*}, Pekka Leskinen^b, Pauline Feschet^c, Riina Antikainen^d^a IRSTEA, UMR ITAP, Groupement de Montpellier, Domaine de Lavalette, 361 rue Jean-François Breton, BP 5095, F-34196 Montpellier Cedex 5, France^b Finnish Environment Institute (SYKE), P.O. BOX 140, FI-00251 Helsinki, Finland^c CIRAD, UPR 26, Boulevard de la Lironde, F-34398 Montpellier Cedex 5, France^d Spinverse Oy, Tekniikantie 14, FI-02150 Espoo, Finland

ARTICLE INFO

Article history:

Received 23 August 2012

Received in revised form

4 March 2013

Accepted 5 March 2013

Available online 22 March 2013

Keywords:

Biodiesel production

Company, region, and state levels

Decision support

Life cycle assessment

Social impacts

ABSTRACT

Assessment of social impacts of products and services has gained increasing interest in society. Life cycle assessment (LCA) is a tool developed to estimate the impacts of products and services from cradle to grave. Traditionally LCA has focused on environmental impacts, but recently approaches for social life cycle assessment (SLCA) have also been developed. Most of them fairly address social performances of business, but the aim of this paper is to analyse the possibilities and development needs in the complementary approach, which is the evaluation of social impacts in LCA. We review the field in general and take a closer look at the empirical case of biodiesel production, which is a timely topic globally in view of the climate change mitigation objectives. The analysis is carried out at three levels – company, regional, and state level. Despite active development in the field of SLCA, we conclude that in many cases it is not yet possible to carry out a comprehensive SLCA. Finally, we outline lines of research that would further improve the methodological and empirical basis of SLCA at various levels of decision-making.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

Society is taking increasing interest in assessing social impacts of various human activities. According to UNEP–SETAC (2009), great variety in methods and approaches exists in the field, depending on the object of interest. If the focus is on a project, intervention, or facility, one can utilise social impact assessment or health impact assessment, for example. In the case of organisations, tools such as value network assessment or social footprint can be applied. For communities, one can apply such methods as participatory action research or focus groups. The approach involving products or services is called social life cycle assessment (SLCA). In SLCA, most methods address social performances of business. In this paper, we focus on complementary methods concerning social impacts.

As the paper is about the assessment of impacts, the first question to address is what social impacts are. Here we refer to the narrow definition of impacts. We draw many ideas from the Impact

Assessment principles (Vanclay, 2003) devoted to project assessment. Social impacts (Vanclay, 2002) are caused by changes (e.g., setting up a new facility), which entail effects (more traffic). Some of these effects directly cause phenomena that are experienced by people or by groups of people (e.g., death or injuries in traffic). The experienced phenomena are ‘social impacts’. The list cannot be fixed, but some examples can be found in impact assessment (Becker and Vanclay, 2003) or SLCA literature. They are related to changes in life expectancy, health, social status etc. Reitingier et al. (2011) suggest the first list of social impacts from the capability theory of Sen (2003) to operationalize the phenomena. Well-being and health are generally agreed upon as social impacts, cited by many authors (Weidema, 2006), but consensus has not yet been reached on other impact categories. For this reason, the rest of this text will focus on the well-being and health impacts, which are the only consensual impact categories to date.

Often, researchers do not have at their disposal the full chain of calculations needed for the assessment of the target social impact. Because of this limitation, they stop the calculation at an intermediate point, such as the change in elimination of jobs, which could lead to further important social impacts (see Jørgensen et al., 2010a,b). To acknowledge our inability to calculate the true social impact when this concern is relevant, we will use the term ‘social effect’ instead of ‘social impact’.

* Corresponding author. Tel.: +33 4 99 61 27 72; fax: +33 4 99 61 24 36.

E-mail addresses: catherine.macombe@irstea.fr (C. Macombe), pekka.leskinen@ymparisto.fi (P. Leskinen), pauline.feschet@cirad.fr (P. Feschet), riina.antikainen@spinverse.com (R. Antikainen).

'Social performances' are neither social effects nor social impacts of changes. Social performances are difficult to link with social impacts of changes, because they are features of a situation in a relevant organisation (or features of the value chain of organisations shaping the life cycle), referring more or less to social issues. The state of gender issues in the workplace, child labour, trade-union freedom etc. are typical social performances of organisations. Table 1 describes the distinction between performances, effects, and impacts.

Processing the assessment of social performances is always feasible by asking stakeholders which performance and indicator they deem important to assess. Many examples have already been published, addressing decision levels from company (Schmidt et al., 2004) to nation (Labuschagne and Brent, 2006). In this paper, we deal not with the social performance assessment of organisations but with methodologies for the calculation of social impacts (or social effects by default) caused by one change affecting these organisations.

The paper addresses the case of three different raw materials – palm oil, forest biomass, and algae – in biodiesel production. The comparison of three distinct raw materials is considered as an opportunity for challenging SLCA methods. The production chains selected are the same as in the work on pages XXX–YYY of this issue, in which the analysis concentrates on environmental impacts. We are interested in biodiesel in general, not in any specific country, region, or company. However, Finland, Sweden, Germany, and France are the European Union member states, which have the greatest potential for forest biomass supply for energy (Ericsson and Nilsson, 2006).

In real-life decision-making, it is necessary to deal with economic, environmental, and social impacts (see e.g., Leskinen et al., 2012), but here we consider only the social effects caused by the functioning of the product chain, and only routine functioning at that. Indeed, neither possible accidents nor construction of facilities is taken into account.

Social impacts are important, because employing biomass for energy provides opportunities also for supporting welfare and employment. So far, most of the empirical research examining the bioenergy industry has only touched on the social aspects of energy production, though one should see the work of Leskinen et al. (2012). In addition, previous research has not approached the different levels (i.e., company, region, and state) of concern in the impacts of bioenergy production. In fact, the individual hierarchical levels (Dreyer et al., 2010) of concern must be examined separately, because differing and potentially competing concerns at different levels may be involved in the same project of one bioenergy plant (Elghali et al., 2007). Also, not all levels of decision-making demand the same types of information. Domac et al. (2005) recall that,

while reduction of carbon emissions and security of energy supply are headline issues at national level, local communities are likely to consider job creation, income improvements, the local environment, and regional development at least as important when considering supporting or opposing any new bioenergy plant. Indeed, it proceeds from Vancly's (2002) definition that reducing carbon emissions, securing resource supply, or getting the approval of people is not a social impact. Here we make the assumption that some conditions (such as public approval) are met by the scenario before the implementation of the assessment via SLCA. Hence, we deal only with how to calculate the well-being and health social impacts thanks to the methods developed within the LCA field.

We borrow methods either from social or environmental LCA. Indeed, environmental LCA practitioners performed some estimation of potential harm to human health long before developing a comprehensive SLCA methodology.

The scenarios presented here are based on the production of bioenergy from palm oil, from forests, or from algae, and they are addressed at the company, region, and state levels.

First, we check the approaches available for assessing social impacts/effects or performances in the LCA framework (Section 2). Then we discuss the possibilities offered by this review, assuming the social assessment of biodiesel projects is applied at each of the company, region, and state levels (Section 3). The main purpose of this exercise is to highlight current knowledge gaps and development needs for SLCA (Section 4). Section 5 presents conclusions of the review.

2. Social impacts and performances in LCA literature

Different types of approaches are available, depending on the scope. They involve different descriptions of the systems under scrutiny.

Social LCA is defined in the work of UNEP–SETAC (2009) as 'a systematic process using best available science to collect best available data on and report about social impacts (positive and negative) in product life cycles from extraction to final disposal'. We do not deal with the entire history of the methods, which can be found in the work of Benoît et al. (2010), and we make only a brief mention of two families of methods stemming from the environmental LCA framework, which address harm to health people might experience due to environmental issues. For instance, the Eco-Indicator 99 method (Spriensma and Goedkoop, 2001) belongs to the first family, dealing with the impact on 'human health'. The second family brings together methods related to 'LCA of work environment' and the determination of possible harm to workers' health caused by their exposure to pollutants (Kim and Hur, 2009; Antonsson and Carlsson, 1995).

We focus here on the main approaches aimed at the assessment of either social performances or social impacts of product chains, quoting representative authors only. We extract them from a corpus of about 50 papers. This corpus is the result of our four years of collection of all literature on social LCA. Only one part may be retrieved from "Scopus" (15 results) or "Web of Science" (14 results) databases with the keywords "social life cycle assessment" in the article title.

All the approaches are highly innovative and experimental, but not yet comprehensive. Nevertheless, they obviously describe and analyse the examined system at a different level, e.g., a chain of unit processes or a chain of companies. We will refer to these SLCA methods in light of the opportunity they offer for the assessment of social impacts of bioenergy product chains. When methods for the assessment of social impacts are not already available, we turn to authors' suggestions for methods to assess social performances, also quoting their work.

Table 1
Distinguishing between performances, effects, and impacts.

Context	This is a performance	This is an effect	This is an impact
One situation (within one company)	Feature of the situation		
One change (driven by one company)		Social phenomena caused by the change that could have impacts	Consequence of the change that is felt by people directly in life
Examples	Gender issue, child work, or freedom to organise within the company	Loss of jobs, creation of jobs, or creation of new networks	Changes in health status, or changes in sense of confidence

Download English Version:

<https://daneshyari.com/en/article/1745239>

Download Persian Version:

<https://daneshyari.com/article/1745239>

[Daneshyari.com](https://daneshyari.com)