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SOCIETAL LIFE CYCLE ASSESSMENT

The guidelines for social life cycle assessment of products: just in time!

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Abstract
Purpose Authors of different sustainability journals, including authors of articles in past issues of the International Journal of Life Cycle Assessment have acknowledged the rising interest and the pressing need for a social and socio-economic life cycle assessment methodology and identified challenges in its development and implementation. Social life cycle assessment (LCA) allows identification of key issues, assessing, and telling the story of social conditions in the production, use, and disposal of products. In this article, the United Nations Environment Programme/The Society of Environmental Toxicology and Chemistry Guidelines for Social Life Cycle Assessment of Products will be presented.
Aim and scope The guidelines demystifies the assessment of product life cycle social impacts and presents an effective framework representing the consensus of an international group of experts leading research in this field. The guidelines complement those for environmental life cycle assessment and life cycle costing, and by doing so contribute to the full assessment of goods and services within the context of sustainable development. They enable a larger group of stakeholders to engage. Key aspects of the

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framework and the research needs identified in the guidelines will be summarized.
Conclusions In a globalized world where transparency and information occupies a predominant place and where consumers and companies reach out to shed light on both the brightest and the darkest side of the economy and, when applicable, transform its condition, social LCA brings strong value. At a moment where major companies and initiatives are going forward with using LCA and are trying to track and communicate about the social impacts of their products they are increasingly held accountable for the guidelines for social life cycle assessment arrive just in time to inform their efforts.

Keywords Business · Guidelines · Social life cycle assessment (S-LCA) · Social responsibility · Socioeconomic · Supply chain · Sustainability

1 History of social life cycle assessment, the project group, and the process of writing the guidelines

The discussion on how to deal with social and socio-economic criteria in life cycle assessment (LCA) started about 15 years ago, with the publication of The Society of Environmental Toxicology and Chemistry (SETAC) Workshop Report: "A Conceptual Framework for Life Cycle Impact Assessment" (Fava et al. 1993). In this report, a "social welfare impact category" was proposed by stating, inter alia, "… the primary emphasis should be on environmental impacts that arise directly or indirectly from other social impacts …." Consequently, the proposed social impact category initiated a comprehensive discussion among LCA methodology developers to include social aspects into the environmental life cycle assessment of products and systems.

The early body of research and tools developed include, but are not limited to, the publication of Social and Environmental Life Cycle Assessment (SELCA) in 1996, Casado Cañeque's work on development of social company performance indicators for use in LCA in 2002, studies by Norris that assessed socioeconomic pathways to worker health impacts in the US economy (2003) and in global supply chains (2004), research on an integrated approach for product assessment in connection with the Label "Sustainable Development" in 2004 by Ghent University, the development of Product Sustainability Assessment by the German Öko-Institut in 2004, the development of the simplified LCA tool of the Quebec Sustainable Development Fund by FIDD and CIRAIG in 2004, SEEbalance by BASF in 2005 and the life cycle working environment analysis method by LBP-GaBi, University of Stuttgart. This early work was followed by Weidema (2006a) and Dreyer et al. (2006) and Benoît et al. (2007) who proposed frameworks for social impact assessment in LCA, including determination of damage categories, impact categories, and suggestions for category indicators or inventory data. At the same time, Norris (2006) highlighted the importance of context-dependent life cycle attribute assessment over traditional forms of life cycle inventory information for conducting social life cycle assessment. These studies and many more (Brent and Labuschagne 2006; Brent and Labuschagne, 2006; Hunkeler 2006; Hutchins and Sutherland 2008; Jørgensen et al. 2008; Klöpffer and de HH 2008; O'Brien et al. 1996), proposed approaches for social life cycle assessment, and also raised important issues that still needed further research. Since 2008, the literature available and the social life cycle assessment (S-LCA; social and socioeconomic LCA[1]) case studies conducted are booming. Already, master thesis and reports using the Guidelines for Social Life Cycle Assessment of Products can be found (e.g., Blom and Solmar 2009).

One of the most commonly debated questions has been: is the social life cycle assessment of a product different from a usual environmental LCA and if yes, how so (for example, Klöpffer and de HH 2008; Swarr 2009)? This question is addressed in detail in the guidelines and will be developed in the next section of this article.

Other questions raised included the implications for system boundary definition generated by including social impacts in a study, whether issues are raised by translating criteria or attributes into impacts, whether an LCA should limit itself to social (and socio-economic) impacts directly or indirectly influencing other environmental impacts, whether social criteria should be related to international agreements and how interdependency between the environmental, social, and economic impacts would play when assessing a product or a service. In addition, Norris (2006) raised the question of how to measure, aggregate, compare, and stimulate society wide improvement of context-dependent attributes within and across product life cycles in LCA. It is also worth noting that when getting acquainted with the abundance of social indicators (occupational accidents, freedom of association, corruption, etc.) and social indicator types (project evaluation, project impact assessment, social return on investment, human well being indexes, etc.) found in the literature, many researchers new in the field have expressed anxiety. While stands are taken or technical solutions are brought in the guidelines on many of these questions, others remain open topics of study, in particular the question of interdependency between the three pillars (environmental, economic, and social).

[1] In the text, social LCA will be used as a synonym for social and socio-economic LCA and S-LCA will be used as an acronym.

In 2004, the United Nations Environment Programme (UNEP)/SETAC life cycle initiative recognized a need for a task force on the integration of social criteria into LCA. The task force was created with the objectives (1) to convert the current environmental tool LCA into a triple bottom line sustainable development tool, (2) to establish a framework for the inclusion of socio-economic benefits into LCA, (3) to determine the implications for life cycle inventory analysis, (4) to determine the implications for life cycle impact assessment, and (5) to provide an international forum for the sharing of experiences with the integration of social aspects into LCA.

The first meeting was held in Prague, back-to-back with the annual SETAC Europe conference in April 2004. At each meeting, methodological issues (including indicators) and case studies were discussed. The first deliverable was the publication of the feasibility study in May 2006 (Grießhammer et al. 2006) which concluded: "In terms of methodology, there are evidently no fundamental problems calling the feasibility of S-LCA into question". In 2007, the name of the Working Group changed to Project Group (PG) on S-LCA. More than 12 meetings, workshops, and seminars were organized between April 2004 and April 2009, 12 organizations representing key stakeholders in the field of social responsibility, provided continuous feedback on the S-LCA guidelines and the PG work, and an international peer review was organized by UNEP and SETAC. Thirty nine key experts were contacted to review these guidelines. Among them, 17 experts in the field of social responsibility, sustainability, and life cycle assessment engaged actively in the process and formulated important comments which were all addressed and integrated in the guidelines. The PG formulated responses to all the reviewers' comments. In addition, as part of funding requirements, two consultations were organized in Quebec, Canada, involving 46 selected social and environmental responsibility local experts. Their comments were also addressed and integrated in the document.

Finally, the publication of the Guidelines for Social Life Cycle Assessment of Products (Benoit and Mazijn 2009) was launched officially on 18th May, 2009 in Quebec, Canada, in conjunction with the ISO 26000[2] meeting.

2 The guidelines—main contributions to methodology development

The Guidelines contain four main sections

The first section presents the historical context in which the guidelines should be placed. From the broad and vague concepts of sustainable development and human well being to the more specific goal of sustainable consumption and production (including corporate social responsibility), a link is made with life cycle thinking and related techniques and tools for assessment before going into details in the methodology of an S-LCA (a social and socio-economic LCA).

The second main section explains clearly the principles of an environmental life cycle assessment (E-LCA) and a life cycle costing, including a comparison of each with an S-LCA. This chapter clarifies the differences and the commonalities.

The third section provides a technical framework for S-LCA from which a larger group of stakeholders can engage to assess social impacts with a life cycle perspective and possibly move towards a sustainable LCA when assessing goods and services. It draws largely and whenever possible on the E-LCA methodology. In this chapter, the four major phases (goal and scope of the study, inventory analysis, impact assessment, and interpretation as outlined in ISO 14040 and 14044) of the methodology are presented and detailed in a systematic and coherent manner.

Finally, the fourth section including the remaining chapters present the possible applications and the limitations, the communication of results, the review process, and currently identified research and development needs.

Key elements of the guidelines will be outlined in the following discussion. A comparison with E-LCA is made whenever feasible.

2.1 Main characteristic and usability of social life cycle assessment

Social life cycle assessment is 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. The scope (the life cycle) and the methodology (a systematic process of collecting and reporting about social impacts and benefits) are both key aspects which draw interest in the technique.

S-LCA is best used for increasing knowledge, informing choices, and promoting improvement of social conditions in product life cycles. S-LCA can be used to identify, learn about, communicate, and report social impacts; set up strategies and action plans; and inform management policies and purchasing practices. S-LCA documents the product utility but does not have the ability or the function to inform decision making at the level of whether or not a product should be produced.

2.2 Depth and breadth of the methodology in comparison with other CSR tools and E-LCA

The vast majority of social responsibility tools address social impacts at the level of the enterprise making use of

[2] ISO 26000 is expected to publish voluntary Guidelines for Social Responsibility in 2010.

management information. Only sometimes do these tools include the impacts at the facility level (for example, SA 8000 certification). Even more rarely do they include parts of the supply chains in their scope, and if so, such inclusion is generally limited to first tier suppliers. Social impact assessment, on the other hand, is a methodology which assesses impacts happening at a single process and/or plant; it is often used in the context of a development project such as mining. Environmental life cycle assessment focuses on products and assesses impacts happening at the process and plant level through the whole life cycle, covering also impacts caused during the use phase. In comparison, social life cycle assessment makes use of information gathered at the enterprise/management, plant/facility and process levels, and it does so for the entire product life cycle (Fig. 1).

2.3 Product system and the functional unit

Social life cycle assessment and environmental life cycle assessment have the same object of study: the product life cycle. In order to model the product system, LCA uses a functional unit. ISO 14040 defines the functional unit as "quantified performance of a product system for use as a reference unit" (ISO 14040, 3.20). The functional unit is a key to LCA (both E-LCA and S-LCA); it is based on the product's function for the consumer, and it allows quantitative assessment and comparison of impacts. Based on the functional unit, a reference flow is defined, and material, energy, and water flows are modeled. A reference flow is a quantified amount of product(s), including product parts, necessary for a specific product system to deliver the performance described by the functional unit. Reference flows translate the abstract functional unit into specific product flows for each of the analyzed product systems.

There is no difference between E-LCA and S-LCA with regards to the functional unit. The need for product system modeling is the same for E-LCA and S-LCA. As for E-LCA, when qualitative data are used, qualitative results are not generally expressed by functional unit. The only contrast between E-LCA and S-LCA is that S-LCA often works with information about the attributes or characteristics of processes and/or their owning companies, which are not relevant to express per unit of process output. Such information is therefore not summarized per functional unit when aggregating information across the life cycle in an S-LCA. Results may be expressed quantitatively using life cycle attribute assessment if desired. In any case, results need to be expressed in a way that renders the proportional weight of the unit processes in the life cycle of the product.

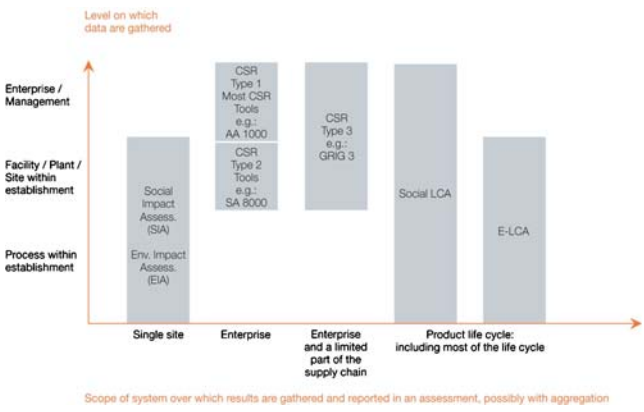

Fig. 1 Scope of CSR and impact assessment techniques of enterprises and their products

2.4 Other key similarities with E-LCA

S-LCA and E-LCA both have a huge need for data, and both operate as iterative procedures; they both call for a peer review when results are communicated to the public or in the case of comparative assertions. E-LCA and S-LCA decision making processes are supported by detailed information and analyses so that critical process steps and hotspots in a product chain can be identified. Also, both benefit from an assessment of data quality, and both methodologies can also examine impacts when semi-quantitative or qualitative data are used. An S-LCA should, just as an E-LCA, cover a broad range of impacts; the guidelines recommend that the list of subcategories (Table 1) is set as a minimum of issues to be assessed during an S-LCA (Table 1).

2.5 Key differences between S-LCA and E-LCA

S-LCA gathers information on the organizational aspects at the enterprise/management level along product life cycles concerning the social and socio-economic impacts. Whereas, both E-LCA and S-LCA impact assessment methods may be sensitive to location, no E-LCA LCIA Life Cycle Impact Assessment methods are site specific, and E-LCA methods often defined and use categories of location types that depend on physical factors such as geography type or population density. S-LCA may require site-specific LCIA in some cases and may also need information about "political" attributes, such as the country and its laws. Regarding the type of data, sometimes the most relevant data to use in an S-LCA is subjective, for example information given by employees. Of equal importance is the recommendation that the list of subcategories is set as a minimum of issues to be assessed during an S-LCA. This aims to prevent the use of S-LCA results on a few limited topics for social marketing purposes while not addressing core issues. Benefits or positive impacts can also play a major role in S-LCA, compared to E-LCA where their presence remains minor.

Table 1 Stakeholder categories and subcategories

Stakeholder "worker"	Freedom of association and collective bargaining
	Child labor
	Fair salary
	Working hours
	Forced labor
	Equal opportunities/discrimination
	Health and safety
	Social benefits/social security
Stakeholder "consumer"	Health and safety
	Feedback mechanism
	Consumer privacy
	Transparency
	End of life responsibility
Stakeholder "local community"	Access to material resources
	Access to immaterial resources
	Delocalization and migration
	Cultural heritage
	Safe and healthy living conditions
	Respect of indigenous rights
	Community engagement
	Local employment
	Secure living conditions
Stakeholder "society"	Public commitments to sustainability issues
	Contribution to economic development
	Prevention and mitigation of armed conflicts
	Technology development
	Corruption
Value chain actors* (not including consumers)	Fair competition
	Promoting social responsibility
	Supplier relationships
	Respect of intellectual property rights

3 The framework

3.1 Impact categories, stakeholder categories, subcategories, and inventory indicators

The backbone of an S-LCA is the information and data describing the product life cycle, the processes therein, and the relations with different stakeholders in accordance with the goal and scope defined for the study. To structure the data gathering, a set of inventory indicators is used. Each inventory indicator specifically defines the data to collect; these data may be quantitative or qualitative. The use of qualitative indicators conforms to the ISO 14040 standard which allows their use, when needed. The inventory indicators are linked to subcategories which in turn are grouped into impact categories and stakeholder categories (Fig. 2). Impact categories are each related to social themes of interest to stakeholders and decision makers. Social themes of interest include: human rights, work conditions, cultural heritage, poverty, disease, political conflict, indigenous rights, etc. There is currently no one set of impact categories recommended. The stakeholder classification and the classification according to impact categories are complementary (Fig. 2).

Fig. 2 Concept of subcategory

3.2 Stakeholder categories

As expressed at the beginning of the article, S-LCA assesses the social and socio-economic impacts of all of a product's life cycle stages from cradle to grave. These are related to resource extraction, processing, manufacturing, assembly, marketing, sale, use, recycling, and disposal, among others. Each of these life cycle stages (and their unit processes) can be associated with geographic locations, where one or more of these processes are carried out (mines, factories, roads, rails, harbors, shops, offices, recycling firms, and disposal sites). At each of these geographic locations, social and socio-economic impacts may be observed in relation with five main stakeholder categories:

(1) Workers/employees;
(2) Local community;
(3) Society (national and global);
(4) Consumers (covering end-consumers as well as the consumers who are part of each step of the supply chain) and
(5) Value chain actors (including suppliers).

A stakeholder category is a cluster of stakeholders that are expected to have shared interests due to their similar relationship to the investigated product systems. Additional categories of stakeholders (e.g., non-government organizations, public authorities/state, and future generations) or further differentiations or subgroups (e.g., management, shareholders, and business partners) can be defined and used.

3.3 Subcategories of impact

Because impact categories are broad themes, the life cycle initiative project group has focused its initial effort in identifying and building consensus around subcategories which describe social area of interest more specifically. Social and socio-economic subcategories of impact have been defined according to international agreements and best practices at the international level. The comprehensive set of subcategories is presented in Table 1. The recommendation is that the list be used as a minimum of theme to include in an S-LCA.

To go beyond personal and cultural subjectivity or political orientation, categories, subcategories, and inventory indicators have as far as possible been defined with references to international instruments. The international conventions on human rights and workers rights are a strong basis for an S-LCA indicators framework and are considered as the best example of a universal set of social criteria.

Additional international instruments, initiatives, best practices, legal frameworks, etc., guide the development of additional stakeholder categories, subcategories of impact, and indicators that go beyond minimal compliance and assess additional and complementary social impacts.

Different application contexts across the supply chain pose challenges that call for different levels of assessment. For example, the legislation in developed economies may already cover many of human rights and worker rights indicators and the application of the law may be excellent. However, this might not be the case in a developing economy. In any case, there is a need to remain vigilant even when the legal context is positive. For example, the right to freedom of association is also known to be threatened in developed economies.

3.4 Inventory indicators

Following the definition of stakeholder categories and subcategories of impact, indicators need to be defined in order to conduct the inventory. Inventory indicators have characteristics such as type (e.g., qualitative or quantitative) and unit of measurement. Methodological sheets defining the subcategory of impact as well as suggesting inventory indicators are the basis for the development of the inventory. The methodological sheets, available on the UNEP/SETAC life cycle initiative's website, provide examples of inventory indicators for each subcategory.

3.5 Inventory analysis

As with environmental LCA, it is not necessary to collect primary data at every unit process across a product life cycle. Instead, there is a need to combine the approaches of prioritizing data gathering and making use of average or proxy data where feasible. Because we are still in the early days of building up inventory databases for S-LCA, the inventory analysis is suggested to consist of different phases. After the product system is modeled based on the reference flows, data on unit process activity variables should be collected to provide a first set of information on the relative importance of the unit processes. Activity variables are typically worker hours or value added for specific unit processes. With information on where the share of worker hours is important (and/or where the value added is high), a first hint on where to focus the inventory data gathering efforts is obtained. However, this information remains indicative, as worker hours and values added are not the same thing as social impacts. So a second step is a hotspot assessment, which provides more information on where the most important potential social impacts may be located within the product life cycle. Social hotspots are unit processes that are within a sector and region that has high risks of negative impact or high opportunities for positive impact. Concluding with a generic approach, such as hotspots assessment, may be consistent with the scope of the study if a generic assessment is requested, for example when a type of product is studied rather than a specific brand or model. Finally, if the goal and scope calls for more specificity, we then

seek to gather social inventory data for the unit processes identified as social hotspots. It is important to restate that, at present, databases to facilitate social hotspots assessment are still in their early stages of development.

3.6 Impact assessment

Modeling the social impacts based on the information provided through the inventory indicators involves multiple steps. While the specifics of impact assessment methodologies for S-LCA are under development, the guidelines present a general framework. The framework is structured as a set of impact categories being aggregates of subcategories, which in turn are aggregates of inventory indicators. The models for aggregating inventory information, the characterization models, need to be formalized. Aggregation may take place through summarizing qualitative information or by adding up quantitative information. The social inventory information may in other cases require a scoring system to facilitate the meaning assessment, relating the information to performance reference points. This can provide a way to handle the distribution of positive and negative impacts in relation to stakeholder needs and context, which is an important task of the impact assessment. The effect of potentially improved or worsened social conditions may have a significant effect on the result.

Another way of aggregating the inventory information is through life cycle attribute assessment, where we calculate the share of relevant activity across a life cycle which has attributes of interest. This generates results as such: 75% of the worker hours of the life cycle of the product are known to be child labor free.

4 Research needs

The authors of the guidelines recognized that the S-LCA methodology is still in its early days, and that the technique will be further refined in the coming years. Table 2 lists research needs that have been identified.

General research needs in S-LCA include the development of material for educational purposes that will effectively communicate the best practices in S-LCA. It also includes conducting case studies that will support the practice of S-LCA and build knowledge facilitating the further development of the methodology. The scope of the stakeholder approach and the role of S-LCA regarding the acceptability of products or services are topics that can be further developed. In order to make the complexity of the results from an S-LCA and possible sustainability LCA easier to handle, the development of models for the presentation of findings and guidance documents is recommended. As S-LCA becomes increasingly used, further guidance for peer review will become essential to structure the practice and ensure quality of the studies.

Table 2 Research needs in S-LCA

S-LCA	Research needs
General	Case studies[a]
	Educational material
	Tools development
	Documentation and communication
	Product utility and social acceptability
	Stakeholder approach
	Model development
	Review process
Goal and scope	Product utility
	Consequential LCA
Inventory Analysis	Documentation of system boundaries
	Methodological sheets[a]
	Development of database
Impact Assessment	Methodologies
	Areas of protection

[a] Priorities

Regarding the goal and scope phase, developing research on consequential S-LCA is identified as strategic and highly encouraged. Further research on the role of product utility attributes in LCA such as time requirement, convenience, prestige, etc., is also suggested.

For the inventory analysis phase, the development and improvement of subcategory methodological sheets is identified as a research priority because it provides the information necessary to collect data on a topic in a consistent manner. Another high priority research need for S-LCA is the development of databases that help screening for hotspots. It is also advised that S-LCA practitioners report about their system boundary practices and their assessment of what are the processes less socially significant, so that guidelines for cutoff rules may be developed.

Finally, impact assessment methodologies are an open field for future research. More specifically, future research should: investigate the question of cause and effect relationships for social and socio-economic aspects, provide guidelines for interpretation, develop characterization models as well as scoring and weighting systems, build a database with the necessary data for interpretation (e.g., minimum wage and livable wage by country), and contribute to the refinement and new development of impact assessment methods.

5 Conclusions

The executive summary of the guidelines present the document as providing a map, a skeleton, and a flashlight

related to social LCA. The map sets the context in which these guidelines are presented. The skeleton presents key elements to consider and provide guidance for the goal and scope, inventory, impact assessment, and interpretation phases of an S-LCA. It is the necessary basis for the development of databases and the design of software that will facilitate efficient practice of S-LCA. It is also the foundation on which a larger group of stakeholders can engage. The flashlight refers to the identification of current research needs that will propel further the use of the methodology.

One of the biggest contributions of the guidelines is to offer a uniformed framework, flexible enough to accommodate continual improvement and variation yet solid enough to provide a basis for consensus, and to allow a wider range of stakeholders to engage. The authors look forward to further discussion about the S-LCA methodology as presented in the guidelines and during its further evolution.

As a follow-up project, the UNEP-SETAC life cycle initiative has started to coordinate a project in order to foster application of the guidelines in case studies because "gaining more experiences in practical application" is an important research need identified. Meanwhile, first case studies based on the guidelines are conducted (e.g., Ciroth and Franze; submitted), and a social hotspots database is being developed in order to facilitate the use of the social LCA methodology (e.g. Benoît et al. 2008; Norris 2006)

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References

Benoît C, Mazijn B (eds) (2009) Guidelines for Social Life Cycle Assessment of Products

Benoît C et al (2008) Development of the Social Life Cycle Assessment Code of Practice: an international effort within the Life Cycle Initiative, Second International Seminar on Society and Materials. SAM2, Nantes

Benoît C, Parent J, Kuenzi I, Revéret J-P (2007) Presentation: developing a methodology for social life cycle assessment: the North American tomato's CSR case, 3rd International Conference on Life Cycle Management, August 27-29, Zürich, Switzerland

Blom M., Solmar C (2009) How to socially assess biofuels, a case study of the UNEP/SETAC code of practice for social-economical LCA. Master's thesis in cooperation with the Division of Quality and Environmental Management at Luleå University of Technology, commissioned by Enact Sustainable Strategies in Stockholm, Sweden

Brent A, Labuschagne C (2006) Social indicators for sustainable project and technology life cycle management in the process industry. Int J Life Cycle Assess 11(1):3–15

Casado Cañeque F (2002) Evaluación de la situación laboral de empresas: El análisis del ciclo de vida como herramienta para el desarrollo sostenible. PhD Thesis, Universitat de Barcelona, Divisió de Ciències Juridíques, Economiques i Socials, Barcelona, Spain

Dreyer LC, Hauschild M, Schierbeck J (2006) A framework for social life cycle impact assessment. Int J Life Cycle Assess 11(2):88–97

Fava J, Consoli F, Denson R, Dickson K, Mohin T, Vigon B (1993) A conceptual framework for life-cycle impact assessment. Workshop Report, Society for Environmental Toxicology and Chemistry and SETAC. Foundation for Environmental Education, Inc, Pensacola

Grießhammer R, Benoît C, Dreyer LC, Flysjö A, Manhart A, Mazijn B, Méthot AL, Weidema B (2006) Feasibility study: integration of social aspects into LCA. Öko-Institut, Freiburg

Hunkeler D (2006) Societal LCA methodology and case study. Int J Life Cycle Assess 11(6):371–382

Hutchins MJ, Sutherland JW (2008) An exploration of measures of social sustainability and their application to supply chain decisions. J Clean Prod 16:1688–1698

Jørgensen A, Le Bocq A, Nazarkina L, Hauschild M (2008) Methodologies for social life cycle assessment. Int J Life Cycle Assess 13(2):96–103

Klöpffer W, de HH Udo (2008) Life cycle sustainability assessment of products (with comments by Helias A. Udo De Haes). Int J Life Cycle Assess 13(2):89–95

O'Brien M, Doig A, Clift R (1996) Social and environmental life cycle assessment (SELCA). Int J LCA 1(4):231–237

Norris G (2003) Life cycle approach to sustainable consumption: conceptual design of a methodological framework. Final report. The Society of Non-Traditional Technology (AIST), Tokyo

Norris G (2004) Life cycle sustainable consumption analysis: evaluating the health impacts of income changes and development in life cycle assessments. Final report. The Society of Non-Traditional Technology (AIST), Tokyo

Norris G (2006) Social impacts in product life cycles: towards life cycle attribute assessment. Int J Life Cycle Assess 11(1):97–104

Swarr T (2009) Societal life cycle assessment—could you repeat the question? Int J Life Cycle Assess 14(4):285–289

Weidema BP (2006) Social impact categories, indicators, characterisation and damage modelling. Presentation for the 29th Swiss LCA Discussion Forum