Positive impacts in social life cycle assessment: state of the art and the way forward

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Accepted version

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Please cite as:

Di Cesare, S., Silveri, F., Sala, S., and Petti, L. (2018), "Positive impacts in social life cycle assessment: state of the art and the way forward", The International Journal of Life Cycle Assessment, Vol. 23, pp. 406-421. https://doi.org/10.1007/s11367-016-1169-7

Abstract

Purpose: Social Life Cycle Assessment (SLCA) is a methodology under continuous development, which may be applied at different scales: from products to economic sectors up to systems at region (meso) and country (macro) scales. Traditionally, SLCA has been focusing on the assessment of negative social externalities, whereas also positive social impacts could be associated to human interventions. The purpose of the present study is to understand how positive impacts are defined in published literature and how they could be assessed through indicators. The aim is to clarify the concept among scholars and to support decision making in business and policy context.

Methods: The study uses a systematic review approach in order to analyse the types of indicators adopted. In the field of SLCA and according to Paragahawewa et al. (2009): "[I]ndicators are 'pointers' to the state of the impact categories (and/or subcategories) being evaluated by the SLCA". Indicators can be quantitative, semi-quantitative or qualitative (UNEP/SETAC 2009). This review was carried out in order to identify and analyse positive impacts and indicators. After careful scrutiny, 47 papers containing theoretical frameworks were considered, as well as 46 papers presenting case studies.

Results and discussion: Compared to Environmental Life Cycle Assessment (E-LCA), where the presence of positive impacts is lower, evaluating benefits or positive impacts can still play a major role in SLCA (Benoît et al. 2010).

A quarter of the analysed papers on theoretical frameworks take into account the topic of positive impacts and indicators.

Results from case studies analysis highlight as "workers" being the most considered stakeholder (in 100 % of the analysed papers), the majority of positive indicators used in the case studies analysed, are recorded in relation to "other value chain actors".

Within the concept of "positive impacts", no reference should be made merely to the utility of a product or service. In a broader sense, we could refer to solutions improving the conditions of one or various stakeholders involved. In other words these are solutions that carry a positive contribution to one or more stakeholders without harming others.

Conclusions: So far positive impacts are barely covered in literature. There is a clear need of streamlining definition and indicators, especially if they should be applied in a policy context complementing traditional –and often monetary-based, Cost Benefit Analysis (CBA).

Keywords Positive impacts • Positive indicators • Policy support • SLCA • Social Life Cycle Assessment

1 Introduction

In the literature, positive social indicators and positive social impacts assessment have been developed over time.

The debate on Social Life Cycle Assessment (SLCA) is still open in particular in the field of Impact Assessment (IA) (UNEP/SETAC 2009). The theoretical roots of positive social impacts and how positive impacts are dealt with in Life Cycle Thinking (LCT) are introduced to understand the aim to this study.

1.1 Theoretical roots of positive social impacts

"An indicator provides evidence that a certain condition exists or certain results have or have not been achieved (Brizius and Campbell 1991). Indicators enable decision-makers to assess progress towards the achievement of intended outputs, outcomes, goals, and objectives." as reported by Horsch (1997) and ENRD (2016). Indicators are generally defined at the level of the organization and not at the level of the individuals (Nazarkina and Le Bocq 2006). In the specific field of SLCA the indicators can be meant as "'pointers' to the state of the impact categories (and/or subcategories) being evaluated by the SLCA" (Paragahawewa et al. 2009). According to UNEP/SETAC (2009:99), "Inventory indicators provide the most direct evidence of the condition or result they are measuring". Impact category indicators are "quantifiable representation of an impact category", this latter standing for an "environmental issues of concern to which life cycle inventory analysis results may be assigned" (ISO 14040 2006).

As reported in the Guidelines and Principles for Social Impact Assessment (1994:107), social impacts are: "the consequences on human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize themselves so as to meet their needs and generally cope as members of society."

The questionnaires administered by Petti et al. (2014) revealed that the unanimity of the authors believe that research in the context of positive impacts is useful for the general advancement in social impacts.

In the early 2000s Vanclay describes Social Impact Assessment (SIA) as "the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions" (Vanclay 2003a, p.6; Vanclay 2003b, p.2). Vanclay (2002) introduced concepts that stimulate social Life Cycle Impact Assessment (LCIA) (Petti and Campanella 2009) categorising social impacts in: the indicative health and social well-being impacts; the indicative quality of the living environment impacts; the indicative economic impacts and material well-being impacts; the indicative cultural impacts; the indicative family and community impacts; the indicative institutional, legal, political and equity impacts and the indicative gender relations impacts.

This is not only seen as a mere method aiming at calculating negative impacts, but it also assumes a positive connotation for a proactive and better development of outcomes. So far, positive social impacts have been evaluated in a multiplicity of contexts, both related to business and to public policies. Just to name few examples: i) Srinivasan et al. (2003) assessed the benefits of integrated policies for health and building environment focusing on health related impacts; ii) Schulenkorf and Edwards (2012) from the positive social implication of sport events when designed for involving local communities in developing countries; iii) Belfiore and Bennett (2007), which focused on art and their related positive social impacts on health and well-being, to

their progressive social and political force; iv) Archer et al. (2005) focused on local community and cultural aspects impacted both negatively and positively impacted by tourism; v) Brouwer and Van Ek (2004) which assess the role of public infrastructures, considering e.g. the positive social impact in terms of public safety related to the protection from flood risk. In the context of public policies evaluation, positive social impacts are usually accounted for among the "benefit" of appraisal methods such as Cost Benefit Analysis (CBA) (Woolcock and Narayan 2000). In fact, CBA is used in several decision making context as support for assessing different policy options.

1.2 Positive impacts and life cycle thinking

Increasingly, social impacts are evaluated with a supply chain approach implementing Life Cycle Thinking (LCT) more holistically (UNEP/SETAC 2009), e.g. in Social Life Cycle Assessment (SLCA). SLCA considers positive impacts (in addition to the negative ones) because beneficial impacts the basis of any social-related policy and intervention. Moreover, positive impacts are meant to encourage performance beyond compliance (with laws, international agreements, certification standards, etc.) as, for example, in the sustainable development goals (UN 2015a,b).

The main purpose of SLCA is to provide decision support. This decision support may create an effect if decision makers follow the 'advice' of the assessment and choose the alternative with the most favourable social consequences (Traverso et al. 2012b).

In order to increase the relevance of SLCA for policy support, the development of indicators addressing both negative and positive impacts is fundamental. This may help assessing social aspects of global supply chains in a more comprehensive way and ensuring that life cycle based methodologies are used to complement more traditionally monetary-based CBA.

Social impacts are consequences of positive or negative pressures on social Areas of Protection (AoP) (i.e. well-being of stakeholders). In the UNEP/SETAC Guidelines (2009) such impacts are understood as the consequences of social interactions in the context of an activity (i.e. production, consumption or disposal) and/or stimulated by it and/or by preventive or reinforcing stakeholders' actions (e.g. enforcing safety measures in a facility). In the UNEP/SETAC Guidelines (2009) social impacts are interpreted in three ways: (i) as consequences due to a specific behaviour held by one or more stakeholders; (ii) as the downstream effect of socio-economic decisions; (iii) as related to the original context (attributes possessed by an individual, a group, a society e.g., education level). They can either be positive or negative.

Social impacts indicators are evidences, subjective or objective, qualitative, quantitative or semi-quantitative being collected in order to facilitate concise, comprehensive and balanced judgements about the condition of specific social aspects with respect to a set of values and goals (UNEP/SETAC 2009, 101). Semi-quantitative indicators are defined as "a numerical description of qualitative information by using different scoring systems" (Aparcana and Salhofer 2013a). They show the presence/absence of something or the occurrence of specific situations (UNEP/SETAC 2009). Qualitative data (and, therefore, qualitative indicators) may best track changes in organizational or institutional behaviours (World Bank 2012) and stakeholder perceptions.

In the LCT instruments, social indicators are indicators of a social Life Cycle Inventory (LCI)[1] result[2] or of a social impact category (UNEP/SETAC 2009:101). As reported in Figure 9 (UNEP/SETAC 2009) inventory indicators are aggregate in subcategories, which can be aggregate again in impact categories.

1.3 Policies implications in assessing social impacts

Assessing social impact is, therefore, increasingly important in business and public policy contexts. Indeed, as key challenges for sustainable development, the United Nation (UN) Millennium Development Goals (MDGs) (UN 2015a) cover global social issues ranging from halving extreme poverty rates to halting the spread of HIV/AIDS and providing universal primary education. Moreover, composite indicators (such as the Human Development Index –HDI, UNDP 2014) or other sets of indicators (such as those of the "Beyond GPD" initiative, EC 2015a) are of upmost importance to measure progress towards sustainability, including social aspects in order to understand how socio-political and economic systems are developing.

However, the challenges in the social impacts evaluation are related to the intrinsic difficulties in unanimously defining what is socially desirable and acceptable. Within the scientific community, the definition of sustainability and 'what should be sustained' (e.g. social capital) is by no means agreed on and rely on value judgements (Bond et al. 2011), up to be interpreted as a shared ethical belief (Seager et al. 2004). Developing sustainability assessment methodologies requires indeed: holistic and system wide approaches, shift from multi- towards trans-disciplinarity; multi-scale (temporal and geographical) perspectives; and better involvement and participation of stakeholders (Sala et al. 2013).

Focusing on social aspects, it is clear that not only negative impacts are of interest but also positive impacts which may stem from a specific human intervention. In the literature on social indicators, published since the 60's, much consideration has been given to their relation with concepts of social welfare, e.g. the overview on social indicators proposed by Drewnowski (1972) and by Sheldon and Freeman (1970). In researching indicators suitable for sustainability assessment, must to be taken into consideration their capability to guide policies and decision at all levels of society (village, town, city, country, state, region, nation, continent and world) (Bossel 1999). In fact, in public policy context, social indicators are an important tool to evaluate countries' social development level and to assess the impact of policies.

As reported by Atkinson et al. (2002), "[O]n a wider geographical scale, international agencies such as OECD, WHO, UNICEF, and UNDP have contributed to the development of social indicators".

In the European context, this has been underpinned by the work carried out by the European Commission on the construction of indicators (Atkinson et al. 2002). Publications such as "Social Portrait of Europe" (EC 1991) and "The Social Situation in Europe" (EC 2015b, since 2000) show the intention and the work made by the EU to promote the introduction of social issues at the forefront of drafting intervention plans.

Considering the current European strategy for 2020, several social targets are defined (e.g. related to employment rates, poverty reduction etc.) (EC 2015c) and policy options should be evaluated in order to

[1] The inventory is the phase of a S-LCA where data are collected, the systems are modelled, and the LCI results are obtained (UNEP/SETAC 2009:58). Inventory analysis involves data collection and calculation procedures to quantify relevant inputs and outputs of a product system. (ISO 14040 2006: 13).

[2] "outcome of a life cycle inventory analysis that catalogues the flows crossing the system boundary and provides the starting point for life cycle impact assessment" (ISO 14040 2006:4).

positively contribute to the target. Indeed, recently released guidance on Better Regulation in Europe (EC 2015d) requires that Impact Assessment of policy (e.g. directive, regulation etc.) compare the policy options on the basis of their economic, social and environmental impacts (quantified as far as possible). The guidelines (EC 2015d) explicitly read that "both positive impacts (i.e. the benefits) as well as negative impacts (i.e. the costs or adverse environmental and social impacts) should be identified. A positive impact for one party can be negative for another. It is therefore important to identify who would be specifically affected by each impact". In this context benefits are meant as additional citizens' utility, welfare or satisfaction (CEPS 2013).

1.4 Purpose of the study

The aim of the present study is to understand to which extent positive impacts are addressed in SLCA, specifically which definitions of positive impacts are given and which indicators have been implemented.
The paper is structured to illustrate the state of the art of theoretical foundations for assessing positive impacts within SLCA studies; to provide an overview of case studies on positive impacts, highlighting methodologies and indicators used to present positive impacts; and to discuss implications of the methodology for assessing policy impacts (including areas of overlapping and contribution with existing social development and policy goals).

The present paper represents an update and extension of two previous works by Petti et al. (2014) and by Di Cesare et al. (2014).

2 Methods

Petti et al. (2014) conducted a literature review in order to identify and analyse positive impacts only in SLCA case studies.
Differently, this work refers to papers containing both theoretical frameworks and case studies.

The case studies analysed in this paper are:

- Those which emerged from the systematic review carried out by Petti et al. (2014), and
- Those published after that study and until June 2015, collected with the same method.

For the analysis of the papers containing theoretical frameworks, a new systematic review was carried out.

This review was based on peer reviewed journal articles. The research was conducted using the following keywords : "social life cycle assessment", "social LCA", "SLCA", "social impacts AND life cycle", and "social effects AND life cycle" . The search engines were: Scopus, Science Direct, Google Scholar and Google Books. The reviewed papers which do not focus on SLCA and Life Cycle Sustainability Assessment (LCSA) and which do not deal with the issue of social indicators, were excluded.

After this scrutiny, 47 papers presenting theoretical frameworks, and 46 papers containing case studies, were selected as relevant. We considered amongst "theoretical frameworks" those papers not having a case study but presenting methodological insights. The papers with an application of the SLCA method are considered as case studies. The papers which present a theoretical framework verified by means of a case study are considered case studies as well.
Afterwards, a summary table was created with the selected results (Table 1): the first column classifies SLCA and LCSA case studies, the other one analyses theoretical frameworks on SLCA and LCSA.

Despite the rigorous application of the search criteria, two other studies (Norris 2013; Norris 2015) were considered for their relevance concerning the topic of social positive impacts and indicators.

3 Results and discussion

3.1 Theoretical frameworks

Compared to Environmental Life Cycle Assessment (E-LCA), where the modelling of positive impacts is still uncovered, evaluating benefits or positive impacts can still play a major role in SLCA (Benoît et al. 2010). 26 % of the analysed papers take into account the topic of positive impacts and indicators.

Initially, the theme of positive social impacts has been dealt with by Norris (2006) and Grießhammer et al. (2006), the "early movers" on emphasising positive impacts.

Norris (2006) questions the issue of how to measure, aggregate, compare and stimulate society wide improvement of context-dependent attributes within and across product life cycles in LCA. With a case study, Norris shows that the health benefits of economic development impacts in product life cycles have the potential to be very significant, possibly even orders of magnitude greater than the health damages from the increased pollution.

Grießhammer et al. (2006) state that the quantification of negative impacts is more difficulty than positive ones. For the authors the social impacts may be assessed using indicators which allow aggregation across the entire life cycle according to the ISO 14040. Some of the positive impacts may be directly quantified but for the negative impacts, and in particular in the obligatory categories, a direct quantification is often not meaningful. For example, violations of labour rights can be hard to prove, and the lack of reported infringements or complaints could tell more about inefficient accounting than of the work environment quality. On the contrary, the risk that negative impacts occur may be gauged from the way that the company manages the relevant activities as proposed by.

Works published by Norris and Grießhammer et al. are characterised by a first approach to the problem as quantifying the positive impacts.

In more recent years, after the publication of UNEP/SETAC (2009), Jørgensen et al. (2010a,b), Ekvall (2011) and Neugebauer et al. (2014) examined in depth the positive impacts issue (Table 2).

Jørgensen et al. (2010a) consider the child labour indicator as generating a context-related positive impact. Child labour can be produce positive impact in some situations. These could include: helping children to develop discipline, responsibility, self-confidence and independence, teaching them how to manage money, and providing them with working skills.

Furthermore, Jørgensen et al. (2010b) makes the distinction between positive "direct" effects and positive "indirect" effects. Assuming that the main functionality of SLCA is to provide decision support, this support can create an effect that depends on the choices of decision makers. By choosing alternatives, which have more favourable consequences than the alternatives that would have been chosen without a SLCA study, the decision that may derive from SLCA can be seen to have created a positive effect. This type of consequence is a 'direct effect'. Consequently, the results of a SLCA study can, in themselves, lead to positive impacts.

Ekvall (2011) suggests accounting for the social performance of governments and countries in an SLCA, by using a positive indicator related to the degree of civil liberties and political rights guaranteed in each country. Ekvall affirms that it is necessary "to focus on the issue of democracy and distinguish between countries that are

free, partly free, or not free. […] if a positive indicator is used, it can be measured in terms of value added in free countries" (Ekvall 2011:2). This approach will describe to what extent the product contributes to economies in countries that are politically free (or not free).

Neugebauer et al. (2014), built two pathways to describe the cause-effect relation between the midpoints fair wage and level of education which may affect the area of protection of social well-being both positively and/or negatively. The authors included three endpoints to address social well-being: economic welfare, damage to human health and environmental stability.

In particular, the midpoint "level of education" affected the economic welfare by the direct impacts of job and working situation via inventory categories like finished apprenticeships or literacy rate. All of this positively influenced social well-being.

In addition, participation on sport or cultural events may have a direct impact on job security and working conditions and positively influence the level of education and finally well-being[3].

The review carried out highlights that one quarter of the analysed papers takes into account the topic of positive impacts and indicators. This can mean that, contrary to what was stated by Grießhammer et al. (2006) and according to Jørgensen et al. (2010a), the negligible incidence of papers dealing with the positive impacts may be explained by the difficulty to evaluate them.

Another explanation can be the lack of a clear definition. In this regard, Norris (2013) coined the term "Handprint", in opposition to the term "Footprint" [4], to address "the beneficial environmental and social impacts that we can achieve". The Handprint is based on the principle that social impact could be reduced by consumption of product and service. It is possible to have a "net positive impact" such as compensation between Handprint and environmental footprint. This phenomenon occurs when positive changes in the conduct of people or companies (in relation to an impact category) are more than the estimated footprints for the same category (in a given year). The reduction of environmental footprints and the increase of handprint entail a "beneficient" behaviour: a combination between efficient (minimize our footprint) and beneficial (generate positive impacts in the world) (Norris 2015).

Finally, since the aim of a SLCA is to improve current living conditions, it will probably, in most cases, be reasonable to include negative impacts rather than positive ones. As consequence, the motivation for improving positive impacts can be expected to be lower (Jørgensen et al. 2012) and the focus on positive impacts may be weaker.

Conversely, focusing on positive indicators is interesting as it improves the completeness and the relevance of SLCA. Indeed, most indicators mask the complexity of the individual topics. An illustrative example can be the topic of child labour. In contrast to what one might think, it is not easy to define child labour with one threshold-age globally. In fact looking at the ILO Minimum Age Convention (No. 138), one finds a whole set of possible threshold-ages for different kinds of work and for different economic situations (Grießhammer et al. 2006). According to that, an example was given by Jørgensen et al. (2010a): in the study, the authors replace the assessment of child labour incidence with other indicators that evaluate positive impacts generated by child labour. These indicators are more precise than those more commonly used, for example to evaluate the presence

[3] Further information can be found in Figure 4 of Neugebauer et al. (2014).

[4] "[t]he footprint of a product is the total sum of all the negative impacts of pollution released and resources consumed over the entire supply chain and life cycle of the product" (Norris 2015).

of child labour within the organisation under study, traceable in most case studies analysed (e.g. presence of child labour, percentage of children working, risk of child labour, and percentage of children out of school).

3.2 Case studies

The analysis performed in this paper, reveals that impact indicators are not specified in 37 % of the total case studies analysed (Table 3).

In the remaining 63 %, 569 indicators were detected. Regarding the typology of indicators considered by the authors, 18 % of the total is quantitative, 57 % is semi-quantitative and 25 % is qualitative (descriptive).

The large percentage of semi-quantitative indicators emphasises the growing effort of the authors to express the indicators as quantitative variables.

By a fuller analysis on the papers, the most considered stakeholder category is "Workers". This could mean that workers are considered by the authors, as the most impacted stakeholder category from a social point of view.

The papers' analysis has shown that the authors use indicators that help to better characterise the context in which a company operates (activity sector and/or geographical area), even if not mentioned in the UNEP/SETAC Methodological Sheets (2013). As reported by Grießhammer et al. (2006), almost all indicators are tailored for specific purposes by researchers. Indicators are chosen from a list based on their author's experience, resulting in heterogeneous lists that differ from one approach to another. These elements are the characteristic indicators of a given sector, or that have significance in a specific geographical area and, which would have little meaning if considered within a different context. Other indicators present in the Methodological Sheets are considered less apt to the case study developed and are therefore not taken into account. This tendency was observed for non-site-specific impact indicators. Conversely, positive impact indicators used appear as more compliant with what is contained in the Methodological Sheets.

The UNEP/SETAC inventory indicators, provided in the Methodological Sheets (UNEP/SETAC 2013), assess the social context surrounding the unit processes. Some "generic" indicators focus on the average social conditions of sector, country, and region as proposed in the Guidelines. Without specifying the social agents responsible for the social conditions observable at the regional and sector-based level, it is clear that the sources of the stressors are of organisational nature and belong to the socio-sphere. Other indicators clearly assess the enterprises, as some are explicitly related to the management practices (Parent et al. 2010).

One of the problems in dealing with positive impacts is found in the definition of the concept. Indeed, the authors interviewed by Petti el al. (2014) demonstrated low consensus in providing a definition of positive social impact. The interviewees were almost perfectly divided between the following options given: "The net positive effect of an activity on a community and the well-being of individuals and families" and "An improvement related to the previous situation". In any case, saying that a positive impact is not the absence of a negative one, was largely agreed upon.

Defining a positive impact as an improvement appears to be vague, because the beneficiary and the duration time are not specified. Conversely, it is important to underline who the subject of improvement is and who acknowledges it. If it is a top-down improvement, it can concern several Stakeholder Categories but may fail to record important changes that occur at a local level (Lähtinen et al. 2014).

According to the definitions listed above, and given the difficulty of finding a definition for positive indicators, in this paper these are understood as those indicators which are aimed at evaluating performances that go

beyond the mere compliance with regulations (examples can be found in Table 4). The term "social performance" designates characteristics of a social life in a company (such as respect of gender equity, child labour, etc.) (Macombe and Loeillet 2013:44).

Regarding the identification of positive social impacts it is useful to make a comparison with what is reported by Di Cesare et al. (2014). An increase of the papers that explicitly identify some positive impact was detected (from 63 % to 72 %) and divided per sector/topic, as shown in Fig. 1.

In spite of "Workers" being the most considered stakeholder (in 100 % of the analysed papers), the majority of positive indicators used in the case studies analysed, are recorded in relation to "Other value chain actors" (see Table 4[5]). This evidence can be explained with the nature of the subcategories associated to the various stakeholders. In fact, the subcategories associated to the stakeholder "Workers" have, as a main objective, to highlight eventual transgressions of national and international rules regarding working conditions[6] and workers' rights[7] operated by the company. Conversely, the subcategories associated to "Other value chain actors" have the aim of assessing company behaviour. The subcategories associated made reference both to aspects regulated also by laws[8], both to voluntary initiatives[9] (that could be linked to the obtaining of social/environmental labels). These latter are assessed throughout an evaluation of the relationships with the other actors involved in the life cycle of the product analysed. Company performances related to these subcategories are not regulated by a specific legislation, but they are encouraged by a framework aiming to promote the improvement of social conditions. The positive indicators identified for the stakeholder "Other value chain other actors "are ascribed to the evaluation of this type of subcategories.

The analysis shows that four papers (Valdivia et al. 2012; Baumann et al. 2013; Ekener-Petersen and Moberg 2013; Wilhelm et al. 2015) considered the utility of goods as a positive impact. It appears, limiting to consider the utility performed by goods during their use phase as a positive impact. The utility, in the economic language, is defined as the well-being that a given good or service is able to provide to a person as it is suitable to satisfy a desire or fulfil a need (Treccani 2012). The satisfaction of consumer desires or needs was the goal of each economic activity and consumption is the sole end and purpose of product/service production (Goodwin et al. 2008).

We consider that the concept of positive impacts does not refer merely to the utility of the product (meant as benefit from its use), but in a broader sense, to the so called "win-win" situations. A "win-win" situation is defined as a situation in which all parties involved in the initiative have a benefit (or are not damaged) in terms of value created in their favour (Molteni 2007). These solutions improve the condition of one or various stakeholders involved. The same definition can also be applied in the context of life cycle assessment (LCA).

The authors propose to refer to positive social impacts as those that neither cause a negative impact, nor transfer it to one or more other phases of the life cycle, in the perspective of the "win-win" approach.

[5] In Table 4 were included all the indicators built to assess a positive impact in the meaning of the authors, and not only to assess a performance that go beyond compliance.

[6] Working hours, child labor, forced labor, health and safety.

[7] Freedom of association and collective bargaining, fair salary, equal opportunities/discrimination, social benefits/social security.

[8] Fair competition and respect of intellectual property rights.

[9] Promoting social responsibility and supplier relationships.

A noteworthy feature of social impacts is that they produce their result as soon as there are changes in social conditions. Moreover, it is not only the stakeholders who are subject to these impacts, but they also provoke an active response, implying a certain degree of dynamism. For this reason, they are difficult to identify and are situation/site-specific (Slootweg et al. 2001), triggering a virtuous chain. They refer, in addition, to both quantitative variables (demographic and economic) and to changes in values, belief system and in the perception of the context in which they are produced (Lähtinen et al. 2014). The SLCA may also create a positive "indirect" effect. For instance, through creating incentives in the market for companies to perform well on the issues included in the SLCA (Jørgensen et al. 2010b).

4 Conclusions and outlook

The aim of this paper was to conduct a literature review about positive social impacts and indicators.
The resulting picture has allowed for a better understanding of the present situation and where research should focus on.

The analysis was performed through the separate analysis of theoretical frameworks and case studies.

The review of theoretical frameworks shows that 26 % of the papers analysed debates about positive impacts, according to different sides, e.g. impact assessment, conceptualisation and general ambiguity in the indicators meaning (the same indicator can be interpreted as positive as negative).

The analysis of case studies emphasises the growing effort of the authors to express the indicators as quantitative variables. Moreover, although "Workers" being the most considered stakeholder, the majority of positive indicators used in the case studies analysed, are recorded in relation to "Other value chain actors".

Toward a shared concept definition. What emerges from the analysis of the papers is that no single definition of positive social impacts as part of the SLCA methodology could be deducted.
Moreover the assessment of positive impacts in the SLCA domain is still in an infant stage considering that they may play a crucial role and also help in addressing negative ones.

Assessing social positive impacts (meant by the authors as "win-win" situations), help communities (and other stakeholders) to identify development objectives and ensure that positive results are maximised. This might be more important than minimising the damage originating from negative impacts. Positive social impacts should be regarded as context-related issues. Both impacts and benefits may be accounted for, including adopting the same category of indicator which may ultimately display a positive or a negative impact. This type of indicator can be defined as "subjective" inasmuch as they are related to values that can vary according to context and cultural heritage.

Policy implications. Positive impacts in a LCT approach has two major implications: i) an improved accounting of benefits beyond the more traditional monetized approaches such as CBA (especially adopted in macro-scale policies at country/EU level); ii) supporting the accounting of positive impacts along supply chains, especially needed for those policies that imply potential impacts on third countries (e.g. for the EU, trade policies potentially impacting or producing benefits on social aspects as well as development policies, directly supporting intervention in third countries). Another perspective could be related to global development policies and target (such as the sustainable development goals) (UN 2015b). Understanding to which extent a policy option may positively contribute to global societal goal, including alleviation of major threats to human well-being may support a transition towards more fair and equitable policies.

Since in EC (2015d), LCA is listed among "methods, models and costs and benefits approaches" for assessing policy options for new policies, there is an important opportunity for life cycle based methodology to be integrated in the policy development and evaluation. Some attempts were made to apply SLCA at macroscale (e.g. Pelletier et al. 2016), so far covering just negative impacts. Hence, recommendations towards integrating SLCA in policy impact assessment are needed, especially in light of the availability and possible systematisation of indicators pointing towards positive impacts.

Future perspectives. Making a parallelism between results from theoretical frameworks and case studies analysis, it would be necessary to dwell more on conceptualization of theoretical roots and, subsequently, to test these through the development of case studies.

There is wide agreement that indicator-sets for the purposes of SLCA are needed: the Taskforce did not develop a universal indicator-set as a basis for all further SLCA applications. A universal set of indicators that covers the social aspects in all social, economic and political contexts is still considered to be a challenge (UNEP/SETAC 2009). Besides, current discussion on indicators for measuring sustainable development goals (UN, 2015b) may benefit from a more structured, rigorous and agreed approach to the assessment of positive impacts along supply chains. It is important that future development of positive indicators will be able to capture to which extent a product is contributing to, e.g., sustainable development goal 3 (on good health and well-being), 5 (gender equality), 8 (decent work and economic growth) just to name a few.

Future research developments may concern identifying social evaluation criteria to establish what is to be considered as "positive" and to deeply understand the context, for instance: in what way might the context evolve after an improvement has occurred? These interrogatives are of fundamental importance especially in light of possible application of SLCA in contexts such as policy impact assessment.

Furthermore, a development of the current IA methodologies in assessing positive impacts as suggested also by Sanchez Ramirez et al. (2016) has to be considered an essential step toward a more holistic approach in both policies and business decision making.

Compliance with ethical standards The authors declare that they have no conflict of interest.

References

Albrecht S, Brandstetter P, Beck T et al (2013) An extended life cycle analysis of packaging systems for fruit and vegetable transport in Europe. Int J Life Cycle Assess 18:1549–1567

Aparcana S, Salhofer S (2013a) Development of a social impact assessment methodology for recycling systems in low-income countries. Int J Life Cycle Assess 18:1106–1115

Aparcana S, Salhofer S (2013b) Application of a methodology for the social life cycle assessment of recycling systems in low income countries: three Peruvian case studies. Int J Life Cycle Assess 18:1116–1128

Arcese G, Lucchetti M, Merli R (2013) Social Life Cycle Assessment as a Management Tool: Methodology for Application in Tourism. Sustainability 5:3275–3287

Atkinson AB, Cantillon B, Marlier E, Nolan B (2002) Social indicators: the EU and social inclusion. OUP Oxford. doi: 10.1093/0199253498.001.0001

Baumann H, Arvidsson R, Tong H, Wang Y (2013) Does the Production of an Airbag Injure more People than the Airbag Saves in Traffic? Opting for an Empirically Based Approach to Social Life Cycle Assessment. J Ind Ecol 17:517–527

Benoît C, Norris G a., Valdivia S, et al (2010) The guidelines for social life cycle assessment of products: just in time! Int J Life Cycle Assess 15:156–163

Benoît C, Vickery-Niederman G (2011) Social Sustainability Assessment Literature Review. Sustain Consort White Pap, pp 1–34

Benoît-Norris C, Vickery-Niederman G, Valdivia S et al (2011) Introducing the UNEP/SETAC methodological sheets for subcategories of social LCA. Int J Life Cycle Assess 16:682–690

Benoît-Norris C (2012) Social Life Cycle Assessment: A Technique Providing a New Wealth of Information to Inform Sustainability-Related Decision Making. In: Curran MA (ed) Life Cycle Assess. Handb. A Guid. Environ. Sustain. Prod. Scrivener Publishing LLC, pp 433–452

Benoit-Norris C, Cavan DA, Norris G (2012) Identifying Social Impacts in Product Supply Chains:Overview and Application of the Social Hotspot Database. Sustainability 4:1946–1965

Benoît Norris C (2014) Data for social LCA. Int J Life Cycle Assess 19:261–265

Benoît Norris C, Revéret J-P (2015) Partial Organization and Social LCA Development: The Creation and Expansion of an Epistemic Community. In: Muthu SS (ed) Soc. Life Cycle Assess. - An Insight. Springer, Singapore, pp 199–226

Bienge K, von Geibler J, Lettenmeier M, et al (2009) Sustainability Hot Spot Analysis: A streamlined life cycle assessment towards sustainable food chains. 9th Eur. IFSA Symp. Vienna, pp 1–10

Blom M, Solmar C (2009) How to Socially Assess Biofuels.

Bocoum I, Macombe C, Revéret J-P (2015) Anticipating impacts on health based on changes in income inequality caused by life cycles. Int J Life Cycle Assess 20:405–417

Bond AJ, Dockerty T, Lovett A, Riche AB, Haughton AJ, Bohan DA, Sage RB, Shield IF, Finch JW, Turner MM, Karp A (2011) Learning how to deal with values, frames and governance in sustainability appraisal. Reg Stud 45(8):1157–1170

Bouzid A, Padilla M (2014) Analysis of social performance of the industrial tomatoes food chain in Algeria. New Medit 1:60–65

CEPS (2013) Assessing the costs and benefits of regulation. Study for the European Commission, Secretariat General. http://ec.europa.eu/smart-regulation/impact/commission_guidelines/docs/131210_cba_study_sg_final.pdf

Chang Y-J, Sproesser G, Neugebauer S, et al (2015) Environmental and Social Life Cycle Assessment of welding technologies. Procedia CIRP 293–298

Chhipi-Shrestha GK, Hewage K, Sadiq R (2014) "Socializing" sustainability: a critical review on current development status of social life cycle impact assessment method. Clean Technol Environ Policy. doi: 10.1007/s10098-014-0841-5

Cinelli M, Coles SR, Jørgensen A, et al (2013) Workshop on life cycle sustainability assessment: the state of the art and research needs—November 26, 2012, Copenhagen, Denmark. Int J Life Cycle Assess 18:1421–1424

Ciroth A, Franze J (2011) LCA of an Ecolabeled Notebook. http://www.greendelta.com/uploads/media/LCA_laptop_final.pdf Accessed 25 May 2015

De Luca AI, Iofrida N, Strano A, et al (2015) Social life cycle assessment and participatory approaches: A methodological proposal applied to citrus farming in Southern Italy. Integr Environ Assess Manag 9999:1–14

Di Cesare S, Silveri F, Petti L (2014) The Role of indicators in Social Life Cycle Assessment : results from a literature review. https://www.researchgate.net/publication/268796670_The_Role_of_indicators_in_Social_Life_Cycle_Assessment_results_from_a_literature_review

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

Dreyer LC, Hauschild MZ, Schierbeck J (2010) Characterisation of social impacts in LCA. Int J Life Cycle Assess 15:247–259

Drewnowski J (1972) Social indicators and welfare measurement: remarks on methodology. The Journal of Development Studies 8(3):77-90

Ekener-Petersen E, Finnveden G (2013) Potential hotspots identified by social LCA—part 1: a case study of a laptop computer. Int J Life Cycle Assess 18:127–143

Ekener-Petersen E, Höglund J, Finnveden G (2013) Social and Socioeconomic Impacts from Vehicle Fuels. http://www.diva-portal.org/smash/get/diva2:721761/FULLTEXT01.pdf Accessed 5 March 2015

Ekener-Petersen E, Moberg Å (2013) Potential hotspots identified by social LCA–Part 2: Reflections on a study of a complex product. Int J Life Cycle Assess 18:144–154

Ekvall T (2011) Nations in social LCA. Int J Life Cycle Assess 16:1–2. doi: 10.1007/s11367-010-0235-9

European Commission (EC) (2015a) Beyond GDP initiative. http://ec.europa.eu/environment/beyond_gdp/index_en.html Accessed 29 November 2015

EC (2015b) Social situation of EU, Periodic reports available at http://ec.europa.eu/social/main.jsp?langId=en&catId=22 Accessed 29 November 2015

EC (2015c) Europe 2020 targets. http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/targets/index_en.htm Accessed 29 November 2015

EC (2015d) Better Regulation Guidelines COM(2015) 215 final and SWD(2015) 110 final

The European Network For Rural Development (ENRD) How to set the indicators? https://enrd.ec.europa.eu/en/leader/leader-tool-kit/the-strategy-design-and-implementation/the-strategy-design/how-to-set-the-indicators

Feschet P, Macombe C, Garrabé M et al (2013) Social impact assessment in LCA using the Preston pathway: The case of banana industry in Cameroon. Int J Life Cycle Assess 18:490–503

Finkbeiner M, Schau EM, Lehmann A, Traverso M (2010) Towards life cycle sustainability assessment. Sustainability 2:3309–3322. doi: 10.3390/su2103309

Fontes J (2014) Handbook for Product Social Impact Assessment. http://www.dsm.com/content/dam/dsm/cworld/en_US/documents/handbook-for-product-social-impact-assessment.pdf Accessed 20 April 2015

Foolmaun RK, Ramjeawon T (2013a) Life cycle sustainability assessments (LCSA) of four disposal scenarios for used polyethylene terephthalate (PET) bottles in Mauritius. Environ Dev Sustain 15:783–806

Foolmaun RK, Ramjeeawon T (2013b) Comparative life cycle assessment and social life cycle assessment of used polyethylene terephthalate (PET) bottles in Mauritius. Int J Life Cycle Assess 18:155–171

Franze J, Ciroth A (2011) A comparison of cut roses from Ecuador and the Netherlands. Int J Life Cycle Assess 16:366–379

Goodwin N, Nelson JA, Ackerman F, Weisskopf T (2008) Consumption and the Consumer Society. http://www.ase.tufts.edu/gdae/education_materials/modules/Consumption_and_the_Consumer_Society.pdf Accessed 11 May 2016

Grießhammer R, Benoît C, Dreyer LC, et al (2006) Feasibility Study : Integration of social aspects into LCA. http://www.saiplatform.org/uploads/Library/UNEP-SETACLifeCycleInitiativeTFonSocialIssues-FeasibilityStudy.pdf Accessed 26 March 2015

Horsch K (1997) Indicators: Definition and Use in a Results-Based Accountability System. http://www.hfrp.org/publications-resources/browse-our-publications/indicators-definition-and-use-in-a-results-based-accountability-system

Hosseinijou SA, Mansour S, Shirazi MA (2014) Social life cycle assessment for material selection: a case study of building materials. Int J Life Cycle Assess 19:620–645

Hsu C-W, Wang S-W, Hu AH (2013) Development of a New Methodology for Impact Assessment of SLCA. In: Nee AYC, Song B, Ong S-K (eds) Proc. 20th CIRP Int. Conf. Life Cycle Eng. Springer, Singapore, pp 469–473

Hu M, Kleijn R, Bozhilova-Kisheva KP, Di Maio F (2013) An approach to LCSA: the case of concrete recycling. Int J Life Cycle Assess 18:1793–1803

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

ISO 14040 (2006) Environmental management - Life cycle assessment - Principles and framework

Jørgensen A, Bocq A Le, Nazarkina L, Hauschild M (2008) Methodologies for Social Life Cycle Assessment. Int J Life Cycle Assess 13:96–103

Jørgensen A, Hauschild MZ, Jørgensen MS, Wangel A (2009) Relevance and feasibility of social life cycle assessment from a company perspective. Int J Life Cycle Assess 14:204–214

Jørgensen A (2010) Developing the Social Life Cycle Assessment:-addressing issues of validity and usability. http://orbit.dtu.dk/fedora/objects/orbit:82775/datastreams/file_5100400/content Accessed 4 February 2015

Jørgensen A, Lai LCH, Hauschild MZ (2010a) Assessing the validity of impact pathways for child labour and well-being in social life cycle assessment. Int J Life Cycle Assess 15:5–16

Jørgensen A, Finkbeiner M, Jørgensen MS, Hauschild MZ (2010b) Defining the baseline in social life cycle assessment. Int J Life Cycle Assess 15:376–384

Jørgensen A, Dreyer LC, Wangel A (2012) Addressing the effect of social life cycle assessments. Int J Life Cycle Assess 17:828–839

Jørgensen A (2013) Social LCA - A way ahead? Int J Life Cycle Assess 18:296–299

Kloëpffer W (2008) Life Cycle Sustainability Assessment of Products. Int J Life Cycle Assess 13:89–95

Labuschagne C, Brent AC (2006) Social Sustainability Social Indicators for Sustainable Project and Technology Life Cycle Management in the Process Industry. Int J Life Cycle Assess 11:3–15

Lähtinen K, Myllyviita T, Leskinen P, Pitkänen SK (2014) A systematic literature review on indicators to assess local sustainability of forest energy production. Renew Sustain Energy Rev 40:1202–1216

Lehmann A, Russi D, Bala A, et al (2011) Integration of Social Aspects in Decision Support, Based on Life Cycle Thinking. Sustainability 3:562–577

Lehmann A, Zschieschang E, Traverso M et al (2013) Social aspects for sustainability assessment of technologies—challenges for social life cycle assessment (SLCA). Int J Life Cycle Assess 18:1581–1592

Luthe T, Kägi T, Reger J (2013) A Systems Approach to Sustainable Technical Product Design. J Ind Ecol 17:605–617

Macombe C, Loeillet D (2013) Social life cycle assessment, for who and why? In: Macombe C (ed) Social LCAs Socio-economic effects in value chains. FruiTrop Thema, pp 35–52

Macombe C, Feschet P, Garrabé M, Loeillet D (2011) 2nd International Seminar in Social Life Cycle Assessment—recent developments in assessing the social impacts of product life cycles. Int J Life Cycle Assess 16:940–943

Macombe C, Leskinen P, Feschet P, Antikainen R (2013) Social life cycle assessment of biodiesel production at three levels: A literature review and development needs. J Clean Prod 52:205–216

Manhart A, Grießhammer R (2006) Social impacts of the production of notebook PCs. http://www.prosa.org/fileadmin/user_upload/pdf/notebooksurvey_final_engl.pdf Accessed 4 June 2015

Manik Y, Leahy J, Halog A (2013) Social life cycle assessment of palm oil biodiesel: a case study in Jambi Province of Indonesia. Int J Life Cycle Assess 18:1386–1392

Martínez-Blanco J, Lehmann A, Muñoz P, et al (2014) Application challenges for the social Life Cycle Assessment of fertilizers within life cycle sustainability assessment. J Clean Prod 69:34–48. doi: 10.1016/j.jclepro.2014.01.044

Mathe S (2014) Integrating participatory approaches into social life cycle assessment: the SLCA participatory approach. Int J Life Cycle Assess 19:1506–1514

Moberg Å, Picha M, Erlandsson-Segerström B et al (2009) Using a life-cycle perspective to assess potential social impacts of ICT services: a pre-study. http://www.diva-portal.org/smash/get/diva2:355953/FULLTEXT01.pdf Accessed 21 May 2015

Molteni M (2007) Gli stadi di sviluppo della CSR nella strategia aziendale. ImpresaProgetto 2:1–25

Moriizumi Y, Matsui N, Hondo H (2010) Simplified life cycle sustainability assessment of mangrove management: a case of plantation on wastelands in Thailand. J Clean Prod 18:1629–1638

Nazarkina L, Le Bocq A (2006): Social aspects of Sustainability assessment: Feasibility of Social Life Cycle Assessment (S-LCA). EDF 2006, Moretsur-Loing, France

Nemarumane T, Mbohwa C (2015) Social impact assessment of sugar production operations in South Africa: a social life cycle assessment perspective. In: Muthu SS (ed) Soc. Life Cycle Assess. - An Insight. Springer, Singapore, pp 71–113

Neugebauer S, Traverso M, Scheumann R, et al (2014) Impact Pathways to Address Social Well-Being and Social Justice in SLCA—Fair Wage and Level of Education. Sustainability 6:4839–4857

Norris GA (2006) Social Impacts in Product Life Cycles Towards Life Cycle Attribute Assessment. Int J Life Cycle Assess 11:97–104

Norris GA (2013) The New Requirement for Social Leadership: Healing. Uncertainty, Divers. Common Good Chang. Norms New Leadersh. Paradig

Norris (2015) Doing More Good than Harm: Footprints, Handprints, and Beneficience. http://isites.harvard.edu/fs/docs/icb.topic979867.files/Basic%20Beneficience%20Primer.pdf Accessed 26 November 2015

Paragahawewa U, Blackett P, Small B (2009) Social Life Cycle Analysis (S-LCA): Some Methodological Issues and Potential Application to Cheese Production in New Zealand. http://www.saiplatform.org/uploads/Library/SocialLCA-FinalReport_July2009.pdf Accessed 24 April 2015

Parent J, Cucuzzella C, Revéret J-P (2010) Impact assessment in SLCA: sorting the sLCIA methods according to their outcomes. Int J Life Cycle Assess 15:164–171

Parent J, Cucuzzella C, Revéret J-P (2013) Revisiting the role of LCA and SLCA in the transition towards sustainable production and consumption. Int J Life Cycle Assess 18:1642–1652

Pelletier N, Ustaoglu E, Benoit C, Norris G, Rosenbaum E, Vasta A, Sala S (2016) Social sustainability in trade and development policy. Int J Life Cycle Assess. doi: 10.1007/s11367-016-1059-z (this issue)

Petti L, Campanella P (2009) The Social LCA: The State Of Art Of An Evolving Methodology. Ann "Stefan cel Mare" Univ SuceavaFascicle Fac Econ Public Adm 9:47–56

Petti L, Ugaya CML, Di Cesare S (2014) Systematic review of Social-Life Cycle Assessment (S-LCA) case studies Impact Assessment method. In: Macombe C, Loeillet D (eds) Pre-proceedings of the 4th International Seminar in Social LCA. FruiTrop Thema, 34–41.

Pizzirani S, McLaren SJ, Seadon JK (2014) Is there a place for culture in life cycle sustainability assessment? Int J Life Cycle Assess 19:1316–1330. doi: 10.1007/s11367-014-0722-5

Reitinger C, Dumke M, Barosevcic M, Hillerbrand R (2011) A conceptual framework for impact assessment within SLCA. Int J Life Cycle Assess 16:380–388. doi: 10.1007/s11367-011-0265-y

Ren J, Manzardo A, Mazzi A, et al (2015) Prioritization of bioethanol production pathways in China based on life cycle sustainability assessment and multicriteria decision-making. Int J Life Cycle Assess 20:842–853

Revéret J-P, Couture J-M, Parent J (2015) Socioeconomic LCA of Milk Production in Canada. In: Muthu SS (ed) Soc. Life Cycle Assess. - An Insight. Springer, Singapore, pp 25–69

Sala S, Farioli F, Zamagni A (2013) Progress in sustainability science: lessons learnt from current methodologies for sustainability assessment: Part 1. Int J Life Cycle Assess 18:1653–1672

Sanchez Ramirez PK, Petti L (2011) Social life cycle assessment: methodological and implementation issues. Ann "Ştefan cel Mare" Univ Suceava Fascicle Fac Econ Public Adm 11:11–17

Sanchez Ramirez PK, Del Sordo M, Petti L (2013) La Social Life Cycle Assessment del PomodoroCuore di bue. DEc Working Paper Series. no. 27

Sanchez Ramirez PK, Petti L, Haberland NT, Ugaya CML (2014) Subcategory assessment method for social life cycle assessment. Part 1: methodological framework. Int J Life Cycle Assess 19:1515–1523

Sanchez Ramirez PK, Petti L, Brones F, Ugaya CML (2016) Subcategory assessment method for social life cycle assessment. Part 2: application in Natura's cocoa soap. Int J Life Cycle Assess 21:106-117

Sheldon EB, Freeman HE (1970) Notes on social indicators: Promises and potential. Policy sciences 1(1):97-111

Seager TP, Melton J, Eighmy TT (2004) Working towards sustainable science and engineering: introduction to the special issue on highway infrastructure. Resour Conserv Recy 42(3):205–207

Slootweg R, Vanclay F, van Schooten M (2001) Function evaluation as a framework for the integration of social and environmental impact assessment. Impact Assess Proj Apprais 19:19–28

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

Traverso M, Asdrubali F, Francia A, Finkbeiner M (2012a) Towards life cycle sustainability assessment: an implementation to photovoltaic modules. Int J Life Cycle Assess 17:1068–1079

Traverso M, Finkbeiner M, Jørgensen A, Schneider L (2012b) Life Cycle Sustainability Dashboard. J Ind Ecol 16:680–688

Umair S, Björklund A, Ekener-Petersen E (2013) Social life cycle inventory and impact assessment of informal recycling of electronic ICT waste in Pakistan. In: Hilty LM, Aebischer B, Andersson G, Lohmann W (eds) Proc. First Int. Conf. Inf. Commun. Technol. Sustain. Zurich, pp 52–58

Umair S, Björklund A, Petersen EE (2015) Social impact assessment of informal recycling of electronic ICT waste in Pakistan using UNEP SETAC guidelines. Resour Conserv Recycl 95:46–57

UNEP/SETAC (2009). Guidelines for Social Life Cycle Assessment of Products. http://www.cdo.ugent.be/publicaties/280.guidelines-sLCA.pdf Accessed 18th January 2015

UNEP/SETAC (2013) The Methodological Sheets For Subcategories In Social Life Cycle Assessment (S-LCA) http://www.lifecycleinitiative.org/wp-content/uploads/2013/11/S-LCA_methodological_sheets_11.11.13.pdf

Accessed 29 November 2015

United Nations (UN) (2015a) Millennium Development Goals. http://www.un.org/millenniumgoals/

UN (2015b) Sustainable Development Goals. https://sustainabledevelopment.un.org/

United Nations Development Program (UNDP) (2014) Human development index. http://hdr.undp.org/en/data

Valdivia S, Ugaya CML, Hildenbrand J, et al (2012) A UNEP/SETAC approach towards a life cycle sustainability assessment—our contribution to Rio+20. Int J Life Cycle Assess 18:1673–1685

Vanclay F (2002) Conceptualising social impacts , Environmental Impact Assessment Review, 22:183-211

Vanclay (2003a) International Principles For Social Impact Assessment. Impact Assessment and Project Appraisal 21:5-11

Vanclay F (2003b) Why have Principles for Social Impact Assessment? Int Assoc Impact Assess 2:1–8

Vinyes E, Oliver-Solà J, Ugaya C, et al (2013) Application of LCSA to used cooking oil waste management. Int J Life Cycle Assess 18:445–455

Weldegiorgis FS, Franks DM (2014) Social dimensions of energy supply alternatives in steelmaking: comparison of biomass and coal production scenarios in Australia. J Clean Prod 84:281–288

Wilhelm M, Hutchins M, Mars C, Benoit-Norris C (2015) An overview of social impacts and their corresponding improvement implications: a mobile phone case study. J Clean Prod 102:302-315

World Bank (2012) Designing a results framework for achieving results: a how-to guide. http://siteresources.worldbank.org/EXTEVACAPDEV/Resources/designing_results_framework.pdf

Wu R, Yang D, Chen J (2014) Social Life Cycle Assessment Revisited. Sustainability 6:4200–4226

Yu M, Halog A (2015) Solar Photovoltaic Development in Australia—A Life Cycle Sustainability Assessment Study. Sustainability. doi: 10.3390/su7021213

Zamagni A, Amerighi O, Buttol P (2011) Strengths or bias in social LCA? Int J Life Cycle Assess 16:596–598

Zamagni A, Pesonen H-L, Swarr T (2013) From LCA to Life Cycle Sustainability Assessment: concept, practice and future directions. Int J Life Cycle Assess 18:1637–1641

Figure 1

Fig. 1 Sectors of activity of analysed papers considering positive social impacts

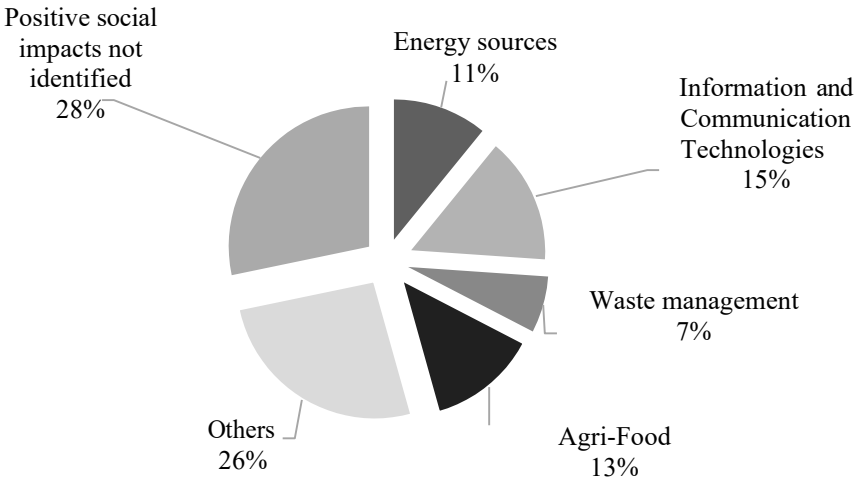

Table 1 Summary table of the case studies and theoretical frameworks analysed

Case studies		Theoretical frameworks	
Author	**Year**	**Author**	**Year**
Albrecht et al.	2013	Benoît and Vickery-Niederman	2010
Aparcana and Salhofer	2013a	Benoît et al.	2011
Aparcana and Salhofer	2013b	Benoît et al.	2010
Arcese et al.	2013	Benoît Norris	2012
Baumann et al.	2013	Benoît Norris	2014
Bienge et al.	2009	Benoît Norris and Revéret	2015
Blom and Solmar	2009	Benoît Norris et al.	2012
Bouzid and Padilla	2014	Benoît Norris et al.	2011
Chang et al.	2015	Bocoum et al.	2015
Ciroth and Franze	2011	Chhipi-Shrestha et al.	2014
Couture et al.	2012	Cinelli et al.	2013
De Luca et al.	2015	Dreyer et al.	2010
Dreyer et al.	2010	Dreyer et al.	2006
Ekener-Petersen and Finnveden	2013	Ekvall	2011
Ekener-Petersen and Moberg	2013	Finkbeiner et al.	2010
Ekener-Petersen et al.	2013	Fontes	2014
Feschet et al.	2013	Grießhammer et al.	2006
Foolmaun and Ramjeeawon	2013a	Hsu et al.	2013
Foolmaun and Ramjeeawon	2013b	Hutchins and Sutherland	2008
Franze and Ciroth	2011	Jørgensen	2013
Hosseinijou et al.	2014	Jørgensen	2010
Hu et al.	2013	Jørgensen et al.	2008
Labuschagne and Brent	2006	Jørgensen et al.	2009
Lehmann et al.	2013	Jørgensen et al.	2010a
Luthe et al.	2013	Jørgensen et al.	2010b
Macombe et al.	2013	Jørgensen et al.	2012
Manhart and Grießhammer	2006	Kloeppfer	2008
Manik et al.	2013	Lehmann et al.	2011
Martínez-Blanco et al.	2014	Lehmann et al.	2013
Moberg et al.	2009	Macombe et al.	2011
Moriizumi et al.	2010	Mathé	2014
Nemarumane et al.	2015	Moberg et al.	2009
Paragahawewa et al.	2009	Neugebauer et al.	2014
Ren et al.	2015	Norris	2006
Revéret at al.	2015	Parent et al.	2010
Sanchez Ramirez et al.	2013	Parent et al.	2013
Traverso et al.	2012	Pelletier et al.	2013
Ugaya et al.	2011	Petti and Campanella	2009
Umair et al.	2013	Pizzirani et al.	2014
Umair et al.	2015	Reitinger et al.	2011
Valdivia et al.	2012	Sala et al.	2013

Vinyes et al.	2013	Sanchez Ramirez and Petti	2011
Wan	2012	Sanchez Ramirez et al.	2014
Weldegiorgis and Franks	2014	Swarr	2009
Wilhelm et al.	2015	Wu et al.	2014
Yu and Halog	2015	Zamagni et al.	2011
		Zamagni et al.	2013

Table 2 Studies discussing positive social impacts in theoretical frameworks, and their main contributions

Year	Authors	Major contributions
2006	Norris	The health benefits of economic development have the potential to be very significant
2006	Grießhammer et al.	Difficult of quantification of negative impacts compared to positive impacts
2010	Jørgensen et al.	Positive "direct" effects and positive "indirect" effects
2011	Ekvall	Assessment of the social performance of governments with positive indicators
2013	Norris	“Handprint” and Beneficient Behaviour
2014	Neugebauer et al.	Fair wage and education as positive and negative indicators

Table 3 Analyses of the case studies using a typology for positive and negative social impacts.

Author	Year	Workers		Local community		Society		Consumers		Value chain actors		Company	
		Negative indicators	Positive indicators	Negative indicators	Positive indicators	Negative indicators	Positive indicators	Negative indicators	Positive indicators	Negative indicators	Positive indicators	Negative indicators	Positive indicators
Albrecht et al.	2013	4,q											
Aparcana&Salhofer	2013a	21,s; 1,d	4,s										
Aparcana&Salhofer	2013b	19,s	6,s; 1,d										
Arcese et al.	2013	2,q; 3,s;6,d											
Baumann et al.	2013	1,q											
Bienge et al.	2009	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Blom&Solmar	2009	9,q; 6,s; 1,d		5,q; 6,s; 1,d		3,q; 3,s; 4,d						2,q: 2,s	
Bouzid&Padilla	2014	4,q; 3,d											
Chang et al.	2015	1,q; 1,d											
Ciroth&Franze	2011	12,q; 6,s; 7,d		10,q; 5, s; 9,d		1,q; 5,s; 3,d	2,s; 4,d	1,q; 5,s; 5;d	1,q; 3,s	1,s; 4,d	3,s		
Couture et al.	2012	13,s		5,s		7,s	1,s				2,s		
De Luca et al.	2015	8,q; 2,s			1,q		2,q						
Dreyer et al.	2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Ekener-Petersen et al.	2013	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Ekener-Petersen&Finneden	2013	20,s		23,s	1,s			1,s		1,s			
Ekener-Petersen&Moberg	2013	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Feschet et al.	2013	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Foolmaun&Ramjeeawon	2013a	2,q; 5,s; 2,d				1,q					1,q		
Foolmaun&Ramjeeawon	2013b	2,q; 5,s; 2,d				1,q					1,q		
Franze&Ciroth	2011										2,s		
Hosseinijou et al.	2014	1,q; 4,s		1,q; 4,s;		4,s							

				3,d									
Hu et al.	2013	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Labuschagne &Brent	2006	1,s; 3,d		5,s; 7,d	1,d					2,d	1,d		
Lemhann et al.	2013	1,q; 1,s; 2,d		2,s; 1,d	1,s	1,d	1,s	2,s					
Luthe et al.	2013	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Macombe et al.	2013	1,q											
Manhart and Grießhammer	2006	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Manik et al.	2013	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Martínez-Blanco et al.	2014	10,q; 11,d						1,s					
Moberg et al.	2009	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Moriizumi et al.	2010	1,q											
Nemarumane et al.	2015	3,q;19,s; 1,d	3,s										
Paragahawewa et al.	2009	14,s	1,s	1,q; 11,s				10,s				4,s	1,s
Ren et al.	2015	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Revéret at al.	2014	8,s		2,s						2,s			
Sanchez Ramirez et al.	2013	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Traverso et al.	2012	6,q											
Ugaya et al.	2011	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Umair et al.	2013	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Umair et al.	2015	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Valdivia et al.	2012	5,q; 1,s											
Vinyes et al.	2013	1,q; 4,s	1,q; 1,s										
Wan	2012	2,q; 15,d		9,d		6,d		1,q; 7,d					
Weldegiorgis & Franks	2014	2,d		1,d									
Wilhelm et al.	2015	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Yu & Halog	2015	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.

q=quantitative indicator; s=semi-quantitative indicator; d=qualitative (descriptive) indicators.

Table 4 Positive indicators identified in the case studies analysed

Author	Year	Workers	Local community	Society	Consumers	Value chain actors	Company
Aparcana and Salhofer	2013a[§],b[Θ]	[§,Θ] Access to further social support programmes for workers. Training programmes for workers regarding occupational health and safety. Access to preventive health care programme for workers. Willingness to continue working in the same company or sector. Work satisfaction. Willingness to be trained regarding the work activities. [Θ] Educational level of children from recyclers´ families. No school absence of children from recyclers´ families. Existence of educational programmes for self-development.					
Ciroth and Franze	2011	Description of how overtime is handled.	Existence of projects to improve community infrastructure. Presence of certified environmental management systems. Presence of community education initiatives and community service programmes. Strength of policies to protect cultural heritage. Strength of policies to protect indigenous community members. Management effort to improve the environmental performance.	Presence of publicly available promises or agreements on sustainable issues and complaints to the non-fulfilment of these commitments. Implementation/signing of principles or codes of conducts. Sector efforts in technology development regarding eco friendliness. Involvement of the company in technology transfer projects. Presence of partnerships regarding research and development. Investments in technology development. Presence of co-operations with internal and external controls to prevent corruption.	Presence of management measures to assess consumer health and safety. Presence and quality of labels concerning health and safety. Presence of feedback mechanisms. Practices related to customer satisfaction. Percentage of organisations within the sector which published a sustainability report. Publication of a sustainability report, availability of sustainability information on the website, and other communication tools. Quality of the provided information regarding sustainability. Presence of certifications or labels for the product/sites. Company rating in sustainability indices Attention to and management of end-of-life	Presence of policies to prevent anti-competitive behaviour. Presence of codes of conduct that protect human rights of workers among suppliers. Percentage of suppliers the enterprise has audited with regard to social responsibility in the last year. Membership in an initiative that promotes social responsibility along the supply chain. Interaction of the company with suppliers. Fluctuation regarding suppliers.	

					issues. Structuring of the take back system including consumer involvement.		
Couture et al.	2012			Environmental certification.		Social responsibility promotion. Responsibility supplier practices.	
De Luca et al.	2015			% of farms—or % of ha of farms—that use information technologies. % of farms producing “Clementine of Calabria” Protected Geographical Indication.			
Ekener-Petersen and Finnveden	2013		Peaceful assembly and association				
Foolmaun and Ramjeeawon	2013a,b					Percentage of Corporate Social Responsibility fund spent on local community projects.	
Labuschagne and Brent	2006		Perceived aesthetics.			Improvement of socio-environmental services.	
Lemhann et al.	2013		Presence/strength of community education initiatives.	Presence of publicly available documents (promises, agreements) on sustainable issues.			
Nemarumane et al.	2015	Promotion opportunities. Family policies. Flexible working hours.					

Paragahawewa et al.	2009	Career development.			Plesure&Satisfaction.		Engagement in R&D.
Revéret at al.	2014			Environmental certification.		Effort to promote social responsibility.	
Vinyes et al.	2013	Total employees with higher education. Children's environmental education.					