Environmental Footprints and Eco-design of Products and Processes

Subramanian Senthilkannan Muthu
Editor

Social Life Cycle Assessment

An Insight

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Preface

Impacts made by products on environmental and social fronts are becoming more and more important these days. Environmental and social impact assessment by various products is no longer an option, rather a necessity, and the time is not very far away when the environmental and societal impact assessment of products and their declaration will become mandatory. The environmental assessment of products with their life cycle-based approach using life cycle assessment (LCA) is at an advanced stage and is widely used in many industrial sectors today. The social assessment of products is relatively new and currently under development and is not as advanced as that of environmental life cycle assessment (ELCA). Social life cycle assessment (SLCA) is a complementary approach to ELCA, used to assess the impacts pertaining to the social and sociological aspects of the products in their entire life cycles; it looks at all the life cycle phases, such as raw material extraction, production, manufacturing process, transportation, its use and final disposal, and it looks at these impacts with the aid of a "social eye." As the name implies, SLCA targets only social and sociological impacts through a range of impact categories. Methodological aspects and applications of SLCA is not yet completely developed and they are currently in the evolutionary stage.

On a comparative scale, the SLCA community is pretty small and is growing slowly. Still, there are many industrial sectors that have not touched social life cycle assessment at all and there are no studies on the SLCA of certain products. Only a limited number of product segments have ventured into SLCA, and again there is a dearth of studies even in those segments. Similarly, methodological choices and aspects have not quite been developed for various industrial sectors. Therefore, only a very limited number of studies on SLCA are available, and hence there is a scarcity of literature pertaining to SLCA as such. Only a few books are available on the subject, and this is the basis for the writing of this book, which, with seven very informative chapters, will become one of the important references in the area of SLCA.

The first chapter, "A Review of Social Life Cycle Assessment (SLCA) Methodologies", presents an overview of the concept of SLCA by dealing with the historical development of the SLCA concept and a detailed review on well-known

SLCA methods developed so far; this chapter also presents some SLCA studies on specific industrial segments.

The second chapter, "The Socioeconomic LCA of Milk Production in Canada", details the SLCA study of the Canadian milk production system. Exemplifying the core concepts of SLCA, it presents the complete application of the SLCA concept for the Canadian milk production system. Details of the hot-spot analysis of this SLCA study are also dealt with in depth in this chapter, along with the discussions pertaining to the merits, limitations and challenges faced in this study, which will be helpful for future researchers in this area of interest.

The third chapter, "Social Life Cycle Assessment in the South African Sugar Industry: Issues and Views", details the SLCA study done on the South African sugar industry. Having a reference to the United Nations Environment Programme (UNEP)'s guidelines of SLCA, this chapter presents an in-depth case study that was conducted on the sugar industry in South Africa with manifold objectives.

The fourth chapter, "Social Life Cycle Assessment Application: Stakeholder Implication in the Cultural Heritage Sector", deals with the discussions pertaining to the SLCA of the cultural heritage sector; it deals with the research that has developed a detailed theoretical framework to assess the social impacts pertaining to the cultural heritage sector.

The fifth chapter, "The Assessment of Social Impacts of Chemical and Food Products in the Czech Republic" discusses a study conducted on SLCA on chemicals and food products in the Czech Republic. It highlights the importance of assessing the social impacts of chemical and food products on stakeholders, along with the presentation of detailed aspects and results of the SLCA of chemical products and food products separately. Finally, the chapter also discusses the sources of uncertainty and the major limitations of these studies.

The sixth chapter, "Partial Organization and Social LCA Development: The Creation and Expansion of an Epistemic Community", enumerates the social shaping of the SLCA technique and its institutionalization process in detail. Having discussed the organization of SLCA within corporate social responsibility (CSR) multi-stakeholder initiatives in detail, this chapter deals with the development of epistemic communities; it also presents the development and growth of the SLCA epistemic community, using the development of the social hotspot database (SHDB) as an example.

The seventh and final chapter, "Social Life Cycle Assessment in a Managerial Perspective: an Integrative Approach for Business Strategy," outlines the implications of SLCA in a managerial outlook by an integrative approach for improving business strategy. This chapter reviews the various instruments related to stakeholder management and CSR and makes an attempt to combine the tools of social responsibility, SLCA, and the stakeholder management approach for improved business strategies.

I would like to take this opportunity to thank the contributors of all seven chapters for their sincere efforts and the enriched technical content in their chapters that helped publish this book. I have no doubt that readers will greatly benefit from it, and, as stated earlier, it will certainly add a feather to the cap of the SLCA community in terms of becoming an important reference for the researchers, students, industrialists, and sustainability professionals working in this field.

Contents

A Review of Social Life Cycle Assessment Methodologies

Yi Fan, Ruqun Wu, Jiquan Chen and Defne Apul

Abstract Social Life Cycle Assessment (SLCA) is emerging as a powerful and necessary tool in sustainability science. With its great flexibility, SLCA can be applied toward quantifying social impacts on a system. However, the literature lacks a review of the current methods that hinder its applicability. This chapter provides an overview of the popular methods in SCLA, including process identifications and quantifications. Specifically, we review the four methods of Dreyer, Norris, Hunkeler, and Weidema. We found that the definition of human well-being seems to be the basis for all SLCAs. The SLCA method can effectively measure social impacts and provide a sound basis for decision-making. Case studies are included in the chapter to illustrate the applications.

Keywords SLCA · Tutorial · Quantification · Measurement · Social indicator

1 The Development of SLCA

The discussion on how to deal with the social and socioeconomic criteria in Life Cycle Assessment (LCA) began around the mid-1990s, following the publication of the SETAC Workshop Report, "A Conceptual Framework for Life Cycle Impact Assessment" (Fava et al. 1993). It stated that the "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 …" The proposed social impact category called for a more comprehensive discussion among LCA methodology developers (UNEP/SETAC 2009).

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SLCA has a predecessor, Social Impact Assessment (SIA), which is a concept used in SLCA. SIA emerged during the 1970s and aimed at examining the social impacts of industrial activities (Freudenburg 1986). However, SIA does not include the social impacts of a product during its whole life cycle, but measures the changes in human well-being only made by one phase of a project or a product. SLCA aggregates the SIA of every phase in a product's life cycle. Environmental LCA (ELCA) is an earlier and more mature technology than SLCA. Weidema (2006a, b) suggested that LCA should not be isolated from social aspects and consequently a more holistic ELCA was introduced with integrated human well-being factors, which broadened the scope of ELCA. According to the requirement of ISO (LCA 1997), the impact assessment must be quantifiable. Dreyer et al. (2006) outlined a framework of SLCA in 2006 that is able to provide a quantifiable result of the assessment. They perceived the life cycle of SLCA as a collection of companies where industrial activities take place (Dreyer et al. 2006). This methodology provided the quantification measurement but left an issue for the practitioners: How does one collect the data for SLCA from the related companies within the life cycle of a particular product? Unlike Dreyer et al. (2006), Jørgenson et al. (2008) argued that the generic data is more applicable and accurate than the site-specific data. Hunkeler (2006) modeled SLCA using the socioeconomic data (i.e., generic data) from the national censuses and public databases that can provide a much larger sample size for researchers than site-specific data. Such a large sample size appears to improve the accuracy of the estimation process in SLCA.

The quantification methods used for SLCA are determined by study objectives because SLCA methodologies are different for a single product and general product families. It is more favored to apply specific company data in SLCA for a single product than to apply general background data. SLCA for a general product family is more suited to using general background data than specific company data. In addition to the development of quantification methods for SLCA, the social impact category also needs to be constructed. A major effort in SLCA is to select the relevant and quantifiable social impacts referring to how an activity has affected its related communities in terms of human well-being (i.e., definition of the social impact). Defining human well-being is the first step in conducting a SLCA.

The concept of human well-being is intangible. It is reflected by a human being's satisfaction (i.e., a mental intellectual experience) with his life. Two questions for measuring human well-being may include: "What concepts are included in human well-being?" and "How do we quantify human well-being?" The earliest known human well-being was defined by Aristotle (384-322 BCE) as *eudaimonia* (i.e., happiness) and ethical virtue (Charles 1999). In Aristotle's *Ethics*, having eudaimon is the highest end goal; other goals (health, wealth, etc.) and resources, are sought because they promote human well-being but not because they make up human well-being (Kraut 2002). Aristotle emphasized that spiritual fulfillment, rather than material satisfaction, is the key to human well-being. However intangible, human well-being needs to be assessed with a quantifiable and reproducible method. To develop the measuring and monitoring methods for SLCA, scientists need to

develop and select quantitative or qualitative socioeconomic indicators to represent human well-being in order to offer understandable information.

Decades ago, social scientists measured human well-being by data models based on socioeconomic indicators such as mortality rate, freedom of association, education, and the GINI Index that were placed in various social impact categories. Each indicator is categorized if it is relevant and pertinent to a production activity or project progress. The social impacts are thus modeled, based on these indicators. Although these socioeconomic-based methods are applicable and reproducible, the results are not completely accurate because (1) they include irrelevant socioeconomic changes in a product's life cycle, and (2) the indicators cannot properly measure human well-being.

In the SLCA literature, social and economic data are recommended for measuring human well-being methods because they are much more concrete and reproducible than the abstract idea of human well-being. In 2006, social scientists carried out a feasibility study of SLCA. The study introduced preferred socioeconomic indicators for future application in SLCA, such as human rights, labor practices, decent working conditions, and product responsibilities. These indicators are directly associated with a stakeholder of the corresponding product system (Grießhammer et al. 2006). This data is applicable, available, and replicable for both midpoint and endpoint SLCA. The midpoint impact is considered to be a point in the cause-and-effect chain of the impact pathway prior to the endpoint (Bare 2000). The midpoint indicator can be an indicator for a particular issue under a social impact. The endpoint indicator is an indicator for a social impact and should be more applicable for the decision-makers. The indicators associated with each stakeholder in a product's life cycle can only facilitate the midpoint assessment because only one dimension of a social impact can be assessed (Fig. 1). To have a standardized endpoint value for social impacts, Norris (2006) developed a quantitative approach for modeling the impact pathway where the impacts are allowed to be aggregated and comparable across life cycles.

SLCA is different from ELCA or Life Cycle Cost (LCC) due to its nature, i.e., SLCA is an analysis based on the way the business affects human well-being, rather than ELCA which is based on operation process. The life cycle inventory of ELCA is comprised of the environmental consequences (impacts) from production. How to quantify the social impacts became a controversial topic. There are some midpoint SLCA methodologies providing effective solutions. Dreyer et al. (2006) developed an SLCA method that uses a scorecard to standardize and quantify the social impacts as specific numbers. Later, Dreyer et al. (2010) improved this method with more details and specifics to a social issue and location, but this requires company-specified data—which is often difficult to access. In addition to the site-specific data, some authors use generic data in SLCA. Jørgensen (2012) pointed out that the crucial issue for SLCA was the accessibility of the data. Because site-specific data is hard to obtain for most studies, it is recommended that practitioners model the social life cycle of a product with generic data, such as those from national censuses or public surveys.

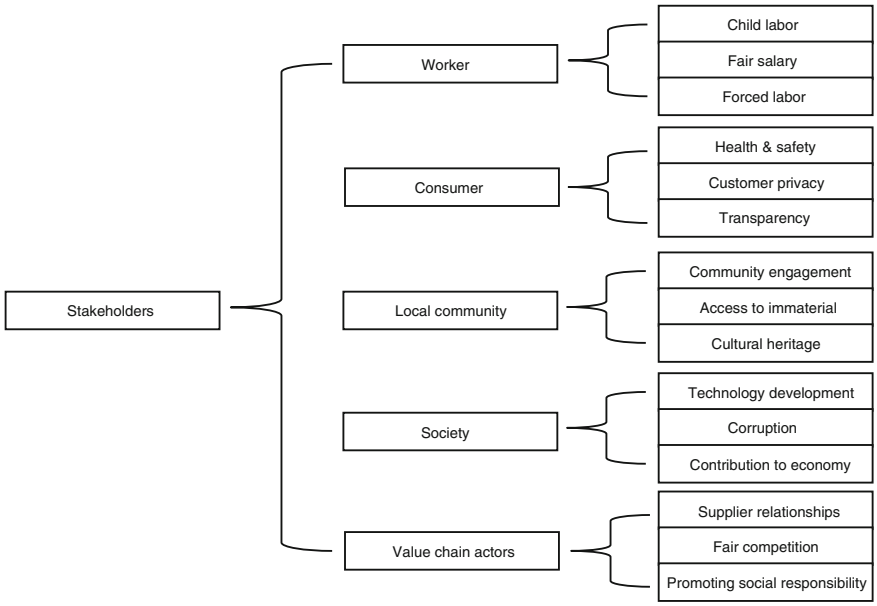

Fig. 1 Five simplified stakeholder categories in the production system according to the UNEP's guideline for SLCA (UNEP/SETAC 2009)

Practitioners of SLCA have to address the following four problems: (1) the definition of human well-being; (2) the selection of social indicators for SLCA; (3) the preference of site-specific data or generic data; and (4) the method for quantifying the social impacts.

2 SLCA Methodology

There are numerous and diverse methodologies in SLCA literatures. During the past decade, most debates have focused on impact categories and measurements (UNEP/SETAC 2009). Here, we provide an overview of four popular quantification methodologies to advance the study of SLCA.

2.1 Norris's SLCA

Norris (2006) developed an endpoint SLCA methodology to estimate the health impact of a product's life cycle. The health impact is characterized by the empirical relationship between the product life cycle's economic activities and the life expectancies of the countries within the product's supply chain. Among the many

endpoint indicators, Norris used the health impact as an example. The health impact is assumed to be measured by life expectancy according to the Health Report of 2002 issued by the European Office of the World Health Organization, which concluded that "poverty is the most important single determinant of ill health" in Europe (Europe 2002). Here, human health is negatively influenced by pollution created by industry, but positively influenced by the economic contribution of the industry. One can use Norris's approach to estimate an endpoint result value of the health impact by aggregating the health impact from both the economic contribution and the pollution caused by a product.

2.1.1 Norris's Endpoint SLCA Case Study

In Norris's study, the health impact is an endpoint indicator of social impact that was measured by life expectancy. Life expectancy is assumed to have a linear relationship with the per capita gross national product (GNP). The GNP's influence on life expectancy is significant, based on the 2002 World Development data from the World Bank (Norris 2006). Norris predicted life expectancy based on the linear relationship between life expectancy and per capita GNP. The coefficients of the linear relationship are estimated based on the World Bank data with Eq. 1. Norris pointed out that the linear model applied in his methodology was not perfect and additional modifications were necessary. However, an imperfect linear relationship, as an example between life expectancy and per capita GNP, is still used in this study, which is expressed as:

$$\text{Life Expectancy} = a - b \times \text{per capita GNP}^{-c} \tag{1}$$

Three coefficients—a, b, and c—were estimated based on life expectancies and per capita GNPs from 126 countries from the World Bank database. To illustrate the application of the Norris (2006) SLCA in an understandable way, we took Dutch Electricity as an example. Dutch Electricity generated $1 million in 2002 and consequently increased the GNP by $1 million. To calculate how much life expectancy increases due to an economic increase, we transformed Eqs. (1–2). Coefficients of c and b can be estimated by the above linear relationship (Eq. 1). Per capita GNP was estimated at country level. $\text{Per capita GNP}_{\text{without \$1 million}}$ was estimated by GNP for the Netherlands, which deducted $1 million from the real GNP in 2002. $\text{Per capita GNP}_{\text{with \$1 million}}$ was the real per capita GNP in 2002. Year gain, a new concept introduced by Norris (2006), was the positive effect from economic growth to human life expectancy. Year gain was the life expectancy increase brought about by economic growth; it is the difference between life expectancy with and without the $1 million generated by Dutch Electricity (Eq. 2).

$$\text{Year Gain} = b \times \left(\text{per capita GNP}^{-c}_{\text{without \$1 millon}} - \text{per capita GNP}^{-c}_{\text{with \$1 millon}}\right) \tag{2}$$

The above equation transfers economic growth to health impact which is a positive health consequence. Indeed, economic growth will inevitably bring some negative health consequence because of the pollution. The estimate of negative health consequences from the pollution is different from Norris's estimate. The emission by Dutch Electricity in 2002 is applied to calculate the life-years lost that were caused by pollution. The pollution caused by Dutch Electricity for producing $1 million of electricity can be estimated by the input/output LCI inventory database provided by the PRe Consultants in Amersfoort, The Netherlands. The database provides the emissions created by a product, and the pollution inventory is then used to evaluate the health impacts in terms of life-years lost. Norris recommended applying the EcoIndicator 99 methodology for estimating the life-years lost from pollution (Goedkoop and Spriensma 1999). In EcoIndicator 99, the life-years lost from pollution are measured as disability-adjusted life-years (DALY), which are determined by the impacts of respiratory inorganic emissions and the potential health consequences of global warming. The difference between the year gain from economic growth and year loss from pollution provides an endpoint result of the health impacts from a product's life cycle.

2.1.2 Notes on Norris's SLCA

Norris's methodology defines an endpoint indicator: life expectancy. He used the mature empirical theory for ill health determined by poverty and pollution-caused DALY to support his methodology. The result is reproductive and provides a quantitative and comparable measurement. This method applied generic data that eases the practice of SLCA. Although there are many advantages to Norris's methodology, a number of warnings must be raised. The relationship between economic growth and life expectancy seems more complicated than the model used in Norris's study. The health impact is not the only indicator for SLCA, and he suggested that "multiple impacts matter" in the endpoint SLCA study, i.e., including more endpoint indicators in SLCA.

2.2 Dreyer et al.'s (2010) SLCA

Inspired by the ISO standard for ELCA, Dreyer and colleagues were the first group to design a complete concept and framework of SLCA (Dreyer et al. 2006). Their explanation for the goal of SLCA is that SLCA is a tool for enabling a company to conduct its business in a socially responsible manner, a perspective that is widely accepted in the academic community. Jørgensen (2008) also summarized past research in SLCA and defined it as a way to "serve to make decisions to improve the social conditions of stakeholders for whom impacts are assessed."

Dreyer et al. (2006) defined two basic categories of the SLCA framework: either developed from the societal perspective, or from the company perspective.

The latter was adopted later by many scholars. This framework clarified one important issue: instead of taking a unit process perspective, as in ELCA, SLCA should take a company perspective because, unlike ELCA, where measurements are based on physical inputs and outputs that directly link each unit process, SLCA measures the social impacts on people, which are related to the activities of the companies in the product chain rather than a single unit process. Corporate social responsibility is the key component of Dreyer et al. (2006, 2010). SLCA estimates the impacts on people directly or indirectly posed by the company's business, and people are treated as stakeholders. Dreyer et al. (2010) developed a quantifiable impact assessment method according to the request of the ISO for LCA (1997), which requires the impact assessment to be a quantifiable result; the method is based on a multi-criteria indicator-assessing model.

The ultimate goal of SLCA is to improve "human dignity and well-being," a principle that should always be kept in mind for SLCA practitioners. Human dignity and well-being are different among countries/regions due to the diverse local or national norms (Dreyer et al. 2006). The social impacts can hardly be assessed accurately when solely based on the socioeconomic indicators, regardless of the social context. These indicators do not directly describe the situation or the level of violation or promotion of human dignity and well-being caused by a product during its life cycle. Dreyer et al. thus defined their SLCA method in 2010 as a characterization of social impacts in LCA. They applied risk management techniques in a multi-criteria indicator model that is similar to the financial risk management in the credit score system, which evaluates a person's, or an organization's, credit score to see the likelihood of bad debt. They created a new concept—company risk score (CR)—to describe the level of the risk or probability that a stakeholder's human dignity and well-being are violated by a product. This method measures the effort that a company puts to prevent the violation of the human dignity and well-being of each stakeholder, an effort that is expressed as company performance (CP), which is calculated through a multi-criteria indicator model that converts the qualitative indicators into quantitative values. The following case study illustrates the concepts and application of the multi-criteria indicator model at the company level.

2.2.1 Dreyer et al.'s (2010) Multi-Criteria Indicator-Assessing Model Case Study

A multi-criteria indicator assessment is comprised of three steps: (1) identification of the impact category; (2) scoring the managerial effort on the protection of human dignity and well-being; and (3) conversion from the managerial effort score to the CR. The impact category includes social issues such as child labor, freedom of association, labor dignity, etc. Unlike Norris's endpoint indicator, which is only for health impact, Dreyer et al. (2010) created another concept of the CR for SLCA that can be applied to all of the social impacts. According to the UNEP's guidelines for SLCA, the impact category was classified into five groups based on the stakeholders in the production system (UNEP/SETAC 2009).

Dreyer et al. (2010) used forced labor as a social impact example in this case study. The assessed issue was extended to a set of company behaviors leading to the issues. The extended behaviors are relevant topics about violation of human dignity and well-being that were discussed at a conference of the International Labor Organization (ILO). ILO established International Labour Standards and Legal Issues to prevent bad company behaviors toward its employees. For example, negative behaviors include disregarding forced overtime and the enforcement of a "no vacation" policy. The internal managerial efforts for preventing these behaviors are scored in a multi-criteria indicator-assessing model. Usually, the scoring process needs physical communication with the managers and workers of the assessed company.

There are three dimensions for the performance of a manager's efforts to prevent negative company behaviors: (1) the company's delegation of the responsibility and communication that is expressed as an established practice or issued guideline to address the listed issue; (2) monitoring expressed as manager and employee compliance with the above-mentioned practice and guideline; and (3) the company's continuous, active control to ensure that managers and employees comply with the established practice or guidelines and integrate those preventive behaviors into daily work (Dreyer et al. 2010).

In Dreyer et al. (2010), an investigator will rate the managerial efforts in three dimensions from 0 to 4, from the least effort to the most. Although the model is comprehensive, it inevitably introduced some subjective experiences into the scoring process because the score given to a manager is based on the investigator's personal judgment and a manager's personal responses to the questions. The three dimensions are represented by I, II, and III in Eq. 4. The product of the multiplication of the three scores is the managerial performance score (MP) of the effort to prevent the given negative managerial behavior (Eq. 3).

$$\mathrm{MP} = \mathrm{I} \times \mathrm{II} \times \mathrm{III} \tag{3}$$

The sum of all MPs is the company's actual performance (CP) in preventing an identified issue (Eq. 4).

$$\mathrm{CP} = \Sigma \mathrm{MP} \tag{4}$$

Dreyer et al. (2010) introduced the concept of company free rein (CFR) to directly express the likelihood or risk of violating behaviors by a company. CFR assumes that if the company did not make a notable effort to generate a positive social impact, its remaining effort will be at risk to bring negative impacts for the involved stakeholders because the goal of a company is to maximize profit rather than benefit others. CFR is the risk of the company behaving improperly and is expressed as the difference between actual CP and CPmax (i.e., CP under an ideal situation). CPmax is the maximum CP when the company behaves virtuously; for CPmax, all of the dimensions of an effort to prevent negative behavior will have a score of 4. The difference between CPmax and actual CP is the remaining effort at risk for a company to pursue unethical profits (Eq. 5). This assumption is rigid that a company could only have

virtuous or unethical behaviors. Dreyer et al. (2010) equate the CPmax of virtuous efforts on preventing inappropriate behavior to the total efforts of a company to perform business operations. According to Murphy's Law, anything that can go wrong, will go wrong—sooner or later (Bloch 2003). The multi-criteria indicator model assumes that CFR represents a company's efforts, which can go in an unethical direction. CFR is an indexed indicator between 0 and 1.

$$\mathrm{CFR} = (\mathrm{CPmax} - \mathrm{CP})/\mathrm{CPmax} \tag{5}$$

Using a company in Germany as an example, if there are 100 listed managerial efforts to prevent negative behaviors that can cause forced labor in the production line, CPmax will be 64 × 100 = 6,400 (64 is the product of the maximum effort of I, II, and III and 4 × 4 × 4 = 64 and 64 × 100 implies that the company maximizes its efforts to prevent every listed negative behavior that can cause forced labor). If the actual CP is 2,000, which is the sum of the score of the 100 listed managerial efforts, CFR will be 68.75 % (1–2,000/6,400 = 68.75 %). CFR shows that the company remains at 68.75 % of its total ability, which should be used for preventing the forced labor. The remaining abilities are at risk of causing the forced labor and are risks for inappropriate behavior.

The final step is to adjust the measured risk of inappropriate behavior by its local and national norms. The adjustment factor is derived from the generic data about the issue for a region or a country; in this case, the issue is the forced labor. There are six companies assumed to be the components in the production chain (all visited by Dreyer et al. 2010). The data in this case study was collected during their visits by adjusting CFR using a contextual adjustment factor (CAF), which represents the relevance or importance of the given issue. For example, with the forced labor, the issue is regarding the social context of the company. The actual CAF is the percentage of the issue, forced labor, for a country. The product of CAF and CFR is CR, which is a characterized index of a company's risk to use forced labor. For example, if the forced labor ratio in Germany is 5 %, the CR for the German company is 3.44 % (5 % × 68.75 % = 3.44 %).

2.2.2 Notes on Dreyer et al.'s (2010) SLCA

Dreyer et al.'s (2010) methodology demonstrates that the adjusted CR is a midpoint indicator for comparison with others when the social issues are similar. In general, this case study confirms the applicability and feasibility of both the inventory data collection and the characterization approach for Dreyer et al. (2010). On this basis, it is also taken into consideration that other impacts may be included in SLCA using this method, as long as they can be meaningfully addressed within the managerial perspective underlying the multi-criteria indicators. This approach focuses on the will and ability of a company to manage an social issue of concern. One can add more CAFs to Dreyer et al.'s model because it can adjust the social issues to a more accurate value regarding local culture. For example, for the national acceptance

ratio of overtime, some countries treat it as a social norm, while others hardly consider it to be a totally bad social issue. Consequently, one can adjust the CR of a certain company according to social culture.

Site-specific and generic data can be accepted by ELCA. However, generic data (i.e., the background data provided by many ELCA databases) does not provide information for carrying out SLCA because SLCA is a highly site-specific methodology. Regional databases may enable macroscale assessments at regional level; however, they are not useful for microscale assessment at company level. For example, two companies producing the same product in the same place may have different social impacts due to company cultures. Site-specific data normally is from surveys of a company.

Dreyer et al.'s (2010) method requires its data from personal interview surveys, which can determine the reliability of the research. In *Improving Survey Questions*, many methodologies aimed at reducing subjectivity in a survey are discussed by Fowler (1995). Designing questions, the first step of a survey, can reduce the subjectivity as much as possible because the answers are to be used as measures. One critical standard for a good question-and-answer process is that the questions provide meaningful information about what we are trying to describe. Sound questions can produce reliable and valid answers, which will, in turn, affect the measures of SLCA. Participants of surveys need to understand the questions and provide the answers without much difficulty. Individual variability in the question-and-answer process inevitably exists in surveys due to the differences among participants, and they should be measurable and acceptable. Because survey results need to be validated in order to support the conclusions, validating the results with a re-interview of a sample of the respondents appears to be necessary for reducing potential errors.

Two classes of impact categories are identified in SLCA: obligatory and optional. The obligatory category is based on four issues of concern (see also ILO), including discrimination, forced labor, freedom of association and right to organization and collective bargaining, and child labor. These categories are universal labour standards for every company. Optional category depends on the context of a company in terms of its geographical and cultural setting. Examples include physical working conditions, working hours, minimum wages and benefits, training and education of employees, and development support for the local society.

In traditional LCA methodologies, we allocate the impacts to every company involved in the business operations; this is called allocation in LCA, which was not applied in Dreyer et al. (2010). In Dreyer 's SLCA social impacts are allocated to every managerial behavior to prevent violation of human well-beings; however, they lack explanation about the mechanisms behind the impacts (e.g., why the impacts are produced by a particular process). Some guilds and studies provide lists of impacts for practitioners to use (UNEP/SETAC 2009). However, it is neither reasonable nor precise to apply an existing impact category or inventory to a research study because SLCA is a site-specific study from a company perspective.

Impact pathway analysis (IPA) is widely used in project management in industries. It describes plausible impact pathways by which the project outputs are used by others to achieve a chain of outcomes leading to a contribution to an

eventual impact on social, environmental, or economic conditions (Springer-Heinze et al. and Dreyer et al 2003). IPA is a logic model of causal relationships between business operations and social, economic, and environmental impacts. In addition, there are many causal relationships among impacts in an IPA that emphasizes the communication processes among stakeholders, impacts, and business operations. IPA draws a picture with holistic interactions among all of the participants. When integrating pathways of impacts to SLCA, it will provide better-explained referential values for companies in their decision-making processes.

Dreyer et al. (2010) proposed a SLCA methodology that integrates real social contexts and regional cultures for assessment. The multi-criteria indicator model advances the traditional single criterion model in SLCA. The single criterion indicators are also referred to as "direct indicators" and often fail to explain the complexities of social issues. For example, the indicator of child labor in every country is only a percentage figure; this means that the ratio of child labor to the total labor for a country can always be treated as a vicious exploitation of poor children. However, sometimes the life of a child who works for money may be of benefit to his or her family. In the child labor example, the company may hire children to work at appropriate workloads and wages based on their ages and maturity levels. The jobs will help children acquire work skills and improve the well-being of their families. In this case, the direct indicator of an issue ignores the social context.

The disadvantages of "direct indicators" are obvious. Moreover, they directly measure the extent and severity of a violation of human well-being by a product, regardless of the real-life conditions. To correct the bias, Dreyer et al. (2010) proposed a concept of "indirect indicators" that contains information on the efforts of the company to ensure human well-being for its stakeholders. This multi-criteria indicator model provides an overall explanation of each impact category with specific issues by identifying specific managerial measures or efforts.

2.3 Hunkeler's SLCA

Unlike Dreyer et al. (2006), who opposed the unit process and proposed uses of company-based specified data, Hunkeler (2006) takes the unit process and uses the existing ELCA data directly for calculating labor hours, which are treated as intermediate variables between ELCA data and the final social indicators (Fig. 2). Hunkeler realized that the relative value, estimated by generic data, of the social impact assessment was more practical than an absolute value estimated by site-specific data (i.e., different from environmental and economic impacts).

2.3.1 Hunkeler's Geographically Specific Method Case Study

Hunkeler's quantification process for SLCA includes five steps (Fig. 2): (1) collecting the data of material usage and emission in a product's life cycle; (2)

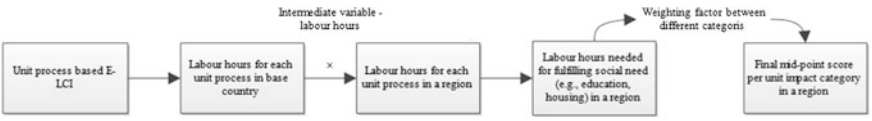

Fig. 2 Five steps of Hunkeler's SLCA

estimating employment hours for a country in material extraction, production, and emission management of material usage and emission; (3) estimating employment hours for every country in a product's life cycle; (4) estimating the purchasing ability for a person working one hour in every country; and (5) estimating the total purchasing ability for each country from working for the product in its life cycle.

Employment hour is the labour unit applied in Hunkeler's SLCA which is associated with the production process. Here, we provide an examples of detergent production. In material extraction, the employment hours are the number of hours used to extract the material to produce a detergent; in energy generation, the employment hours are hours used to generate the energy to produce the detergent. In the production process, the employment hours are for producing the detergent. In waste administration, the employment hours are for processing the emission and wastewater from the detergent's life cycle. Hunkeler's SLCA used the data from ELCA research for a study on a detergent in Germany (Baumann and Tillman 2004). The data includes material usage and emission, which are applied to estimate employment. Those employment data applied in the method are generic, making them easier to access than site-specific data.

However, not all of the data is available because some countries do not publish their basic socioeconomic data. Hunkeler created a regional factor of a baseline country to solve this problem. The regional factor explained the proportion of productivity of one country to another. This productivity is a measure of the efficiency of production. For example, if Germany is the baseline country and the productivity is 8 for Germany, 4 for China, and 10 for Israel, then the regional factor is 2 for China (8/4 = 2) and 1.2 for Israel (8/10 = 0.8). (Data of productivities for every country are available in the World Bank database.) It is not necessary to find the working hours for every country within the production system. Hunkeler's estimates of the employment hours for a country are based on that country's productivity. For example, if the employment hours for producing 1 kg of a material is 10 in Germany, this number for China and Israel would be 20 (10 × 2 = 20) and 8 (10 × 0.8 = 8), respectively.

The total employment hours for a country can be estimated (Eq. 6) as the ultimate indicator based on the regional factor for each country's employment hours for every process of the detergent's life cycle. For example, in a detergent's life cycle stage in China, production accounts for 10 h/person, waste management 3 h/person, and energy generation 3 h/person occurred. Therefore, the total employment hours for China are 16 h/person (10 + 3 + 3 = 16). The employment hours for each process in this life cycle are not determined by a product, but all kinds of products.

For example, the labor hours for a material extraction to produce a cup will not change if the material is used to produce paper. The employment hours are allocated by the country during the product's life cycle because they provide quantitative comparisons among the countries.

The employment hours used in a production system are the only measurements for evaluating the social value and the purchasing ability. In Hunkeler's SLCA, the purchasing ability is estimated based on the employment hours for a country that participates in a product's life cycle. Purchasing ability explains how much a person working one hour for the product in the country can afford when buying a home (i.e., a human basic need).

In a case study of the SLCA, four impact categories were measured: housing, health care, education, and necessities (note that other social contributions can also be modeled, although we use housing as an example in this chapter). The purchasing ability is explained by the quantity of basic human needs. For example, if the wage is \$8 h^{-1}/person and the price of the home is \$80,000 in Germany, 10,000 h/person are equivalent to the value of a home (\$80,000/(\$8 h^{-1}/person) = 10,000 h/person). Thus, the inverse of the amount of the labor hour equivalent (1/10,000) is the purchasing ability (i.e., the number of units of a home that can be purchased by a person working one hour for a product). The benefit from a product's life cycle for a country can be estimated based on the total employment hours of the country contributing to the product. For example, if Germany has 1,000 h/person in total, including employment hours for every production process occurring in Germany, for the product's life cycle, the working hours will be 1/10 of a house (i.e., 1,000 h/person × (10,000 h/person) = 1/10) (Eq. 7). This measure explains the benefits to workers by each country through the life cycle. Both the methods and the results can be used for business decision-making and assessing the survival pressure among the workers within the supply chain for a product. Two simplified equations are here for understanding the above illustration:

$$H_{\text{country}} = \Sigma Q_{\text{material}} \times H_{\text{labor}} \tag{6}$$

H_{country} total labor hours for a country related to producing a function unit of a product
Q_{material} units of material used in production for a country
H_{labor} labor hours per person for extraction or production of a material per unit of a product

The basic human need that can be met by a country for a product is calculated as:

$$Q_{\text{need}} = P_{\text{country}} \times H_{\text{country}} \tag{7}$$

Q_{need} the quantity of a basic need that can be met for a country in a product's life cycle

$P_{country}$ Purchasing ability, which is the ability of purchasing a human basic need by working one hour in a country.

The goal in Hunkeler's SLCA is to estimate the number of labor hours for producing a product that satisfies human needs in all countries. The average prices for basic human needs in each county are required and can be found in the World Bank database. By doing this, a country's needs can be compensated.

2.3.2 Notes on Hunkeler's SLCA

Hunkeler's method estimates amount of basic human needs, measured by labour hours, being met by a given product. This SLCA is also characterized by region, like Dreyer's SLCA, so that the result of this SLCA can reflect the difference among the regions. The result is not an endpoint conclusion for a social impact, but a useful measure for the decision-makers to monitor the social benefits for the employees throughout the life cycle of a product. The entire process of Hunkeler's SLCA is based on generic data. The life cycle working time has already been provided in some databases (e.g., the World Bank, ILO, etc.). Practitioners of SLCA can find the labor hours and average wage data in (some) national census databases or publications. Hunkler's methodology is similar to ELCA because it derives social impact and purchasing ability from environmental data in ELCA. Unlike Dreyer et al.'s (2006, 2010) SLCA that focuses on social issues associated with the industry, Hunkeler focuses on the social benefits created by the industry. Hunkeler's SLCA cannot reflect a real situation for a company because the data is from general public databases. This SLCA quantifies the social impacts; it can also provide an informative picture on the performance of a product within the global market. Clearly, Hunkeler's SLCA is a supplement to Norris's approach, as both use generic data to determine the social impacts. Hunkeler's SLCA gives a value measuring social benefit, and Norris's SLCA reflects health impacts.

2.4 Weidema's SLCA

Weidema (2006a, b) introduced the quantification method of SLCA in *The Integration of Economic and Social Aspects in Life Cycle Impact Assessment*. This method has its roots in the UNEP/SETAC LCIA framework, where the areas of protection were identified (e.g., humans, biotic environment, and abiotic environment). The social impact in this SLCA focuses on human health, with an indicator measured by human longevity. The social impact is quantified as human life-years lost during a product's life cycle. The quantification method defines social impact by a human life-year as a final result of SLCA (i.e., the endpoint indicator).

The human life-year loss can be caused by many damage categories (e.g., poverty, illness, working environment, etc.), suggesting that damage categories have to be created during an SLCA exercise. We provide examples using anxiety, unequal opportunities, and autonomy infringement to illustrate the construction of damage categories.

2.4.1 Weidema's Damage-Oriented Case Study

Weidema (2006a, b) developed a damage-oriented method based on damage categories (Fig. 3). The indicator of this SLCA is Quality Adjusted Life Years (QALY), which is adjusted DALY (Disability Adjusted Life Years) without year loss due to the damages (Table 4). DALY is the sum of the Years of Life Lost (YLL) due to premature death in the population and the Years Lost Due to Disability (YLD) for people living under adverse conditions. The average human life expectancy (i.e., YLL and YLD) is available in the database of the World Health Organization. For example, if the human life expectancy was set at 80 years, YLL is 10 years, and YLD is 20 years, that will result in a DALY value of 50 years (i.e., 80 years − 10 years − 20 years = 50 years). There are many damage categories that can lessen the human life span (e.g., anxiety, unequal opportunities, autonomy infringement, etc.). Using the above study as an example, if the years lost caused by unequal opportunities is 2, a year lost caused by anxiety is 1, and a year lost caused by autonomy infringement is 3, the three above-mentioned damages will adjust DALY to be 44 years as QALY (i.e., 50 years − 1 year − 2 years − 3 years = 44 years). The QALY is defined as the level of human well-being by Weidema (2006a, b); its goal is to determine a stakeholder's human well-being level by identifying the damages through a product's life cycle.

This method begins with identifying the damage categories (e.g., anxiety, unequal opportunities, and autonomy infringement) before quantifying the number of years lost due to damages for a stakeholder. However, there are many stakeholders affected by the same or different damages in a product's life cycle. Indeed, some stakeholders can be affected by specific damages, while others are affected by different ones. Clearly, identifying the damages by stakeholder groups is a major task. In a product's life cycle, many social issues, such as lost holidays, polluted

Fig. 3 Impact pathways for the Weidema method (adapted from (Weidema 2006a, b))

working conditions, and forced labor, vary by stakeholders, which can be estimated following the SLCA guidelines of the UNEP/SETAC (2009, Fig. 1). These social issues, on the other hand, can be allocated to other damages in the impact pathway that illustrates the route from a social issue to a damage category (Fig. 3). One can associate the stakeholders with relevant damage categories based on the above relationships. The total QALY for a product can be estimated by subtracting the total years lost due to the damage from the total DALY of all of the stakeholders. For example, three damage categories were identified: anxiety, unequal opportunities, and autonomy infringement. If 40 stakeholders are related to a product in its life cycle, 20 are affected by anxiety, 30 by unequal opportunities, and 5 by autonomy infringement, the QALY for the product's life cycle will be 1,875 years (i.e., 1,875 years = 50 years × 40 people − 1 year × 20 people − 2 years × 30 people − 3 years × 15 people). This is summarized by:

$$\mathrm{QALY} = \mathrm{DALY} \times N - \Sigma YL_i \times N_i \tag{8}$$

N Total number of stakeholders related to a product in its life cycle
YL_i Life-year lost due to damage i (data source of year lost for a certain damage in Fig. 3)
N_i Number of stakeholders affected by damage i.

The overall well-being for a product's life cycle takes 52.1 % of full well-being [i.e., QALY/(expected human life × total people) = 1,875 years/(80 years × 40 people)], suggesting that 52.1 % of expected human years are healthy without the inclusion of negative social impacts. QALY presents the level of human well-being affected by identified damages that are relevant to a product's life cycle. Here, Weidema (2006a, b) proposed QALY as the endpoint indicator for SLCA. His application also influenced Norris's work, in which the social and economic impacts were integrated for the health impacts of SLCA.

2.4.2 Notes of Weidema's SLCA

Generic data, but not site-specified data, is applied in Weidema's SLCA (Weidema 2006a, b). Here, the impact pathway is focused on the social impacts as well as the affected stakeholders. Impact pathway is a complicated structure that defines the links between social issues (inventory indicator) and social damages (damage category) through social impact categories (impact category, Fig. 3). These links are mixed. For example, forced labor is an issue within social impact categories of both working environment and human rights, hence forced labor is associated with two impact pathways. Forced labor is both a worker issue and a community issue, so the stakeholders are workers and citizens who would be damaged by forced labor. These two social impact categories are all associated with damage categories of

both anxiety and autonomy. There are several pathways or links from forced labor to autonomy and anxiety. The estimation of QALY needs both the identified damage categories and number of stakeholders who will be affected by the identified categories. Impact pathway is the key for estimation of QALY. For impact pathways, Weidema (2006a, b) suggested identifying the social issues before identifying damage categories because of the lack of an accepted impact pathway. Practitioners could define their conclusive and informative damage categories based on the identified social issues.

3 Case Studies

While the methods discussed in Sect. 2 are widely used, unified rules for SLCA do not exist. Here, we provide briefs on four additional SLCA case studies that show how SLCA is applied in the real world.

3.1 Palm Oil Biodiesel

Manik et al. (2013) assessed the palm oil biodiesel system in Indonesia. As a product-/site-specific study, the input data was acquired from stakeholder surveys/questionnaires (Table 1). Four groups of stakeholders were involved in the surveys and were asked for their social expectations and social perceptions of social issues in the product system using a seven-point Likert scale.

The impact categories were selected and identified according to the guidelines of the UNEP/SETAC (2009). A scoring process was done by experts in the palm oil

Table 1 Issues under social impacts of human rights (modified from Manik et al. 2013)

Human right ($Factor_1$ = 0.6)		$Factor_2$	Score	$Factor_3$
1	Respect for cultural heritage and local wisdom	0.28	7	0.168
2	Respect for customary right of indigenous people	0.12	3	0.072
3	Community engagement	0.24	6	0.144
4	Safe and healthy living condition	0.2	5	0.12
5	Transparency on social/environmental issues	0.16	4	0.096

Note

$Factor_1$: Factor of human right that is estimated by the scores on human rights given by experts in the palm oil industry

$Factor_2$: Factor of each issue under human right is estimated by the score on subcategorical issues of human rights given by experts in the palm oil industry. (i.e., $Factor_2 = Score_i/\sum Score_i$, $0.28 = 7/(7 + 3 + 6 + 5 + 4)$)

$Factor_3$: Factor is calculated as $Factor_1 \times Factor_2$

Score: Scores are given by workers as stakeholders

industry to number the importance levels of relevant social issues from other social impact categories. During the scoring process, the expert would first give a score—from 0 to 7—to a social issue based on its importance (0 is not important, 7 is the most important). The stakeholders of the biodiesel system in Indonesia were identified as customers, social communities, and workers. They scored the subcategorical issues of each impact category from 0 to 7. In this case study, 24 social issues in 5 impacts are identified, based on the guidelines of the UNEP/SETAC (2009). The five social impacts are human rights, working conditions, cultural heritage, socioeconomic repercussions, and governance. An example of the subcategories are human rights which is in Table 1.

Each impact category was given a factor based on the scores by the experts. The total of all factors for the five social impact categories is 1, and a higher factor value indicates a more important social impact category. For example, if the average scores for five social impacts are 5, 6, 3, 4, and 7, the factors for the five impacts will be 0.2, 0.24, 0.08, 0.16, and 0.32 (i.e., 5 + 6 + 3 + 4 + 7 = 25, 5/25 = 0.2, 6/25 = 0.24, 3/25 = 0.12, 4/25 = 0.16, 7/25 = 0.28), respectively. Every subcategorical issue can also be estimated based on its score, with the sum of the factors of all subcategorical issues of a social impact category being equal to 1. The estimate of the factoring process is the same as the social impact. Factors of social impacts explain the importance of a social impact to all social impacts, while the factors for subcategorical issues explain the importance of a subcategorical issue to its social impact category.

The factor for each social issue was transferred to a new factor by multiplying the factor of a social issue by the factor of its social impact. The new factor, then, will explain the overall importance of a social issue to a product (Table 1). There are five issues in the social impact category of human rights; these scores, given by workers who are in a category of stakeholders, are 7, 3, 6, 5, and 4. The factors of those issues are 0.28, 0.12, 0.24, 0.2, and 0.18, which are the importance of each subcategorical issue to human rights. If the factor of human rights is 0.6 (i.e., the importance of human rights to all the social impacts), one can calculate the importance of each subcategorical issue to the overall issues by multiplying each issue's factor by the human rights factor. The factors of overall importance for the five subcategorical issues are 0.168, 0.072, 0.144, 0.12, 0.096 (i.e., 0.168 = 0.28 × 0.6, 0.072 = 0.12 × 0.6, 0.144 = 0.24 × 0.6, 0.12 = 0.2 × 0.6, 0.18 = 0.18 × 0.6, Table 1).

The factors in Manik et al. (2013) reflect the importance of every identified issue for the whole palm oil biodiesel system. The hotspots of some social issues can be disclosed from those factors. It is an effective tool for identifying the serious social issues within the product's value chain for each stakeholder, based on site-specific data. This methodology can only be used to generate mid-point indicators for SLCA, since the factor here is a scenario-based relative value that cannot be used for comparison of social impacts among different industries (versus an endpoint indicator, applied in Norris and Weidema).

Both Manik et al.'s (2013) and Dreyer et al.'s (2010) SCLAs are based on multi-criteria indicator models and company-specific data; the palm oil's SLCA

introduced a more subjective scoring process into the survey. The experts in the palm oil method would introduce biased judgment of the importance for every impact category, which Dreyer et al.'s SLCA did not.

3.2 The Tourism Industry in Italy

An interesting SLCA on the social impacts of an accommodation facility was conducted in Italy. The authors found that even though Italy shows significant development in sustainable tourism, the social aspects of sustainability still need improvement according to the data obtained from available social accounting and business management sources (Arcese et al. 2013). The questionnaires were prepared to retrieve first-hand data, which consisted of open-ended questions about responsible social behaviors to protect sustainable tourism (Table 2). The authors evaluated the social impacts as "positive" or "negative," and reported the negative social issues to be eliminated (Table 3).

Three impact categories based on the UNEP/SETAC guidelines were used in Arcese et al. (2013), including workers, customers, and the local community. The subcategorical issues for these impact categories were selectively chosen, including forced workers, working hours, fair salaries, and social benefits, while other indicators, such as health and safety, were not included. The justifications for the selection/exclusion of subcategories seem weak in this SLCA, probably because it is difficult to get theoretical support for the SLCA, especially in the service industry. In the Italian tourism SLCA study, the authors selected the impact category by asking if the Italian tourism industry performed sustainably for human well-being. Although the fixed impact categories for every product do not exist, practitioners can define the detailed purpose for their SLCA in order to choose the relevant impact categories.

Table 2 Questions in the survey about sustainable tourism (modified from Arcese et al. 2013)

Stakeholder theory	Questions
Workers	1. How many people are engaged?
	2. How many hours a day are usually dedicated to the company?
	3. Which type of collaboration agreement do workers have?
	4. What is the average hourly salary?

Table 3 The impact assessment results (modified from Arcese et al. 2013)

Category	Subcategory	Meet the standard?	Impacts	Standard
Workers	Fair salary	Yes	Positive	€7/hour
	Social benefit	Partially	Negative	Health insurance and pension

This study differs from the product-based studies because the SLCA object is a service (i.e., accommodations facilities). Here, the functional unit was defined by the temporal tourism facilities instead of a mass-based product (Arcese et al. 2013). No quantitative result was presented per functional unit because the authors aimed at identification of the social issues. They analyzed data from a questionnaire based on the guidelines of SLCA. This study seems to be a good example of identifying the negative impacts on the industry without reporting the results of SLCA, probably because the definition of the functional unit for a service is very complicated. As with many SLCA publications in the literature, this study also focused on data collection rather than a comprehensive report of SLCA results.

3.3 Recycling Systems in Low-Income Countries

Aparcana and Salhofer (2013) developed an SLCA to examine the recycling systems in low-income countries such as Peru. As a product-/site-specific study, most of the data was site-specific through interviews of the dominant stakeholders who were involved in municipalities. They assigned 1 or 0 to each indicator for the fulfillment or non-fulfillment of the social compliance criteria (Table 4). The social compliance criteria were referred to as the responsible behaviors to prevent the social issues (e.g., no exploration of child labor, no exploration of forced labor, etc.). Each social issue was associated with a relevant social indicator (e.g., child labor was indicated by the behavior of compliance with the rule of no child labor in the workplace). The social impacts were quantified by subcategorical issues (e.g., human rights by child labor, discrimination, and freedom of association). The average score for each indicator was calculated as the proportion of stakeholders affirming fulfillment of the criterion, and the score of each indicator as 1 (if the proportion was over 50 %) or 0. Furthermore, the social impact score was 1 only if

Table 4 Impact assessment methods (of Aparcana and Salhofer 2013)

Social impact category	Social impact subcategory	Indicator	Result at subcategory level			Results at indicator level	
			Formalization approach (operated by the municipality)	Formalization approach (cooperation with recyclers associations)		Formalization approach (operated by the municipality)	Formalization approach (cooperation with recyclers´ associations)
			Recycling system Santiago de Surco	Recycling system San Vicente de Cañete	Recycling system Colca Valley	Recycling system Santiago de Surco	Recycling systems San Vicente de Cañete and Colca Valley
Human rights	Child labor	No child labor	1	1	1	1	1
	Discrimination	Formal policy against discrimination	0	0	0	0	0
		No income differences between women and men	1	1	1		
	Freedom for association and collective bargaining	Presence of collective bargaining	0	1	1	0	1

all of its subcategorical indicators were 1; it was 0 if one or more indicator was 0. The aggregation method is presented in Table 4 by the solid and dashed lines. There are three social impact categories: human rights, working conditions, and socio-economic repercussions. Here, we use the impact category of human rights and its subcategorical issues and associated indicators as a demonstration of the methods (Table 4).

3.4 Polyethylene Terephthalate Bottles (PET)

Foolmaun and Ramjeeawon (2013) established an SLCA to compare different End-of-Life (EoL) scenarios for polyethylene terephthalate (PET) bottles in the Republic of Mauritius. This study compared various disposal methods in alternative PET bottle use from ELCA and SLCA perspectives. We focus, here, on the SLCA methods. The product- and site-level data were collected through surveys/questionnaires. The methods for selecting the social impact categories are the same as Aparcana and Salhofer's (2013, Table 4). The questionnaires used in the interviews were prepared in simple language involving "yes/no" types of questions and were delivered to stakeholders, including scavengers, landfill workers, incinerator workers, and flake-producing industrial workers. The qualitative interview data with "yes" or "no" answers was converted to qualitative percentage data following Aparcana and Salhofer (2013) by a single score (0–4, according to the percentage; 0 means 0 %, 1 means 25 %, 2 means 50 %, 3 means 75 %, 4 means 100 %). For example, if 55 % of the interviewed stakeholders answered "yes" to the question "Are you satisfied with your wages?", it would receive a score of 2. The scores of every issue were summarized for different EoL scenarios. According to the UNEP/SETAC guidelines, three stakeholder categories (i.e., worker, society, and local community) and eight subcategories (child labor, fair salary, forced labor, health and safety, social benefit/social security, discrimination, contribution to economic development, and community engagement) were identified as relevant for the studied system. This study used data collection methods similar to those of Aparcana and Salhofer (2013), and it entailed more score levels during the aggregation for the impact assessment (i.e., score of 0–4).

4 Conclusions

The traditional LCA model, based only on a functional unit, looks at a specific product chain and disregards other unit processes that occur in the same company, while SLCA advances the field to include social impacts. Social impacts are directly related to the behavior of a company instead of the function delivered by a given product. One solution to quantify social impact is to figure out the impact pathway, but the development of impact pathway can introduce some bias to the LCA

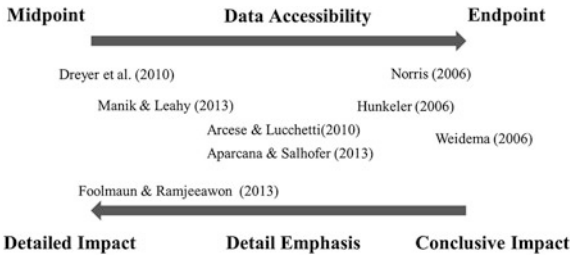

Fig. 4 The strengths and weaknesses for all SLCA methodologies in this chapter

because the causal relationships in social impact pathway is based on the goal SLCA. Meanwhile, SLCA is flexible because it is a tool for decision-makers who choose their concerned impacts or issues according to their business strategies and goals. For people who are looking for a conclusive social impact indicator, methods proposed by Norris and/or Weidema and Hunkeler seem suitable. For assessing the social impact of a specific issue or location, Dreyer et al. (2010) and the industry-oriented methodologies are appropriate. There seems to be a preference for end-point methodologies with more data accessibility than the midpoint approaches. We also noticed that data acquisition is much easier if one puts less emphasis on the details of social impacts (Fig. 4).

For ELCA, functional units are often aggregated through the entire product chain. Multiple hotspots could be identified for each life cycle stage; thus, one can have detailed information on which life cycle stage has the most significant environmental impact. For SLCA, one should consider whether the impacts distributed evenly among life cycle stages (e.g., aggregating impacts from different upstream/downstream suppliers/users in different locations) or identified and weighted by site (e.g., if a product is distributed and used in locations A, B, and C and also disposed of in the local landfills of A, B, and C). For example, assuming that a landfill in A is close to a community and notorious for its foul odor in the neighborhoods, while B and C have no adverse impacts, the social impacts are thus relatively more negative in A than those in B and C. When final scores are calculated using functional units, they may fail to report the importance of air pollution in A. This suggests that SLCA is required by location in addition to ELCA efforts.

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Socioeconomic LCA of Milk Production in Canada

Jean-Pierre Revéret, Jean-Michel Couture and Julie Parent

Abstract Over the years, the agricultural sector, and the livestock and dairy sectors in particular, have been increasingly criticized for their environmental impacts, especially with regard to greenhouse gas emissions. At the same time, there has been a growing awareness that farm activities equally induce significant social and economic impacts over a wide range of stakeholders. In order to face the new challenges arising from this context and to clarify the path towards sustainable milk production in Canada, the Dairy Farmers of Canada (DFC) commissioned the

AGECO is a Quebec (Canada)-based consulting firm established in 2000 as a spin-off from Laval University in Quebec City by a group of professors well recognized in Quebec and Canada in the domain of socioeconomic analysis applied to the agrifood sector, natural resources, and the environment. AGECO performs impact assessment studies, policy and regulatory analyses, socioeconomic studies, surveys, structural analyses, studies of management tools as well as strategic channel planning. First and foremost, AGECO is a team trained in economics and the social sciences, specializing in agrifood, and natural and environmental resources. The team is known for its ability to understand the socioeconomic, political and strategic situations. Over the last 5 years, AGECO has developed expertise in SLCA, both in theory and practice.

The Interuniversity Research Centre for the Life Cycle of Products, Processes, and Services (CIRAIG) was founded initially by the École Polytechnique de Montréal, in collaboration with the Université de Montréal and HEC Montréal. The CIRAIG was created to meet the demands of industry and governments to develop leading-edge academic expertise on sustainable development tools. The CIRAIG now includes a team from the Department of Strategy, Social and Environmental Responsibility that is located within the School of Management Sciences of the Université du Québec à Montréal (UQÀM). This team deals specifically with the social and socioeconomic dimensions of life cycle assessment. The CIRAIG is the only university research centre on life cycle in Canada; it is also one of the largest internationally. It hosts the International Life Cycle Chair, supported by 14 industrial partners.

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realization of a Social and Environmental Life Cycle Assessment (SELCA) of Canadian Milk. Launched in 2010, this project, which ended in September 2012, was conducted as part of the Dairy Research Cluster. The study was conducted by three partners, two consulting firms (Groupe AGECO and Quantis) and a research center (CIRAIG), based at the Montreal Polytechnic, with a section dedicated to socioecomic life cycle assessment based at the University of Quebec in Montreal. It aimed at providing a comprehensive assessment of the Canadian milk production sector with respect to sustainability. The main deliverables include an environmental profile of the average kilogram of milk produced in Canada, as well as an evaluation of the socioeconomic performance of the Canadian dairy sector. This chapter addresses the social and socioeconomic dimensions of the global project. It presents the methodological choices made, such as combining a specific analysis and a potential hotspots analysis (PHA) for two parts of the system under study. It then presents the economic contributions of the Canadian dairy sector, which has generated over 127,000 direct, indirect and induced jobs in 2009, contributed approximately $7.2 billion to the national GDP, and procured almost $1.4 billion in total tax revenue. Canadian dairy farmers are also corporate citizens whose behaviors—individually and collectively—impact their stakeholders. This SLCA provides a detailed picture of this socioeconomic performance. It appears from this assessment that the Canadian dairy farms perform positively overall. The dairy farmers' engagement towards their local communities is significant, with the vast majority involved in their communities in many different ways. However, more could be done in terms of cohabitation, with producers adopting practices minimizing the spreading of odors, for example. The picture is also contrasted with regard to farm workers. Although dairy farmers provide overall working conditions that go beyond labor standards—to which they are mostly not legally subjected—there is room for improvement regarding various issues, such as professional training and communication of working conditions. The same holds true with respect to their suppliers and business partners, given that a majority of dairy producers do not usually consider their suppliers' performance in regards to social responsibility in their procurement decisions.

Keywords Milk production · Social LCA · Socioeconomic · Dairy farmers of Canada · Performance reference points · Hotspots · Specific analysis · Stakeholders · Impact categories

1 Introduction

In an effort to clarify the path towards sustainable milk production in Canada, the Dairy Farmers of Canada (DFC), through the Dairy Research Cluster, a part of the Canadian Agri-Science Clusters Initiative of Agriculture and Agri-Food Canada (AAC), commissioned an environmental and social life cycle assessment (SLCA) of Canadian milk. This study was carried out by Quantis Canada, AGECO, in collaboration with The Interuniversity Research Centre for the Life Cycle of Products, Processes and Services (CIRAIG), and the results were published in 2012 (Quantis Canada, Ageco and CIRAIG, 2012, Environmental and Socioeconomic Life Cycle Assessment of Canadian Milk, DFC, 285 pages). This project is the basis of the case study that we are presenting in this chapter and, as we will see, there was an exploratory dimension in the objectives as it was the first time that the DFC were commissioning an LCA, and, furthermore, an integrated environmental and socioeconomic LCA.

The project's objectives were threefold:

(1) To evaluate the environmental and socioeconomic impacts of dairy production in Canada;
(2) To identify potential areas of focus for further improvements of the dairy sector's sustainability; and
(3) To provide the framework and the building blocks to support comparison and benchmarking (in reference to milk production in other countries, for example).

The results of this environmental and socioeconomic life cycle assessment were meant to be used by DFC for decision-making at a macro level, but also for communication purposes with all stakeholders (dairy farmers, policy makers, processors, consumers, media, etc.). The results will also serve as a basis for the sustainability agenda of the farmers' association.

This initiative took place within a context where many relevant actors of the industry have been active on the international scene. At the international level, the International Dairy Federation (IDF) promotes the sustainable production of milk and milk-based products through its Dairy Sustainability Framework and the production of a methodology for the lifecycle assessment for the dairy sector.

Many associations of milk producers and governments have already reported the results of LCAs of milk production, including the European Dairy Association, which commissioned a carbon footprint across the EU dairy sector (Sevenster and De Jong 2008), as well as the Swedish Dairy Association, the Australian Dairy, and the US Dairy Management Inc. In France, an upcoming policy towards environmental labelling of products under the "Grenelle Environment Forum" has accelerated the implementation of LCA in various consumption products, including food and dairy. Furthermore, the FAO also completed a carbon footprint in 2010 with a global perspective over the entire supply chain, and there is a continuous process

for improvement in place. Because of the wide scope of the study however, numerous assumptions and generalizations were needed.

Companies having performed and communicated on LCAs of their dairy products include Danone in France, Arla in Sweden and Denmark, Fonterra in New Zealand through a national investigation (Lundie et al. 2009), Aurora Organics in the US in 2007, and Cadbury in England in 2008. In Canada, Liberté has been active in LCA for many years and publishes information on their Web site (Liberté 2012). These studies are sometimes limited to a few farms only, which does not imply a small herd, as the Aurora Organics study involved six farms only and a total herd of close to 12,000 cows.

However, there is little to no literature surveying the social or socioeconomic aspects of sustainability in dairy. The need to do so has been noted in certain documents, such as in the Life Cycle Initiative Program for the United Nations (Grießhammer et al. 2006) and the IDF review of literature, which noted that "Future research will possibly enable inclusion of social issues in LCA to create a new impact category. The social conditions of workers could be accounted for at farms as well as dairies or retail phase" (IDF 2009).

This chapter is directly derived from the full report, with a formal authorization of representatives of the DFC, but it will concentrate only on the social and socioeconomic LCA part of the study. In particular, we wish to stress that all tables and figures come from the report and therefore are not referenced individually to this report (For a detailed presentation of the environmental LCA and the socio-economic LCA, please refer to the full integrated report at http://www.groupeageco.ca/PLC_EnvironmentalAndSocioeconomicLCA_FullReport.pdf).

After this introduction, the chapter is divided into four main sections. In Sect. 2 we consider a series of definitions related to SLCA and qualify the approach selected for the study. This will expectedly cover the boundaries, the system under study, and the assumptions made in defining the approach. Then we present the two different types of analysis that we will use for two components of the Canadian Milk Production System. First, the "specific analysis" that will apply to the farm level, for which we have gathered primary data (Sect. 2.2). Then we will present the various stakeholder categories used and the impact of the categories that we considered for these different stakeholders, continuing with the impact assessment methodology and the data collection process. Secondly, in Sect. 2.3 we deal with the generic part of the study—that is, the potential hotspot analysis. The same elements will be considered in this subsection as that in the previous one. In Sect. 3 we present the results of both assessments and discuss them as well as the challenges met in the study in Sect. 4. Section 5 deals with the main conclusions and possible future steps.

2 Social and Socioeconomic Life Cycle Assessment: Definition and Approach

SLCA is a "technique that aims to assess the social and socioeconomic aspects of products and their potential positive and negative impacts along their life cycle" (UNEP/SETAC 2009, p. 37). The main features of this tool are its broad scope, which encompasses a product's entire life cycle, and its assessment method, which relies on benchmarks to assess the relative social performance of the organizations (private, public, or non-profit) involved in the product's life cycle.

The SLCA methodology relies on the recently developed *Guidelines for Social Life Cycle Assessment of Products* (hereinafter the Guidelines). Published in 2009 by the United Nations Environment Programme (UNEP) in collaboration with the Society of Environmental Toxicology and Chemistry (SETAC), these Guidelines provide the general framework needed to conduct such an assessment.

The Guidelines propose a classification of the main socially significant themes to assess, as well as a categorization of the main stakeholder categories potentially affected by the socioeconomic impacts induced by the activities and behaviors of the organizations involved in the product's life cycle. Six main impact categories are listed in the Guidelines, each one related to a number of impact subcategories, or specific issues of concern, which are "socially significant themes or attributes" to assess (UNEP/SETAC 2009, p. 44). These impact categories are: human rights, working conditions, health and safety, governance, cultural heritage, and socio-economic repercussions. As for the stakeholder categories, the Guidelines list the following five groups: workers, local communities, society, consumers, and value chain actors.

In addition to this general framework, the Guidelines also specify the steps to follow and the requirements to fulfill in order to conduct a rigorous and transparent assessment. However, the Guidelines are a work in progress towards the elaboration of a comprehensive assessment framework. Adaptations are admittedly needed in order to perform an SLCA (UNEP/SETAC 2009, p. 82). For instance, the Guidelines do not define any particular assessment methodology, so it was necessary to develop an "assessment framework," compatible with the Guidelines in order to perform the SLCA of milk production in Canada. The following sections thus describe this framework and present the methodological underpinnings on which it is based. When needed, the adjustments made to the general framework provided by the Guidelines are discussed.

The first step of an SLCA aims to describe the intended application and the reasons for carrying out the study (goal) and to define its depth and breadth (scope). As highlighted in the Guidelines, "the ultimate objective for conducting an SLCA is to promote improvement of social conditions and of the overall socioeconomic performance of a product throughout its life cycle for all of its stakeholders" (UNEP/SETAC 2009, p. 50). This is also the project's main objective: assessing the socioeconomic performance of the Canadian milk production sector and identifying

potential social hotspots to provide some recommendations in order to improve the system's overall socioeconomic performance towards its stakeholders.

As for an ELCA, this implies identifying the functional unit, the product system, and its boundaries (UNEP/SETAC 2009, pp. 51–57). The UNEP/SETAC Guidelines do not provide any particular direction on how the scope of an SLCA should be adapted to fit that of an ELCA when both assessments are conducted together. It is acknowledged, however, that given the SLCA's specificities, the scope might not necessarily be the same or totally integrated.

As the objective of the Canadian Dairy Farmers is to study not only the production of the milk but also its transportation at the gate of the processing facility, excluding the transformation, the functional unit for the ELCA part of the study is:

1 kg of fat and protein corrected milk (FPCM) from a Canadian farm, to the processing facility

We used it for the SLCA as well as for the sake of similarity in the development of the two components—social and environmental—of the project.

2.1 Boundaries and Assumptions

For the purposes of this analysis, the system was grouped into five principal life cycle stages, as presented in Fig. 1.

(1) Feed Production: includes manure spreading, pesticide and fertilizer production and spreading, any energy required (diesel) for field manipulations, irrigation water.

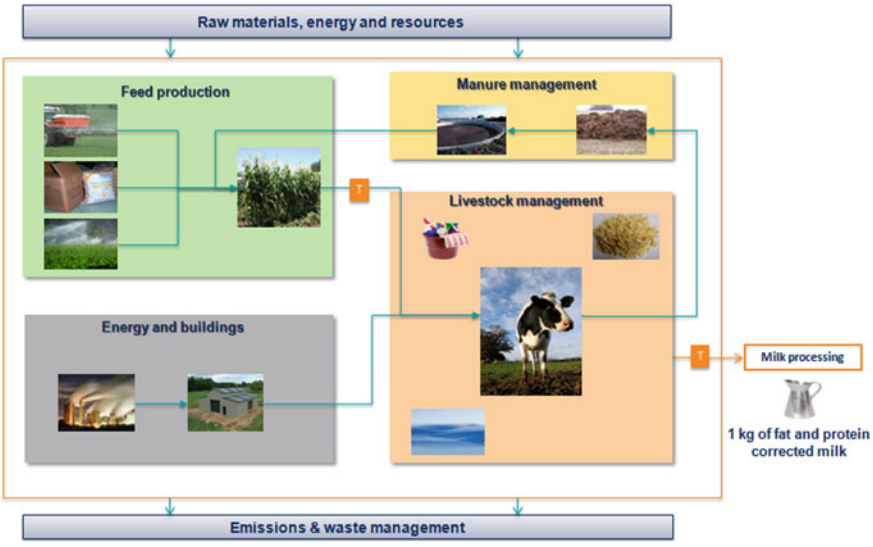

Fig. 1 Life cycle system

(2) Livestock Management: includes bedding, drinking water, milking equipment, cleaning products and water, ammonia emissions from housing, and methane emissions from enteric fermentation.
(3) Manure Management: limited to emissions of nitrous oxide, methane and ammonia from storage.
(4) Energy and Buildings: includes electricity for dairying, cattle housing and milk parlor equipment and buildings, and gasoline for regular operations.
(5) Transportation: includes only purchased feed transportation, purchased animal transportation and raw milk transportation to processor.

Within each of these stages, the LCA considers all identifiable "upstream" inputs to provide as comprehensive a view as is practical of the product system. For example, when considering the environmental impact of transportation, not only are the emissions of the truck considered, but also included are the impact of additional processes and inputs needed to produce the fuel, as well as truck and tire manufacturing. In this way, the production chains of all inputs are traced back to the original extraction of raw materials, within feasible limits.

However, the product system differs slightly between an SLCA and an ELCA, firstly in its constituting parts: Since an SLCA primarily focuses on the behavior of the organizations involved in the product's life cycle, an SLCA product system is made of those organizations, organized in value chains, rather than by the processes they perform as in an ELCA. Secondly, it differs in its scope: For a matter of simplification and access to data, the scope of an SLCA product system is usually circumscribed to include only the most important and relevant value chains and organizations, where the product system in ELCA is more exhaustive and usually extended until no more exchanges are made between processes inside the technosphere.

Hence, the definition of an SLCA product system first requires identifying the organizations involved in each value chain included in the product's life cycle. In an SLCA perspective, a value chain can be defined as a set of businesses located whether upstream or downstream of an organization, providing the inputs and services needed for the production and the marketing of the product under assessment. Then, depending on the objectives of the project, criteria are set to delimit the scope and the range of the system under study.

The above considerations have been taken into account to specify the product system used to perform this SLCA of milk production in Canada. Based on the information provided by the Milk Cost of Production Database,[1] it was possible to define the main value chains involved in milk production according to the inputs

[1] The milk CoP database is a sample of farms (stratified by region and size and randomly selected to represent the population) used by provincial Dairy Boards and the CDC each year to establish the cost of production of 1 hl of milk. The P5 database (Quebec, Ontario, Maritimes) is supervised by AGECO.

and services they provide to the dairy farms.[2] Given the vast array of inputs and services involved, decisions were made to further circumscribe the scope of the system. First, inputs related to farm buildings are excluded from the system, because this group of expenses is related to various kinds of tools, materials and services of low individual significance. Cow replacement is also excluded, given that these animals are generally traded among dairy farmers. Items only related to services, such as salaries, joint marketing plan management fees and field equipment maintenance expenditures, and those not directly associated to milk production, such as interest fees and taxes, are also excluded. Although milk transportation is a service, it is left within the system since it is part of its scope. Finally, it was decided to exclude "electricity" from the system and to include "pesticides," although it accounts only for 0.4 % of the average total cost. These choices are justified by the fact that electricity is a relatively minor and non-agricultural input from which suppliers are globally disconnected from the agricultural sector (Parent et al. 2012), whereas pesticides are an economically and socially sensitive product primarily used in agricultural production. According to these choices, the following inputs and services are therefore included in the SLCA system:

- Animal feed
- Farm inputs (fertilizers, seeds, pesticides)
- Milk transportation
- Veterinary services (drugs and bovine semen)
- Agricultural machinery
- Fuel and diesel

Each of these inputs and services is provided to dairy farms via a specific supply chain composed of a number of steps (from extraction of raw material to final distribution). Each step involves a vast number of businesses producing products or providing services. In order to simplify the system, cut-off criteria have also been used to limit the length and complexity of each of these value chains:

- For each value chain, only one to two representative inputs or services have been considered at each step, according to their relative importance at this step.
- The range of each value chain was extended, as long as it was possible to trace back a main input or service used in the production of the previous product or service.

Figure 2 shows the product system selected for the SLCA study. First tier suppliers, i.e., businesses or value chain actors directly interacting with dairy farmers for advice or commercial purposes related to the selected inputs, are shown to the left of dairy farms. They include advisers or representatives, such as feed and farm inputs dealers, whether or not affiliated to specific companies involved in the

[2] While part of the socioeconomic system in which the milk production sector and its business partners operate, the institutional, sectorial, social and political organizations or associations operating with and around the economic actors involved in milk production are excluded from this system.

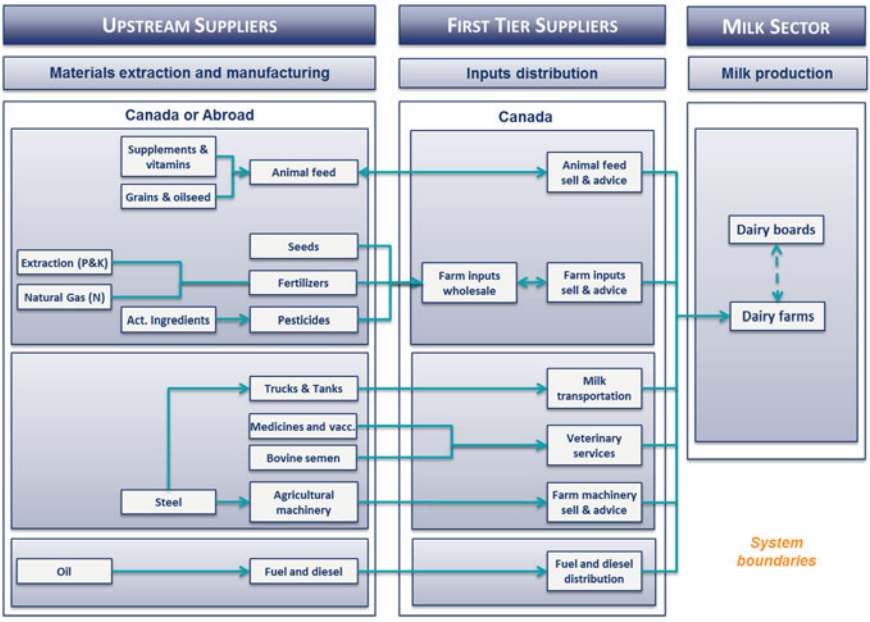

Fig. 2 Product system of the Canadian milk production

production or the handling of some inputs. Upstream are listed the selected inputs sold to dairy farmers (or used to supply the services) and the main auxiliary inputs needed to produce them. Taken together, these inputs, auxiliary inputs and the companies producing and handling them, shape the product system considered to perform this SLCA.

Although the aim of an SLCA is to provide, for a given product, a profile of the socioeconomic performance of the organizations involved in its entire life cycle, the assessment's degree of details can vary across the system. It is not always readily possible, necessary or even relevant, to assess in detail the behavior of all the organizations throughout the life cycle of a product. While practical constraints such as data limitations, short delays or budget restrictions can impede in-depth analysis, the assessment's focus is generally determined by the intended applications of the SLCA results by the commissioner (Parent et al. 2012).

In the case of this study, the objective of the SLCA is to give a socioeconomic profile of the product system with an emphasis on the Canadian milk production sector. Therefore, the socioeconomic performance of the Canadian dairy farms and their sectorial organizations are assessed through a specific analysis—which provides a high level of details on their degree of social responsibility based on the compilation of primary data collected on-site.

For the rest of the product system, a potential hotspots analysis (PHA) is performed—which offers an overview on the possibility of encountering risky

behaviors among the supply companies/sectors based on the compilation of generic data collected from international and national databases, the Social Hotspots Database (SHDB), human rights reports, etc.

2.2 The Specific Analysis

The aim of the Specific Analysis is to provide a detailed analysis of the socio-economic performance of a particular company/organization/sector by assessing its degree of social responsibility toward its stakeholders. Given the focus of this project, the Specific Analysis approach is used to assess the socioeconomic performance of the milk production sector in general, and of the dairy farms and dairy organizations in particular.

Because of the structure of the Canadian milk production sector, which involves about 13,000 dairy farms across Canada that are provincially and nationally organized, the assessment addresses more specifically the socioeconomic performance of the sector at three different levels—since the behaviors and practices encountered at each level do not necessarily affect the stakeholders in the same way or do not relate to the same issues of concern. The three assessment levels are:

- *Dairy farms level*. The dairy farms are at the center of the assessment. Their behavior and practices affect mostly the farm workers, the local communities where they are located, and their suppliers.
- *Dairy boards level*. All across Canada, dairy farms are organized in provincial dairy boards performing the administrative, marketing and communicative tasks assigned by the dairy farmers. By fulfilling these tasks, those organizations induce impacts on different stakeholders.
- *Sector level* Milk production takes place in a legal and institutional framework that shapes most of the sector's characteristics, which in turn have significant implications on the entire sector's stakeholders. Whereas this particular framework is not necessarily specific to the milk production sector, or dairy producers directly accountable for it, its implications still have to be assessed as producers have the ability to act upon it together.

In this chapter we will only present the detailed methodology and results for the dairy farm level, but neither for the dairy board nor sector levels.

It is important to stress that the SLCA approach in general, and the Specific Analysis in particular, exclusively addresses the relationships between a business/organization and its stakeholders, the former being the one inducing the socio-economic impacts—positive or negative—on the surrounding groups of individuals. Accordingly, the impacts experienced by the dairy farmers or the dairy boards resulting from their own behavior are not addressed by this framework. Rather, the assessment framework assesses the degree to which the Canadian dairy farmers and dairy boards behave in a socially responsible manner towards their stakeholders.

2.2.1 Stakeholder Categories

Formally, stakeholders are "those groups and individuals that can affect, or are affected by, the accomplishment of organizational purpose" (Freeman 1984 cited by UNEP/SETAC 2009, p. 47). As pointed out earlier, the UNEP/SETAC's Guidelines proposes a list of five main stakeholder categories potentially impacted by the life cycle of a product. These are the workers, the local communities, the society, the consumers, and the value chain actors. However, depending on the study's boundaries and the sector's particularities, it is possible to add, to exclude, to differentiate, or simply to define more precisely the proposed categories to get a clearer description, at each step of the value chain, of the stakeholders involved (UNEP/SETAC 2009, p. 46).

Given the scope of this study and the focus of the Specific Analysis, such adaptation of the basic stakeholder categories was necessary. The "consumers" category (seen as the "people who buy milk in different forms from a retail store") was hence excluded from the framework. The issues of concern potentially affecting consumers have instead been assessed in relation with the "value chain actors" category, since raw milk is the main input used by dairy processors to elaborate the dairy products sold to consumers. The other four stakeholder categories adequately cover the various groups of individuals potentially impacted by milk production activities, as shown by a review of the existing literature. Based on the results of several focus groups conducted in the first stages of the study, each stakeholder category has been defined in more detail (Table 1). Given that the Specific Analysis was exclusively conducted on the dairy farms and their boards, the categories have been adapted only to the individuals impacted by dairy activities.

2.2.2 Issues of Concern or Impact Subcategories

Impact subcategories are the "socially relevant characteristic or attribute to be assessed" in an SLCA (UNEP/SETAC 2009, p. 71). Based on international agreements (conventions, treaties, etc.), the guidelines already propose a list of internationally recognized impact subcategories, each being related to a specific stakeholder category. While most of the listed impact subcategories are relevant in a Canadian context, some of them, such as "delocalization and migration" or "prevention of armed conflicts," are not necessarily relevant.

In order to encompass comprehensively the issues of concern related to milk production in Canada, and as allowed by the guidelines, the list of subcategories was justifiedly adjusted on the basis of a review of the existing literature, experts' opinions, and the results of three focus groups conducted among the sector's stakeholders.

Table 2 presents the impact subcategories chosen for the study. Each one is explicitly defined to ensure a common understanding of the social issue it covers. These definitions do not necessarily follow those proposed in the methodological

Table 1 Definition of the stakeholder categories impacted by milk production activities of the Canadian dairy farms and their boards

Stakeholder categories	Definition
Workers	This category covers only farm workers that are not relatives of the producer (husband, wife, children, etc.). As business owners, the producer and his family members are not considered to be "workers," even if they work on the farms This category has been further subdivided into four subcategories of workers frequently working on farms (a) *Regular workers*: farm workers working at least 25 h/week, at least 40 weeks/year on the farm (irrespective of their particular occupation) (b) *Temporary foreign workers*: foreign workers hired to work on a farm for a temporary period of time through the Seasonal Agricultural Worker Program (SAWP) or the Agricultural Stream of the NOC C and D Pilot Project (c) *Young workers*: school-age individuals working on a farm (family included) (d) *Occasional workers*: local or foreign workers hired temporarily through the services of an employment agency
Local communities	Regardless of their geographic location, this category covers the individuals or groups of individuals directly affected by the milk production activities, i.e., neighbors, local and regional groups, surrounding populations, etc.
Society	This category refers to acknowledged social values upheld in a particular society by organizations such as provincial, national or international interest groups, government agencies, or the civil society as a whole
Value chain actors	This category refers to dairy farms' inputs and services suppliers (Fig. 2), but also indirectly to consumers, given that the Canadian milk production sector's efforts to provide dairy processors with high quality milk have an impact on "final" consumers

sheets published by the Life Cycle Initiative (LCI 2010), because they do not adequately describe the issues under assessment in this specific case.

A scale of assessment level is also specified, as some issues of concern relate primarily to dairy farm activities while some others relate rather to their provincial boards, or even to the milk sector as a whole. One issue of concern can be related to more than one level of assessment as well.

2.2.3 Impact Assessment Methodology

The impact assessment phase of an SLCA involves translating inventory data into measured impacts by aggregating inventory indicators within subcategories and comparing them against a so-called "performance reference point" (PRP)—or benchmark. However, as the Guidelines point out, "impact assessment methodologies are under development and SLCA is an open field for future research" (UNEP/SETAC 2009, p. 69). For instance, unlike the ELCA methodology, there is

Table 2 Impact subcategories according to the corresponding stakeholder categories

Stakeholder categories	Selected impact subcategories	Definition	Assessment level		
			Dairy farms	Dairy boards	Dairy sector
Workers	Working hours	Working hours are a major proxy of proper working conditions. Even if agricultural production is characterized by long work days and that most farm workers are not covered by labor standards, too many working hours per week can affect workers' welfare	X		
	Benefits	Government sets minimal norms regarding benefits and social securities. An employer can, however, offer improved conditions to his employees and their families	X		
	Salary and contribution to fringe benefits	Salary is a central component of working conditions. It should not be inferior to minimum wage, when required by law. If possible, it should be competitive compared to the sectorial average wages and be inflation-adjusted to protect workers' purchasing power. Other monetized benefits can also be provided to workers in addition to/or as a complement to the salary, such as bonuses for statutory holidays and premiums for overtime	X		
	Working conditions transparency	Good communication between the employer and the employees concerning working conditions is essential to build a fair relationship between the two parties	X		
	Freedom of association and collective bargaining	The growing numbers of non-family related workers on farms causes unionization to become an economic as well as a social issue in the agricultural sector. While challenging, this new issue needs to be addressed by provincial regulations to allow farm workers to assert their rights			X
	Health and safety	Farm workers should benefit from safe and secure conditions at their workplaces and have access to all the necessary resources to prevent incidents that could compromise their physical or psychological health	X		
	Professional accomplishment	Employees should benefit from a stimulating and rewarding workplace that allows personal and professional development	X		

(continued)

Table 2 (continued)

Stakeholder categories	Selected impact subcategories	Definition	Assessment level		
			Dairy farms	Dairy boards	Dairy sector
	Integration and/or discrimination (*for temporary foreign workers*)	There should be no significant and unfair discrepancies between the working conditions offered to temporary foreign workers and to regular farm workers			X
	Young workers employment	Working conditions of school-age workers should respect legal requirements and contribute positively to their development			X
Local communities	Community engagement	Through its implication and involvement in its community, a producer can foster local development and contribute to the creation of a harmonious environment with the community	X	X	
	Natural and built heritage	Farms can contribute to the beauty of the countryside through initiatives aiming at enhancing and protecting the natural and built heritage	X		
	Cohabitation (i.e., life quality)	Although nuisances such as noise, smells and dust inevitably arise from normal agricultural activities, farmers can minimize their impacts on local life quality by using different production methods and by informing the neighborhood before the most disturbing activities	X		
Society	Commitment to sustainability issues	Producers as well as their organizations can commit themselves in regard to sustainability by holding formal certifications	X	X	
	Agroenvironmental practices	Milk production can have a significant impact on the environment, depending on how producers manage the manure, use chemicals, and work their land. By adopting good agroenvironmental practices, they can minimize this impact	X		
	Contribution to economic development	This subcategory assesses to what extent dairy activities contribute to the economic development of the country by generating revenue and creating jobs			X

(continued)

Table 2 (continued)

Stakeholder categories	Selected impact subcategories	Definition	Assessment level		
			Dairy farms	Dairy boards	Dairy sector
	Technology development	This subcategory assesses whether the boards participate in joint research and development for efficient and environmental sound technologies		X	
	Animal welfare	As a growing number of consumers are becoming sensitive to the way animals are treated and require more humane treatment, animal welfare is becoming one major concern in the agrofood sector, especially at the production level	X	X	
Value chain actors	Responsible procurement practices	Purchasing decisions can be based on social and environmental considerations or criteria to ensure socially responsible procurement practices	X		
	Responsible supplier practices	As a supplier, dairy producers can adopt voluntary norms and certifications in order to supply the dairy industry with a competitive, yet high quality product	X		
	Promotion of social responsibility	This subcategory assesses to what extent dairy boards are committed and involved in initiatives and partnerships aimed at promoting social responsibility		X	
	Fair competition	Competitive markets in which a vast number of sellers and buyers interact freely usually constitute a safeguard to protect market actors as well as consumers against abusive market practices and non-competitive prices. This subcategory assesses to what extent the Canadian milk sector is characterized by fair competition			X

no characterization model allowing the translation of inventory indicators into socioeconomic impacts using quantitative models.

Although the Guidelines do not provide any particular indications or suggestions regarding the impact assessment methodology to use in an SLCA, this issue is extensively discussed in the socioeconomic impact evaluation literature (Burdge 2004; Burdge and Vanclay 1995; Chadwick 2002; Becker and Vanclay 2003). Our assessment methodology thus relies not only on this literature, but also on our expertise in this field.[3]

Most social assessment methods, including the SLCA methodology, rely on socioeconomic indicators to measure and assess the social and economic impacts induced on stakeholders by a particular activity. But as pointed out in the Guidelines, "several inventory indicators and units of measurement/reporting types may be used to assess each of the subcategories. Inventory indicators and units of measurement may vary, depending of the context of the study" (UNEP/SETAC 2009, p. 44). Indeed, there is no formal or universally acknowledged set of indicators to which one can refer to assess the socioeconomic performance of a particular product or company. To carry out a particular assessment, a specific set of indicators thus has to be developed according to the project's objectives and data availability.

Based on the multiple assessment frameworks suggested in the literature—many of which have been conceived to be used in an agricultural context—but also on expert judgments, a list of indicators has therefore been developed to assess the socioeconomic performance of the Canadian milk production sector. A four-level evaluation scale was created and they specify how each indicator can be declined practically, given the PRP used.

More specifically, these evaluation scales (Table 3) allow assessing, for a given issue of concern, the level of social responsibility of a dairy farmer.

A *risky behavior* is considered to be a hazardous practice that can cause significant damages or create serious problems to the concerned stakeholders. Given that most hazardous practices are forbidden by law, they are generally related to illegal behaviors. Yet, in some cases, it is possible to consider a particular behavior as risky (even if it is not illegal) insofar as it can potentially have serious and negative implications for the individual or group of individuals it concerns, compared to its potential benefits. This is, for example, the case with the "working hours" subcategory, as there is generally no legal limit to the length of the work week or legal standard relating to work overload in the agricultural sector. Allowing

[3] The dairy industry has been analyzed by AGECO from various points of view over the years and at different industry levels (farm level, processing activities, domestic and international dairy policies, etc.): supply system management, financial situation of Canadian dairy farms, dairy farm production costs, and labor problems at the farm and processor levels are some of the subjects that have been studied. New opportunities in marketing settings and dairy products marketing were also studied. AGECO has also animated a few years ago a reflection session within the Premium Milk Innovation project. Therefore, AGECO is familiar with each actor as well as with the stakes of the Canadian dairy industry on a national and international level.

Table 3 Specific analysis's behavior evaluation scale

Risky behavior	Compliant behavior	Proactive behavior	Committed behavior

a number of working hours beyond a certain threshold can, however, have negative implications for the workers' health and safety—irrespective of the fact that they agree to work them.

A *compliant behavior* refers to a normal and expected practice. It generally corresponds to a minimal legal requirement or simply to an absence of initiative or commitment in situations where it is not required. In other words, a compliant behavior means that the organization, while not acting in a socially irresponsible manner, is not especially socially responsible either.

The two other levels refer to behaviors that go beyond compliant or minimal expectations to tend toward more socially responsible behaviors. Depending on the issue and the PRP identified, a *committed behavior* is hence considered to be the most socially responsible practice a leading organization can reach, while a *proactive behavior* translates an in-between engagement; the business goes beyond legal requirement, but has not yet reached a leading behavior.

Of course, this classification is relative, as the PRPs used to determine whether a particular behavior is more or less socially responsible can evolve in time and place. In other words, today a committed behavior could become a minimal expectation in the future, or could be considered a desired behavior in another region. This evaluation scale is also dependent on data availability. In order to assess a particular behavior according to this four-level scale, it is necessary to have access to detailed information both to establish the PRPs and to assess the behavior itself.

Table 4 presents a selection of indicators used to assess the socioeconomic performance of dairy farmers, but all indicators developed are presented later in the results of the study. They are classified according to the stakeholder categories and the related impact subcategories. To ensure that the assessment framework is both clear and transparent, each indicator is detailed, using a standardized approach. First, a brief description of what each indicator measures is given; then, the PRPs—or benchmarks—against which the performance is assessed are specified (UNEP/SETAC 2009, p. 69).

As mentioned earlier, PRPs are acknowledged social standards, norms or practices used as thresholds to distinguish, among the observed practices or behaviors, those that are socially responsible from those that are minimally expected from the organization. One indicator can be related to several PRPs, such as a national or international minimal legal standard, a "best available practice," an average performance of a company or a group of businesses, etc. Given the Canadian milk production sector's particularities, the PRPs have mostly been selected according to minimal legal requirements, sectorial standards and average performance, as well as best expected practices based on our own expertise of the sector. The choice of each PRP is justified for each indicator.

Table 4 Selection of impact subcategories and the corresponding socioeconomic indicators per stakeholder categories documented at the dairy farm level

Farm workers			
Benefits			
Scope of the protection	Description	Number of social benefits provided to employees	
	PRP	AGECO (2010): list of the social benefits most commonly provided to farm workers (wage insurance; health insurance; life insurance; pension plan contribution; paid sick days; unemployed insurance; in kind)	
	Justification/ commentary	Each benefit is counted individually even if they are provided in a collective insurance scheme	
	Evaluation scale	■	–
		□	The producer provides only the minimal legal requirements to its employees
		▨	The producer provides enhanced social benefits to its employees and their families in at least one of the listed categories
		■	The producer provides enhanced social benefits to its employees and their families in more than one of the listed categories
	Justification/ commentary	Provincial labor standards define socially accepted working conditions that should be minimally guaranteed to employees. Even if farm workers are frequently excluded from most provisions, they are still relevant benchmarks to consider. The provincial median hourly wage in the agricultural sector is another relevant benchmark to compare with the salary paid to dairy farm workers (regardless of the other premiums or benefits paid or provided)	
	Evaluation scale	■	The average hourly wage of regular workers < the provincial legal minimum wage rate
		□	The average hourly wage of regular workers is = the provincial legal minimum wage rate
		▨	The average hourly wage of regular workers is > the provincial legal minimum wage rate, but ≤ the provincial median hourly wage
		■	The average hourly wage of regular workers is > the provincial median hourly wage rate in the agricultural sector
Farm workers Working conditions transparency			
Communication of working conditions	Description	Employees should receive and have access to written copies of their contracts	
	PRP	Best expected practices	
	Justification/ commentary	In order to avoid conflicts and to ensure a correct understanding of working conditions, a formal and written contract should be given and signed by each employee	
	Evaluation scale	■	–
		□	Employees neither receive nor have access to formal copies of their employment contracts
		▨	–
		■	Employees receive and have access to formal copies of their employment contracts

(continued)

Table 4 (continued)

Farm workers			
Benefits			
Health and safety			
Health and safety training	Description	Whether employees have received health and safety training.	
	PRP	Best expected practices.	
	Justification/ commentary	Although most farm workers are covered by the provincial occupational health and safety legislation, employers can tool up their employees with additional skills and resources	
	Evaluation scale		–
			Employees have neither received health and safety training nor does the farm have a formal procedure in case of injury
			Either employees have received health and safety training, or the farm has a formal procedure in case of injury
			Employees have received health and safety training and the farm has a formal procedure in case of injury
Local community Community engagement			
Implication within the community	Description	Assess whether the producer is involved in a local organization, hosts trainees, allows free visits on his farm, or makes donations to local non-profit organizations	
	PRP	Best expected practices	
	Justification/ commentary	These four examples are the frequently observed forms of engagement in the agricultural sector	
	Evaluation scale		–
			The farmer is not involved in a local organization, does not host trainees, does not allow free visits to his farm, or make any donations to local non-profit organizations
			The farmer participates in at least one of the previously listed activities
			The farmer participates in at least two of the previously listed activities
Cohabitation (i.e., life quality)			
Communication with the neighborhood	Description	The farmer informs his neighbors before spreading manure	
	PRP	Best expected practices	
	Justification/ commentary	Informing the neighborhood before spreading manure application can reduce the risk of conflict with the surrounding community	
	Evaluation scale		–
			Producer does not inform its neighbors before spreading manure
			–
			Producer informs its neighbors before spreading manure

(continued)

Table 4 (continued)

Farm workers			
Benefits			
Society Commitment to sustainability issues			
Environmental certification	Description	The enterprise holds a formal certification/specification aiming at minimizing environmental damage (ISO 14 001, organic certification, etc.)	
	PRP	Best expected practices	
	Justification/ commentary	Producers can go beyond goodwill and engage in formal and binding processes aiming at minimizing environmental damage induced by their activities	
	Evaluation scale	■	–
		□	The dairy farm does not hold any certification/ accreditation or specification requiring minimizing environmental damage
		▨	–
		■	The dairy farm holds a certification/accreditation or specification requiring minimizing environmental damage
Agroenvironmental practices			
Manure storage structure	Description	Whether the farm is equipped with a manure storage structure	
	PRP	Best expected practices	
	Justification/ commentary	An efficient storage structure can contribute to reducing manure spillage and facilitate manure management, hence reducing potential environmental damage	
	Evaluation scale	■	–
		□	The producer does not have any particular manure storage structure (manure pit, cement slab, lagoon/cement pond, lagoon/earth, slurry store/metal)
		▨	–
		■	The producer holds a manure storage structure
Animal welfare			
Training and practices	Description	Assess whether the producer and/or his employees are informed and trained and whether they have changed their practices with regard to animal welfare	
	PRP	Best expected practices	
	Justification/ commentary	In order to respond to the growing awareness and questioning of consumers regarding animal welfare issues, producers and farm workers can inform themselves and participate in training activities in order to enhance their practices	
	Evaluation scale	■	–
		□	The producer has neither (1) read the "Codes of Practice for the Care and Handling of Farm Animals" from the National Farm Animal Care Council; (2) fulfilled the "Checklist for Dairy Animal Welfare on Farms" published by the DFC; nor (3) attended any training activity regarding animal welfare issues
		▨	The producer has performed one of the previous training activities, but has not changed his practices to enhance his animals' welfare
		■	The producer has performed one of the previous training activities and has changed at least one of his practices to enhance his animals' welfare

(continued)

Table 4 (continued)

Farm workers			
Benefits			
Value chain actors Responsible procurement practices			
Effort to promote social responsibility	Description	Producers' purchasing decisions are influenced by social and environmental considerations or criteria	
	PRP	Best expected practices	
	Justification/ commentary	By referring to socially responsible procurement practices, producers can ensure that their suppliers and their products respect both the environment and the individuals	
	Evaluation scale		–
			The producer does not make purchasing decisions on the basis of social and environmental considerations or criteria
			–
			The producer makes purchasing decisions on the basis of social and environmental considerations or criteria

The Specific Analysis was conducted by scoring, at the level of each socioeconomic indicator, the behavior or practice of each participating farm. However, given that the project aimed at evaluating the socioeconomic performance of the milk production sector as a whole, and in order to preserve the respondents' privacy, the individual scores have been compiled at the provincial level to get a weighted[4] average score of the socioeconomic performance of the Canadian milk production sector.

2.2.4 Data Collection Process

Conducting a Specific Analysis requires a significant amount of data and information to document the PRPs and the organizations' behaviors. Unfortunately, there are very few databases that cover and record, on a regular and systematic basis, the social and socioeconomic issues at the sector or organization level. Primary data, i.e., data collected directly from the participating businesses and organizations, are thus generally needed to undertake such an analysis.

Due to the scope of the Specific Analysis performed in this project, the data collection process was expectedly challenging. In addition to the large variety of undocumented information needed, it was also necessary to document this information in a standardized manner across all provinces in order to obtain consistent results at the Canadian level.

[4] In order to obtain a representative national average score, the individual answers have been weighted according to each province's relative importance in the Canadian sector, in terms of the number of milk producers they host.

This challenge was first met through the PRPs. The lack of data and reliable documentation on most of the issues of concern under assessment made it difficult to assess not only these issues, but also to select standardized PRPs suited for the milk production context in each province. For that reason, most of the PRPs used have been based on experts' judgement and on our own knowledge of the Canadian dairy sector and agricultural production.

Primary data were used to assess dairy farms' behaviors and practices. To do so, questionnaires were sent to 817 milk producers located in six (6) provinces: Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, and Alberta. The indicators in Table 4 above were at the basis of the questionnaire, together with traditional socioeconomics variables qualifying the farm. The participation in the survey was on a voluntary basis,[5] and various techniques were used to distribute the questionnaires. In Quebec and New Brunswick, the producers participating in the annual cost of the production study carried out by the AGECO team were asked to complete a complementary questionnaire between September and November 2011. In Ontario, Nova Scotia, and Alberta, questionnaires were sent to all dairy producers, all of whom were offered $20 in compensation for sending back the completed form between March and June 2012. Three hundred (300) completed questionnaires were received. Both the sample's size and the characteristics (number of cows, ownership, cultural practices, etc.) of the participating dairy farms in each province fairly well reflect the population they represent.

The data collected at the provincial level have been pooled and weighted at a national level to assess the average Canadian dairy farmers' socioeconomic performance. Weighting was necessary because the provincial samples were not of relative equivalent size, and the Canadian average score has been determined by compiling, for each indicator, farmers' individual answers. In case of a missing value for a particular question, this was taken into account by an adjustment of the size of the sample when calculating the mean. Then, the weight of each individual answer was established according to the relative size, in terms of number of dairy producers, of the respective province.

2.3 The Potential Hotspot Analysis: The Generic Part of the Study

The PHA aims to provide a screening of the socioeconomic performance of the companies involved in the product system. This assessment uses generic data, i.e., data that are not site-specific, and it is therefore easier to run than a Specific Analysis.

[5] Surveys were sent in provinces where at the beginning of the project the board showed an interest in participating in the data collection process.

The PHA assesses the risk of encountering behaviors going against accepted social norms among businesses that are part of the system's supply chains (upstream system). More specifically, this assessment method allows identifying *potential socioeconomic hotspots*,[6] i.e., the presence of risky behaviors that might negatively impact groups of stakeholders. A PHA therefore provides a preliminary overview of the social issues found among a product's supply chains to bring awareness of the socioeconomic risks related to current procurement practices and to point out issues requiring deeper analysis. It was carried out through the combination of literature survey, consultation of specific sources of information (such as Web sites) and of using the Social Hotspot Database (SHDB), a database that was under development when the study was being conducted.[7]

As for the Specific Analysis framework, the PHA framework is built upon the UNEP/SETAC's Guidelines, which have been adjusted to be operationalized.

The stakeholder categories considered in the PHA framework are the same as those considered in the Specific Analysis: *workers*, *local communities*, *society*, and *value chain actors*. The "consumers" category is also excluded, as they are not significantly and directly impacted by the behavior of the assessed businesses operating upstream in the milk's value chain.

2.3.1 Impact Subcategories

The PHA assesses the possibility of encountering risky behaviors according to a list of issues of concern (impact subcategories) related to a particular stakeholder category. While most issues are drawn from the UNEP/SETAC's Guidelines, some adjustments have, however, been made in the context of the PHA.

Since the PHA framework is developed to cover a vast array of organizations operating in various countries, impact subcategories have not been adjusted to take into account specific sectorial or regional issues of concern. The reasons that subcategories have been removed or adjusted are rather related to methodological concerns. In some cases, it is due to the lack of relevant generic data necessary to assess a particular issue. Some subcategories have also been removed because they

[6] In the Guidelines (UNEP/SETAC 2009), a social hotspot is defined as an activity "located in a region where a situation occurs that may be considered as a problem, a risk or an opportunity, in function of a social theme of interest". As suggested by Parent et al. (2012) "for the sake of consistency in the use of concepts in LCA and SLCA, social hotspots are therefore defined as areas where an improvement is required. This definition is also more consistent with the hypothesis that an organization uses SLCA to enhance enterprises' behaviors as a way to reach the ultimate goal of improving social conditions along the product life cycle, as implicitly suggested in the Guidelines". National and regional context influences businesses' behaviors, but at the end it is those behaviors that are of interest. Therefore, a country's situation is considered to be a factor influencing the possibility of encountering—or not—companies behaving in such ways that they can cause negative social impacts.

[7] The Social Hotspot Database is now fully operational and can be accessed at www.socialhotspot.org.

are not related to risky behaviors that could negatively impact individuals (e.g., social benefits and social security or end-of-life responsibility). When possible, those subcategories have been adjusted (or reworded) to cover social risks rather than benefits (e.g., "social benefits and social security" has been replaced by "employment insecurity"). Finally, some have been merged not only because of their similarities, but also because the subtlety between them could not be adequately captured by the PHA methodology (e.g., access to material resources, access to immaterial resources, delocalization, and migration and cultural heritage have been merged).

To perform a PHA it is first necessary to identify and localize the companies involved at each step in order to document their behaviors afterwards. The product system defined earlier identified nine (9) main supply chains associated with milk production. Each supply chain has been defined by identifying only one or two representative inputs and by limiting its range up to the last identifiable major auxiliary input.

In order to assess the presence of potential social hotspots, the PHA refers to proxies such as representative sectorial practices or frequently observed behaviors, informing on businesses' behaviors. According to Macombe et al. (2010), "companies belonging to one industry tend to become similar with time." Therefore, one can assume that the information gathered at a sector or industry level is a representative proxy of individual behaviors of the companies operating in that sector or industry.

Moreover, given that the legal and cultural context can influence businesses' behavior, it is also important to specify where the companies, sectors or industries assessed carry their operations. As one product or input supplied to the Canadian market can come from several countries, only the main or outweighing sourcing countries for each input have been taken into consideration, in line with Bienge et al. (2010). As a consequence, the possibility of encountering businesses behaving inappropriately (or in a risky way in comparison with the commonly accepted social norms) has been assessed, at each step of each supply chain, at the sector level and in the different countries where the companies are supposed to carry out their activities.

For this purpose, the relevant representative sourcing regions have been specified. To do so, the relative weight of imports, compared to the domestic consumption level, has been calculated to make, first, an assumption on whether the supply of each input is mostly ensured by the domestic market or by a foreign one.[8]

[8] An activity was considered to be taking place fully abroad when, for a given input, imports accounted for 60 % or more of the total domestic consumption. The same activity was considered to be taking place fully in Canada when the import level accounted for 40 % and less of the total domestic consumption. When the import level was similar to the domestic production level, the activity was considered as taking place in Canada as well as abroad. Data were collected in the Canadian Trade. by industry database (data for 2010 were collected online from the Canadian Industry Statistic database between February and June 2012 [http://www.ic.gc.ca/eic/site/tdo-dcd.nsf/eng/Home]). Data for 2009 were collected online between February and June 2012 from

Then, countries supplying the Canadian market have been identified using a trade database.[9]

2.3.2 Data Collection Process

The PHA approach relies on generic data and is thus dependent on their availability. In order to document potential risky behaviors among supply chains, three complementary data collection techniques were therefore used, depending on the information needed.

First of all, when available, data on potential behaviors in a *specific sector located in a specific country* have been collected from national and international statistical databases, country-specific human rights reports, and from a variety of other sources identified through a Web search and a literature review.

While data collected at the sector level are relevant proxies to document behaviors of specific companies, they are generally scarce. To fill in this gap, another proxy was used; it involved documenting behaviors of a *small sample of companies* belonging to the sector and localized in the country under assessment. Samples were built by identifying the major businesses operating in the sector/country under assessment by using, for example, the Canadian Industry Statistic database.[10] Information on those businesses' behavior was also collected from human rights literature and other sources. The Business and Human Rights Resources Centre[11] collects articles on businesses' practices related to human rights issues, and Wikipedia also compiles information on social issues related to specific companies; those two sources were systematically used. As the goal of the PHA is to highlight the risk of encountering potential hotspots, it was not necessary to validate the collected information at the field level.

Finally, when no data were available, either at the sector level or by referring to the sample of companies, the social performance of the *country* was used as a proxy. It is acknowledged that the national context in which a business carries out its activities greatly influences its behavior (Macombe et al. 2010).

In summary, for each step of each supply chain under assessment, three proxies were used to collect data giving insight on the potential behavior of companies:

(Footnote 8 continued)
CANSIM, Table 379–0025. [http://strategis.ic.gc.ca/eic/site/cis-sic.nsf/eng/Home]. Data for 2007 collected online in February [http://www5.statcan.gc.ca/cansim/a01?lang=eng] from CANSIM.

[9] Only countries holding a share of 30 % or more of the total value of imports have been included in the system. Data were collected in the Canadian Trade See above by industry database (data for 2010 were collected online between February and June 2012 [http://www.ic.gc.ca/eic/site/tdo-dcd.nsf/eng/Home]).

[10] Canadian Industry Statistics (CIS). Hosted by Industry Canada, available online [http://strategis.ic.gc.ca/eic/site/cis-sic.nsf/eng/Home], accessed from February to May 2012.

[11] Business and Human Rights Resource Center, online library available [http://www.business-humanrights.org/], accessed from March to June 2012.

1. Sectorial data;
2. Information related to the behavior of a sample of representative businesses; and
3. Country-level data.

2.3.3 Impact Assessment Method

This section details how the possibility of encountering companies not behaving in compliance with accepted social norms was assessed. As for the Specific Analysis, each issue of concern was assessed using an assessment method. Since the PHA relies on generic data, the method varies according to their availability. For some issues of concern, it was possible to document behaviors at a business or sectorial level. For others, information was only available at a national level. Depending on sources, quantitative, semi-qualitative and qualitative data have also been used. But in all cases, the assessment was carried out using a standardized three-level evaluation scale assessing the possibility (low, moderate, high) of encountering companies with risky behavior, i.e., not behaving in compliance with the accepted social norms (Table 5).

The following tables describe the method used to assess the possibility of encountering enterprises with non-complying behaviors for each issue of concern, depending on how the indicators have been documented. When more than one source of data could have been used to assess the level of risk related for a same issue of concern, only the most relevant, i.e., the most closely related to the sector, was used. Sector- specific data, as well as data collected through a sample of companies, have been favored because they constitute better proxies of businesses' behavior than country-level data. We relied on a country-level indicator only when no sectorial data were found using available statistical databases or a Web review. But given the current scarcity of information regarding companies' or sectors' behavior, the assessment relied mostly on country level indicators.

2.3.4 Sectorial Data

The issues of concern have first been documented using sectorial data collected from three different sources. In the case of *fair salary*, *working hours* and *occupational health and safety*, statistical data at the sector level have been used to assess the possibility of encountering social hotspots. Table 6 describes the indicators developed as well as the PRPs considered to assess the level of risk.

The issues of freedom of association and collective bargaining, child labor, working hours, forced labor and occupational health and safety have also been

Table 5 Risk evaluation scale

Low possibility	Moderate possibility	High possibility

Table 6 Risk evaluation scale

Workers			
Fair salary			
Adequacy of the median salary	Description	The possibility of encountering businesses offering an inadequate median salary is based on the comparison between the median salary of the sector and half the median salary at the national level	
	PRP	50 and 60 % of the national median salary	
	Rationale/ commentary	This indicator is derived from the International Labor Organization (ILO) works, suggesting that a salary being half of the national median is inadequate (Anker et al. 2002). When the median wage was not available, the average wage was used	
	Data sources	National and international statistical databases	
	Evaluation scale	■	The sectorial median salary is <50 % of the national median salary
		▨	The sectorial median salary is between 50 and 60 % of the national median salary
		□	The sectorial median salary is >60 % of the national median salary
Working hours			
Excessive hours of work	Description	The possibility of encountering excessive weekly hours of work, i.e., more than 48 h/week, was assessed using the occupational hours of work per country published in the October Inquiry statistics gathered by the ILO (the more recent data available are for 2008)	
	PRP	48 and 45 h/week	
	Rationale/ commentary	This indicator is based on the international standards set by ILO convention C-01, art. 2 (ILO 1919), stating that working more than 48 h/week is excessive. In this analysis, working more than 48 h/week was considered as a high risk of hotspot and 45 h as a moderate risk. As the database provides the weekly hours of work for a variety of occupations in a same sector and that here we are interested in the risky behaviors in a sector, the occupation with the longer weekly hours of work was used	
	Data sources	The possibility of encountering excessive weekly hours of work, i.e., more than 48 h/week, was assessed using the occupational hours of work per country published in the October Inquiry statistics gathered by the ILO (the more recent data available are for 2008)	
	Evaluation scale	■	Occupational hours of work are ≥48
		▨	Occupational hours of work are ≥45 and ≤48
		□	Occupational hours of work are <45

(continued)

Table 6 (continued)

Workers			
Fair salary			
Occupational health and safety			
Rates of fatal and non-fatal injuries	Description	The possibility of encountering unsafe and unhealthy practices was assessed on the basis of the average rates of fatal and non-fatal occupational injuries at the sectorial level. They have been compared to the average rates of the various sectors in a country	
	PRP	National average rates of fatal and non-fatal occupational injuries	
	Rationale/ commentary	The statistic collected by the International Labor Organization (ILO) on rates of fatal and non-fatal occupational injuries were used. The rates were not compared between countries, since "varying reporting formats hamper the comparability of the data" (Anker et al. 2002). Comparing sectors in a same country is, however, expected to minimize this bias	
	Data sources	International database (Laborstat)	
	Evaluation scale	■	Rate of fatal injuries is above country average
		▨	Rate of non-fatal injuries is above country average
		□	Rates of fatal and non-fatal injuries are below country average

assessed at the sector level using information found in two human rights reports: the US Department of State Country Report on Human Rights (U.S. Department of State 2011), and the Annual Survey of Violations of Trade Union Rights 2011 (ITUC et al. 2012). The qualitative information provided in those reports has been used to assess the possibility of encountering violations in the sectors under assessment.[12] The assessment method used to differentiate the risk level relied on our expert judgment. For a matter of transparency, this judgment is always justified in the "detailed justifications" sections found in Appendix J of the full report.

Finally, a web search has been conducted to document all issues of concern at a sector and country level. The collected information was assessed based on our expert judgment and transparently detailed in the "detailed justifications" sections found in Appendix J.

[12] Except for the US, as no report on human rights is available. The issues of concern (freedom of association and collective bargaining, child labor, working hours and forced labor) were assessed at the country level when no better information was found through the web and libraries search.

2.3.5 Data Collected from a Sample of Businesses

To complement the sectorial data, a review of the available publications was conducted to document, for each issue of concern, the potential risky behaviors of the main companies involved in the sectors and regions under review. This review focused on the criticisms directed towards the businesses included in the sample for practices going against accepted social norms. Here again, the collected information was assessed based on our expert judgment and transparently detailed in the results sections.

2.3.6 Country Level Data

Finally, for issues that could neither be documented through the sector-level assessment nor through the sample of businesses, country-level data were used. The possibility of encountering companies behaving inappropriately compared to accepted social norms was assessed using social indicators selected from several sources.[13]

Three main sources of data have been used:

- The World Economic Forum's (WEF) annual Executive Opinion Survey, whose results are published in The Global Competitiveness Report 2011–2012 (WEF 2011);
- The SHDB; and
- a variety of other sources, such as the GINI and the Corruption Perception Index.

Some issues of concern were assessed using data collected from the WEF Annual Executive Opinion Survey. This survey, published in The Global Competitiveness Report 2011–2012 (WEF 2011), asks business executives about the situation in their respective countries regarding several socioeconomic issues, some of them similar to those addressed in the PHA. For each issue, the survey respondents' opinion was scaled from 1 to 7, with 1 representing the worst situation and 7 the best; the score represents the average opinion.

Table 7 lists the WEF indicators to which we referred in the PHA. The assessment method, which is similar for all indicators, is described below.

Table 8 presents the list of indicators selected from the SHDB, which is being developed to support SLCA practice. Only the "workers" stakeholder category is evaluated using the SHDB indicators. The SHDB offers a risk assessment analysis at the country level. The evaluation scales come from the SHDB: Risk and

[13] The Task Force for the integration of social aspects to LCA has gathered a broad range of national data sources in their Methodological Sheets (Benoît-Norris et al. 2011). Indicators that could apprise a possibility of encountering businesses not behaving in compliance with accepted social norms were selected through a review of those sources.

Table 7 Indicators of the WEF annual executive opinion survey

Subcategories assessed by the WEF		
Stakeholders	Subcategories	WEF indicators
Workers	Freedom of association and collective bargaining	Cooperation in labor-employer relation
	Employment insecurity	Hiring and firing practices
Society	Secure living conditions	Reliability of police services
	Corruption[a]	Transparency of government policymaking
		Ethical behavior of firms
Value chain	Fair competition	Effectiveness of anti-monopoly policy
	Respect of intellectual property rights	Intellectual property protection
Evaluation scale[b]		The survey result is >5
		The survey result is ≥3 and ≤5
		The survey result is <3

[a] When the two WEF indicators for corruption did not yield the same result, the level of risk was determined based on our expert judgment. Justification is provided in the "Detailed Justifications" sections in Appendix J

[b] The scale is reversed for "hiring and firing practices" for which the best situation is ease in hiring and firing. We interpreted it as a threat to employment security. The scale is also slightly modified to better represent the different levels of probability: >6 is a high risk, between 4 and 6, a moderate risk, and below 4, a low risk

Opportunity Table Development document (Benoît et al. 2010). Data sources are not listed in the present document but can be found in Benoît et al. (2010).

Finally, Table 9 presents a list of country level indicators selected from various sources. Issues of concern related to the stakeholder categories *Local community* and *Society* are evaluated using these indicators. The PRP and the scales of evaluation are also presented.

All these indicators in Tables 7, 8 and 9 were documented and assessed. However, they were aggregated in Table 11, as indicated later, but the detailed results are published in the 50-page Annex J of the full report.

3 SLCA Results

The socioeconomic performance of the Canadian milk production sector will therefore be analyzed in two ways: (1) at a specific level by describing the dairy farms' level of social engagement on the one hand, and (2) at a generic level by providing a preliminary overview of the social risks (potential hotspots) related to the sector's supply chains on the other.

Table 8 Indicators selected from the social hotspots database

Workers			
Working hours			
Risk of population working more than 48 h/week	Description	The possibility of excessive hours of work is based on the percentage of the population working more than 48 h/week (when quantitative country data were available) and/or on qualitative description of some criteria	
	PRP	Percentage of a country population working more than 48 h/week	
	Evaluation scale	■	>25 of the population[a]
		▨	10–25 % of the population
		□	<10 % of the population
Risk of population working more than 48 h/week	Description	The possibility of excessive hours of work is based on qualitative description of some criteria	
	PRP	Presence of laws, proofs of enforcement or violations	
	Evaluation scale	■	If more than one "medium" issue exists
			If laws are "frequently not enforced"
		▨	If no laws exist for compulsory overtime or compensated overtime
			If only domestic workers work overtime
			If only formal sector abides by laws
			If foreign workers do not have adequate labor laws
			If laws are not "actively enforced"
		□	Laws are enforced and overtime is compensated
Forced labour			
Risk of forced labor	Description	The possibility of encountering forced labor in a country is based on qualitative description of the situation regarding this issue	
	PRP	Importance of the evidence	
	Evaluation scale	■	Forced labor is indicated in 2 or more of the main resources or, if only one source is available, the evidence is very compelling
		▨	Forced labor is indicated in one of the main sources
		□	From available sources, risk of forced labor seems low as there is minimal evidence as such

(continued)

Table 8 (continued)

Workers			
Working hours			
Equal opportunities/dscrimination			
Overall fragility of gender equity	Description	The possibility of encountering non-compliance with the right to equal opportunities is represented by a composite index on gender inequity. In the SHDB, the risk of gender inequity in a country is based on a weighted mean of five gender equity indicators derived from different data sources (see Benoît et al. 2010): the "Social Institutions and Gender Index (SIGI)" (30 %), the "Global Gender Gap (GGG)" (30 %), the CIRI (20 %), the GDI (10 %) and the GEM (10 %)	
	PRP	Interval throughout the scores of the composite index	
		■	>2,3[b]
		▨	1,3–2,3
		□	<1,3
Child labour			
Risk of child labor	Description	The possibility of child labor is based on the population of children working over the entire population of children in a country	
	PRP	Interval in percentage of children working	
	Evaluation scale	■	>10[c]
		▨	>4–10 %
		□	<4 %

[a] The scale used in the SHDB has 4 levels: low (<10% of the population), moderate (10–25% of the population), high (25–50% of the population) and very High (>50% of the population). We aggregated the «high" and «very high" levels in order to be consistent with our evaluation scales. When the SHDB attributes a very high score for a specific country, this will be mentioned in the results section.

[b] The scale used in the SHDB has 4 levels: low (<1,2), moderate (1,3–2,3), high (2,3–3,3) and very high (<3,3). We aggregated the "high" and "very high" levels in order to be consistent with our evaluation scale. When the SHDB attributes a very high score for a specific country, this will be mentioned in the results section

[c] In the SHDB, the scale for the risk of child labor has 4 levels: low (<4%), moderate (>4–10 %), high (>10–20 %) and very High (>20 %). We aggregate high and very high in order to be consistent in our evaluation scale. However, when the SHD attributes a very high score for a specific country, this will be mentioned in the results section

3.1 Socioeconomic Performance at the Dairy Farm Level

Figure 3 shows the average socioeconomic performance of the Canadian dairy farms towards their stakeholders, i.e., the farm workers, their local communities, the society and the value chain actors—i.e., their suppliers and business partners (including the consumers). Each circle represents a level of the social responsibility

Table 9 Indicators selected from a variety of sources

Local community			
Delocalization and migration			
Centre of housing rights and evictions (COHRE)	Description	The possibility of impairment to the access to material or immaterial resources is based on the presence or absence of the country in the reports database of the Centre of Housing Rights and Evictions (COHRE) and the likelihood that a violation could be related to an economic activity (potentially found in the life cycle of a product)	
	PRP	Presence of a country in a database; experts' judgment on the possibility that the violation can be related to an economic activity	
	Evaluation scale	■	The violations mentioned are related to an economic activity (other than war or politics)
		▨	The country is in the COHRE database
		□	The country is not in the COHRE database
Indigenous rights			
Violations in human rights reports	Description	The possibility of encountering cases of non-respect of indigenous rights is based on the presence of violations reported in two human rights reports: the US Department of State Country Report on Human Rights (2011), and the State of the World's Human Rights Country Report of Amnesty International (2011)	
	PRP	Presence and importance of the evidence	
	Evaluation scale	■	There is at least one mention of violations of indigenous rights in the US Department of State Country Reports or the State of the World's Human Rights Country Report of Amnesty International reserves a section for the indigenous issue
		▨	There are mentions of poor living conditions of the natives without specific violations of indigenous rights in any of the reports
		□	There is no mention of concerns related to indigenous people in any of the reports
Society Corruption			
Corruption perception index	Description	The possibility of encountering corruption is based on the Corruption Perception Index (2010), which is a measure of the perceived level of corruption in the public sector of a country by business people. The lower the score, the higher the perceived level of corruption	
	PRP	Interval in the index scores	
	Evaluation scale	■	<3
		▨	≥3 to <6
		□	≥6

(continued)

Table 9 (continued)

Local community			
Delocalization and migration			
Fair distribution of revenues			
GINI	Description	The GINI Index is an index of the equity in the distribution of wealth where 0 is a completely equal distribution and 100 a totally unequal distribution. The GINI is used here as a proxy of the distribution inside the enterprises of a country. Data comes from the World Fact Book of the US Central Intelligence Agency (CIA)	
	PRP	Interval in the GINI scores	
	Evaluation scale	■	GINI ≥50
		▨	GINI ≥30 et <50
		□	GINI <30

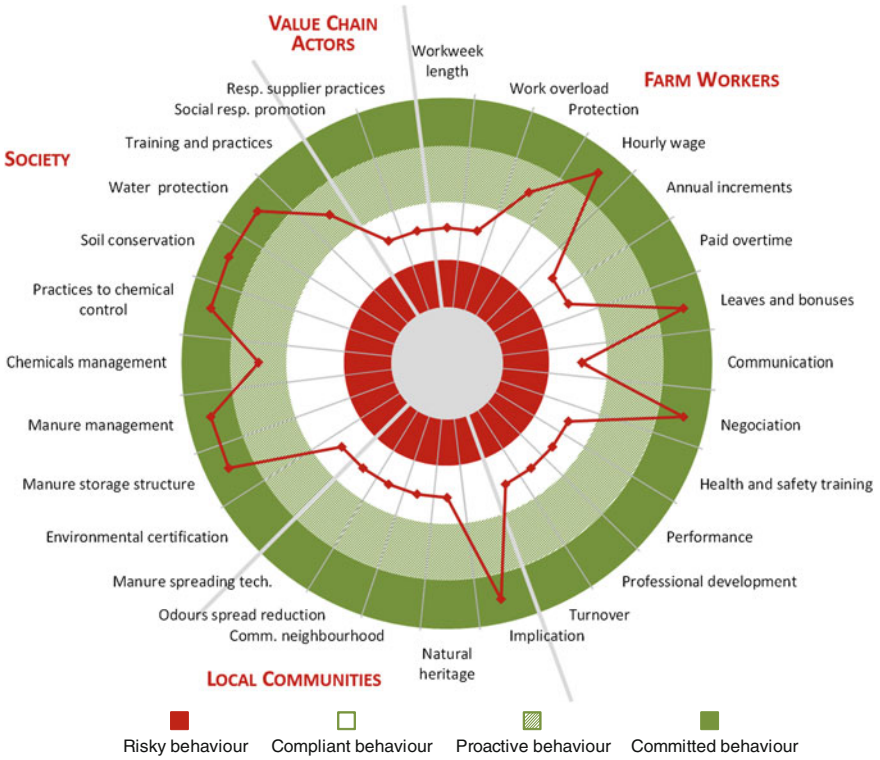

Fig. 3 Socioeconomic performance of the Canadian dairy farms

evaluation scale, going from "risky behavior" in red to "committed behavior" in dark green. The red line represents the average socioeconomic performance of the Canadian dairy farmers according to each indicator. The closer the red line is to the outermost circle, the better the sector's average socioeconomic performance, with a leading socially responsible behavior.

Canadian dairy farms have a positive socioeconomic performance globally. That is the case, for instance, for the agroenvironmental practices, whether it concerns water source protection, manure storage, or soil conservation. If this commitment is obvious from an environmental point of view, it is also significant in a socioeconomic perspective, as it also meets the Canadian society's expectations.

The dairy farmers' engagement towards their local community is also significant, with the vast majority involved in their communities in many different ways. More could be done, however, in terms of cohabitation, with more producers adopting practices—for instance, in minimizing odor propagation.

The picture is also contrasted with regard to farm workers. Although dairy farmers provide overall working conditions that go beyond the labor standards—to which they are mostly not legally subjected—there is still room for improvements regarding various issues such as professional training and communication of working conditions. The same holds true with respect to their suppliers and business partners, since a majority of dairy producers do not usually consider their suppliers' performance with regard to social responsibility in their procurement decisions.

The average performance of the Canadian dairy farmers, as seen before, can hide some variability within the sector. For a given issue of concern, some producers might have a proactive or committed behavior where others will only comply with the expected social norms, as is the case with the odors spread reduction practices. This variability suggests that there is always room for improvements, since the average socioeconomic performance can be improved and, when already committed, reinforced, as more dairy producers could adopt some more socially responsible practices. Moreover, since today a committed behavior could become a minimal expectation in the future, a continuous engagement from all the producers is also advisable in order to improve, but also to preserve, the sector's socioeconomic performance over time.

This variability is shown in Table 10. For each indicator, the average score is presented according to the evaluation scale used, as well as the variability of the practices and behaviors documented.

The "Variability" column presents the relative share of answers that correspond to each possible value and the "average performance" column shows where the "mean" value is, via an arrow. The color code is as described earlier in the document:

■: risky behavior; □: compliant behavior; ▨: proactive behavior;
■: committed behavior; ✖: non-available evaluation level.

Table 10 The average socioeconomic performance of the Canadian dairy farms

Farm workers		Variability	Average performance
Working hours	Workweek length		
	Work overload		
Social benefits	Scope of protection		
Salary and contribution to fringe benefits	Average hourly wage of workers		
	Annual increments		
	Paid overtime		
	Leaves and bonuses for statutory holidays		
Working conditions transparency	Communication of working conditions		
	Negotiation of working conditions		
Health and safety	Health and safety training		
Professional accomplishment	Performance		
	Professional development		
	Turnover rate		
Local community			
Community engagement	Implication within the community		
Natural and built heritage	Preservation of natural and built heritage		
Cohabitation	Communication with the neighbourhood		
	Odours spread reduction		
	Manure spreading technology		
Society			
Commitment to sustainability issue	Environmental certification		
Agroenvironmental practices	Manure storage structure		
	Manure management		
	Chemicals management		
	Alternative practices to chemical control		
	Soil conservation techniques		
	Water sources protection		
Animal welfare	Training and practices		
value chain actors			
Responsible procurement practices	Effort to promote social responsibility		
Responsible supplier practices	Practices ensuring the products' quality		

3.2 The Potential Hotspots Analysis Results

Although this SLCA is primarily aimed at assessing the socioeconomic performance of Canadian milk at the farm level, the study also looked at the potential social risk in the suppliers upstream of the dairy sector, such as manufacturers of machinery, fertilizers, pesticides, or pharmaceuticals.

The PHA has been conducted over nine supply chains in order to assess, by using generic data, the possibility of encountering risky behaviors among the businesses involved at each stage.

The detailed description and evaluation of these risks can be found in Appendix J of the full report. This section presents the overall results and discusses their implications for the Canadian dairy sector.

Table 11 presents the *aggregated results* as well as the main potential hotspots related to the Canadian dairy sector's supply chains. The results have been aggregated for simplification, by measuring the average risk related to each stakeholder category, given the score attributed to each associated issue of concern. No weighting method has been used between the issues of concern or the regions, when it was applicable.

Globally, this preliminary overview indicates that most supply chains show low social risk. With the main suppliers located in Canada or the United States, the prevalence of social hotspots is generally lower than in countries such as China. Yet there are some socially troubling practices occurring upstream in the sector's supply chains, beyond the first-tier suppliers (which were not covered in this study). Among the most troubling practices are corruption, unsafe working conditions, non-respect of indigenous rights, and unfair competition.

This is, for example, the case in the fertilizer and oil extraction industries, where it was possible to document disturbing practices of collusion as well as bankrolling techniques from subsidiary companies of some major players. Potential hotspots were also identified in the Canadian grain and oilseed sector with regard to working conditions, as workers are generally not protected by labor standards. The analysis also brought up public health issues, as well as conflicts of use of natural resources related to many industries, among them the pesticides and pharmaceutical sectors.

Unfortunately, the use of generic data does not allow having a precise and detailed analysis of the actual hotspots occurring in the supply chains. Manufacturing information is only available at a national level, for instance, and is hence characterized by a high level of uncertainty regarding the actual behaviors of the businesses operating there. Furthermore, many of the identified hotspots are related to companies, sectors or regions located far upstream and on which the Canadian dairy sector has little power to influence.

The objective of this PHA was, however, to provide a preliminary overview of the social issues found among a product's supply chains in order to bring awareness of the socioeconomic risks related to current procurement practices and to point out issues requiring deeper analysis. In a social responsibility perspective, it is important for the Canadian dairy farmers—as well as for their organizations—to

Table 11 Aggregated results and main potential hotspots related to the Canadian dairy sector's supply chains[a, b]

Supplly chains	Aggregated results				Main potential hotspots
	W	LC	S	VCA	
Retail and wholesale	☐	☐	☐	▨	There are no major hotspots identified at this stage of the supply chain, apart from the relatively high rate of non-fatal occupational injuries occurring in this sector and the rapid concentration taking place in the farm retail sector, which could lead to a decreased level of competition
Fertilizer manufacturing					
Extraction	☐	☐	▨	☐	The PHA indicates that there are some preoccupying situations occurring in the fertilizer sector. There are, for instance, some hotspots related to the working conditions and in particular with the occupational health and safety and working hours issues, especially in the Canadian and US mineral extraction sector. Also relating to the mineral extraction activities, it was possible to document criticisms addressed to the mining industry in Canada and the United States with regard to the safe and healthy living conditions issue. More preoccupying are, however, the documented behaviors regarding the implication of some major fertilizer manufacturers in armed conflicts and corruption practices in North America and abroad. While these documented behaviors are localized and isolated, they suggest that they might be more widespread in this industry
Gas distribution	☐	☐	☐	☐	
Manufacturing	☐	☐	▨	☐	
Pesticides	☐	▨	■	☐	There are some disturbing hotpots identified in the pesticides system. Among them are the documented cases of contamination in the US and abroad from major pesticides manufacturers, which impacted the health and safety of a vast number of individuals. Similarly, there are preoccupying incriminations hanging over some major companies for their involvement in armed conflicts, in addition to proven practices of corruption, falsified entries and bribing. Here, again, these documented practices are isolated, since they are related to specific actors and circumstances. However, given that the six main companies operating in this sector own 85 % of the market worldwide, such behaviors can be more widespread than this assessment infers

(continued)

Table 11 (continued)

Supplly chains	Aggregated results				Main potential hotspots
	W	LC	S	VCA	
Seeds	☐	▨	☐	▨	The main potential hotspots related to this input are associated with issues related to local communities. The PHA documented, for example, a contrasted situation regarding the responsibility of the agribusiness sector in general and the seed breeding companies in particular towards the food (in)security issue. Similarly, the assessment suggested the possibility of encountering risky behaviors related to the protection and preservation of the cultural heritage, as well as a risk of encountering behaviors negatively impacting the living conditions of a local population. There are also preoccupying indications that the seed breeding sector is evolving in a non-competitive market and that its main operating companies adopt unfair behaviors against each other and their clients
Animal feed					
Feed manufacturing	☐	☐	☐	▨	As discussed in the Specific Analysis, agricultural workers in Canada are, depending on the region where they work, partially or totally excluded from the labor standard's provisions. This—makes them more vulnerable to abuse or potential risky behaviors. The main hotspots documented are consequently related to this stakeholder category. For example, the salary and working hours issues at the farm level are both related to moderate hotspots based on the assessment framework used in this PHA. The same can be said with regard to the occupational health and safety issue, given that the grain production and feed manufacturing sectors, are characterized by significant and documented risks
Additives and supplements	☐	☐	☐	▨	
Grain production	▨	☐	☐	☐	
Medicines and vaccines	☐	▨	▨	☐	There are no major hotspots identified in the medicines and vaccines supply chain. The main issues are globally related to the lobbying efforts of the main companies operating in this sector ,whether to protect their markets by jeopardizing the efforts made to facilitate the access to cheap generic medicines, or to promote politically their interests with politicians
Bovine semen	☐	☐	☐	☐	There is no significant hotspot specifically related to this supply chain

(continued)

Table 11 (continued)

Supplly chains	Aggregated results				Main potential hotspots
	W	LC	S	VCA	
Agricultural machinery					
Machinery manufacturing	☐	☐	☐	☐	The PHA raised several hotspots regarding the agricultural machinery sector and supply chain. Most of them are isolated and are related to a specific business in a particular region. There are, however, some more preoccupying ones. The occupational health and safety of workers operating in the steel production and recycling sector is, for instance, still characterized by the high level of fatal injuries, despite all the efforts made by this industry to improve the situation. Among the other hotspots are some preoccupying practices with regard to land appropriation, as well as to environmental damages caused by the pollution generated by steel plants activities
Steel production and recycling	☐	▨	☐	☐	
Trucks and trailers manufacturing	☐	☐	☐	☐	There is no significant hotspot specifically related to this supply chain
Fuel and diesel					
Fuel distribution	☐	☐	☐	☐	The PHA indicates that there are many potential socioeconomic hotspots related to this input, and at all stages of the supply chain. Regarding the workers category, the PHA has documented, for example, moderate and high possibilities of encountering impairment to the rights of freedom association and of collective bargaining at the step of oil extraction in Algeria and Kazakhstan. The same is true regarding the child labor issue. The overall working conditions in the oil extraction sector, especially Algeria and Kazakhstan, are in fact preoccupying. Local communities are also affected by this industry, with its activities impacting the health and safety of local populations as well as limiting and degrading their access to natural resources. Numerous lawsuits have been launched against oil companies, in Canada and abroad, regarding these issues. Potential social hotspots are also significant on a societal perspective, as major companies operating in this industry are involved in serious controversies related to armed conflicts and corruption practices
Petroleum refining	☐	▨	☐	☐	
Oil extraction	▨	▨	■	▨	

[a] Risk evaluation scale ☐ Low possibility; ▨ Moderate possibility; ■ High possibility

[b] These are aggregated scores measured by calculating the simple average of all scores related to a specific stakeholder category, regardless of the region. No weighting was used. This aggregation is for simplification purposes only. The detailed evaluation is available in Appendix J of the full report

consider not only the risks but the potential socioeconomic consequences related to their sourcing practices as well. By getting involved and by considering environmentally and socially responsible criteria in their procurement practices, the Canadian dairy sector could improve the overall socioeconomic performance of milk production in a life cycle perspective. This assessment can be seen as a starting point in this direction.

4 Discussion: Advantages, Limitations and Challenges Faced

As one of the first SLCAs conducted after the publication of the UNEP-SETAC guidelines in 2009, this project has been the opportunity for developing an innovative methodology to assess the socioeconomic performance of a product in a life cycle perspective. We strove to develop a rigorous, transparent, replicable and evolutive assessment methodology to enhance the SLCA development and facilitate its wider use. To do so, we relied on a few guiding principles that we still follow today: operationalization, readability, usefulness, and participation.

However, this context of novelty was also the first challenge that we faced. There were not many practical studies to use as a model, and the guidelines were vague on many aspects (Blom and Solar 2009; Revéret and Parent 2012, 2013). As Feschet (2014) explains, we could see that some researchers were promoting an impact pathway approach to SLCA and others a social responsibility approach and performance-based SLCA. Macombe and Falque (2013) identify this second category as "life cycle corporate social responsibility." Although we understand and accept that measuring a company's social performance is not an endpoint measurement of the social impact that we are interested in, we considered the fact that there are solid hypotheses on the causal relationship between adopting good practices and generating a positive impact. Therefore we made the choice to develop an approach based on PRP, which was later adopted in other studies conducted by our team and also by others. We note that the recently published *Handbook for Product Social Impact Assessment* (2014) also promotes an approach based on PRPs (Goedkoop 2014). However, it remains important to develop a better understanding of the pathways that link company behaviors to social impacts so that SLCA can make use of these relations to measure accordingly the positive and negative social impacts of products.

A second limitation of the guidelines that we faced was that not much was said about the linkages between environmental and SLCA when both were to be conducted simultaneously in a single study. Questions about the goal and scope, the limits of the system under study, and the still controversial question of the functional unit about whether or not it is relevant to use the same, when it is clear that the impacts as they are considered in an SLCA, are not quantified in a way that allows them to be reported per functional unit. This question of the quantitative versus qualitative nature of what is being observed is as present now as it was four years ago.

These differences—between the now classic environmental LCA and the newly born SLCA—were another source of debate. Although the development of SLCA was very much influenced by the parallel development of tools for CSR, such as ISO 26000 (performance-based, using similar categories of stakeholders, etc.), it was also firmly based on the ground of environmental LCA and on a similar logic. However, social issues are of a different nature than environmental ones, and are captured by different types of variables. Very often the more important aspects of social impacts are qualitative in nature, and the causal relationship with the product at the core of the study is not so clear; they are more related to the company's behavior than to the product itself. All these elements do not facilitate the integration into a tool that is designed for quantitative data with solid causal chains that can be accurately and mathematically modeled—all of which create obstacles in the development of an efficient interdisciplinarity.

Understanding that we would not be able to develop integration at a conceptual level, we at least made sure to develop a procedural integration in the way we worked with the environmental team from QUANTIS and CIRAIG. We developed the social system under study from that used for environment and adjusted it to the fact that our social study was conducted, as we saw, at two levels of precision—the first, a specific study at the farm level using primary data, and the second, searching for potential hotspots in the supply using secondary and generic data.

5 Conclusion

The purpose of this study was to profile the socioeconomic performance of ordinary Canadian milk. Using data from over 300 farms as well as provincial and national statistics, a regionalized characterization of average provincial scenarios allowed for a nationwide understanding and assessment of milk production. While variability in farm practices and results were discussed at every stage of the life cycle steps, and for the different socioeconomic indicators, it is important to remind the reader that such variability was evaluated only between the provincial averages, and, as such, does not come close to evaluating and understanding the variability between various farms. As a result, the current study provides an understanding of how various scenarios and locations affect the environmental profile of milk—without, however, being able to assess the potential by which best practices within one type of management can contribute to reducing the overall burdens. With respect to the assessment of the average socioeconomic performance of Canadian milk production, the study evaluated the Canadian dairy farmers and their boards at a national level, based on their degree of social engagement, and was not intended to assess the performance at an individual level.

It is clear from this assessment that Canadian dairy farms have an overall positive performance. It is also obvious, with respect to the agroenvironmental practices, whether concerning water source protection, manure storage, or soil conservation. The engagement of dairy farmers with their local community is also

significant, as he vast majority are involved in their communities in many different ways. More can be done, however, in terms of cohabitation, with producers adopting practices that minimize odors propagation.

The picture is also contrasted with regard to farm workers. Although dairy farmers provide overall working conditions that go beyond labor standards—to which they are mostly not legally subjected—there is room for improvements regarding various issues, such as professional training and communication of working conditions. The same holds true with respect to their suppliers and business partners, given that a majority of dairy producers do not usually consider their suppliers' performance with regard to social responsibility in their procurement decisions.

This suggests that there is always room for improvement, both now and in the future. For example, with more producers adopting more socially responsible practices, the average socioeconomic performance could be enhanced. Moreover, since a committed behavior today can become standard in the future, continuous improvement from all producers is also required, not only to improve, but also to preserve the sector's socioeconomic performance.

Finally, the study also looked at the social risk potentially present in the suppliers upstream of the dairy sector, such as manufacturers of machinery, fertilizers, pesticides, or pharmaceuticals. With the main suppliers located in Canada or the United States, the prevalence of social hotspots is generally lower than in countries such as China. The fact remains, however, that some risks seem present in a few links of the supply chains. This is the case in the fertilizer and oil extraction industries, for example, where it was possible to document disturbing practices of collusion as well as bankrolling techniques from the subsidiaries of some major players. Potential hotspots were also identified in the North American grain and oilseed sector with regard to working conditions, as they are generally not protected by labor standards. The analysis also brought up public health issues, as well as conflicts of use of natural resources related to many industries, among which are the pesticides and pharmaceutical sectors. Some links are also characterized by a lack of competition. Although the Canadian dairy sector has little power to influence these actors located far upstream, in a life cycle perspective, it falls under the responsibility of dairy farmers and their associations to get involved. This assessment can be seen as a starting point in this direction.

This SLCA and the environmental LCA were the first step towards engaging all stakeholders in a comprehensive sustainable development strategy. This assessment provides the Canadian dairy sector with an innovative, comprehensive and actionable roadmap to move in the direction of a more sustainable milk production in Canada. We should mention, as a practical recognition of the importance of the role of farmers, the Dairy Farm Sustainability Award, which was established in 2012.[14] This competition promotes the recognition of Canadian dairy farmers that

[14] http://www.dairyfarmers.ca/what-we-do/programs/environment-and-sustainable-development/dairy-farm-sustainability-award.

have adopted on-farm management practices that extend beyond standard industry practice and meet the objectives defined in the DFC's sustainability strategy.

Moreover, capitalizing on these results also depends on the extent of communication with involved parties, which is a crucial part of the next steps. In addition to the various academic conferences and the numerous webinars organized for farmers and their boards' representatives across the country, many communications documents based on the study were produced and are being used at the national and provincial levels. The model generated here can also serve as a basis for a self-assessment tool aimed at farmers, which could be improved to better identify best practices. Such a self-assessment tool is now under development as part of the next phase of the Dairy Research Cluster and will be soon implemented at the farm level.

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Social Life Cycle Assessment in the South African Sugar Industry: Issues and Views

Takalani Musundwa Nemarumane and Charles Mbohwa

Abstract The South African sugar industry is one of the world's leading cost-competitive producers of high- quality sugar and makes an important contribution to employment and sustainable socioeconomic development, particularly in rural areas, as well as to the national economy. The South African sugar industry is divided into growers and millers. South Africa produces its sugar from sugar cane, which is a tall tropical grass with thick, solid, tough stems that are a chief commercial source of sugar. The objectives of the study were directed by the guidelines on social life cycle assessment of products developed by the United Nations Environmental Programme and SETAC initiatives. The data were collected using field research, historic comparative research, interviews and questionnaires. The analysis and validation data was done using the Statistical Package for Social Sciences software. The impacts identified and discussed were health and safety, gender equality, and wages; these impacts were analyzed in terms of descriptives and factor matrix. The employers in the sugar industry provide full independence of the operations and procedures of the existing associations, but do not encourage their workers to become members. It was found that workers do not have wage-related incentives, and that wages have not increased in the past 2 years. The workers reported that they have been discriminated against due to their genders; it was also found that male workers were favored by employers as compared to women, with regard to remuneration, training and development, and promotional opportunities. It was also found that the workers are exposed to unpleasant smells and dust particles in their working environment. Recommendations were made to enable favorable working conditions for both employers and employees.

Keywords Sugar production · Wages · Gender equality · Health and safety

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1 Introduction

This study will focus on the social impact of the sugar industry in South Africa. A social impact assessment is a method that aims to assess social features of the product and their positive and negative aspects in terms of its processing of raw material, up until the final stages of its disposal (Maloa 2001). Life cycle analyses are the tools to be used to apply life cycle thinking in a fact-based manner, with increasing use by industry and policy. While the consideration of environmental impacts of products in life cycle assessment (LCA) studies are quite common today, the investigation of social effects in a life cycle perspective has so far been rare,. despite a clear recognition that products have, in addition to environmental and economic impacts, multi-faceted social impacts as well, not only on employees, but also on customers, suppliers, communities, and society (Ciroth and Franze 2011). To predict what the probable impact of development will be, we seek to understand the behavior of workers and communities affected by the industry's actions, development, or policy changes (GPSIA 1994).

1.1 Summary of the Study

1.1.1 Goal and Scope of the Study

The goal entails the objectives of the study and its expected outcome, and in this phase, the reasons for carrying out the study are outlined. Its scope is concerned with the areas within the product's life cycle that the data will be collected from. It states the limits and breadth of the study and also describes its depth.

1.1.2 SLCA Inventory Analysis

The inventory analysis is concerned with the process by which the data is collected. Within this chapter, the data is validated and the system boundaries established. The chapter focuses on the assembling of data that is later used in the impact assessment.

1.1.3 Impact Assessment

The analysis of the inventory data is carried out in this chapter, which also deals with the establishment of categories and subcategories of the study. The results of this characterization are discussed in detail.

1.1.4 Interpretation

In this chapter, the solutions are identified for the negative impacts that were established in the results and discussion chapter. A detailed description of how to change negative impacts into positive ones is explained within it.

2 Goals and Scope of the Study

2.1 Background and Justification

The South African sugar industry employs some 77,000 people who work directly for the industry, and another 350,000 who are employed indirectly, making it one of the largest contributors to employment in agriculture within the country. There are more than 42,000 registered cane growers; 1,660 farmers have large farms, and 40,600 have small plots of sugar cane, according to SACGA (2011). A study on the environmental impacts of the South African sugar industry was carried out; it had a direct link to the economy of South Africa. Based on Ciroth and Franze (2011), the environmental, economic, and social aspects of a product are important.

2.2 Objectives of the Study

The primary objective of the study was to conduct a social life cycle assessment (SLCA) study for South Africa's sugar millers and sugar growers. The study would apply the United Nations Environmental Programme, Guidelines on Social Life Cycle Assessment of Products, on the South African Sugar Industry. The study aimed to add value to the social assessment methodology and application techniques of social impacts assessment.

The secondary objectives of the study were:

- to identify the social impacts of the sugar growing and milling within the sugar industry;
- to determine how employees of the sugar industry relate to the organization in terms of wages, gender equality, and health and safety;
- to identify how the local communities view the operations of the sugar industry in relation to community services; and
- to promote the social awareness and social responsibility within the South African sugar industries.

2.3 Goal of the Study

The goal of this study is to assess the social aspects of sugar production in South Africa. The results of this assessment are meant to provide the South African sugar industry with knowledge of their operational consequences and responsibilities to the social society. The results are also intended to help the sugar industry utilize their processes in a way that could improve their response to the social society that they serve. The recommendations of the assessment will help the industry to optimize its processes to positively affect the societies that they serve. These should also be communicated to policy makers that are concerned with the social responsibility of agricultural organizations.

2.4 Assumptions

The following assumptions were made:

- that the SLCA impacts identified and characterized form part of social impacts;
- that the millers and growers in the designated areas all have the same social impacts; and
- that the UNEP (2009) Guidelines is valid in its applications.

2.5 Scope of the Study

The scope of the study defines the limits placed on the product's life-cycle and the details of information to be collected and analyzed. It explains where the data will be coming from and where the results will be applicable (UNEP 2009). The sugar processes that the study is concerned with are the sugar growing phase, the harvesting phase, and the milling phase; transportation and distribution will not be considered because they form part of an environmental study that has already been conducted. The disposal phase will also not be taken into consideration because users dispose in various ways and that would complicate the study. The system boundary will include cane growing and cane milling exclusively.

2.6 System Boundaries

The system considered for this study was one in which sugar is produced from sugar cane stalks. The locations of focus were the Kwa-Zulu Natal Province, the Eastern Cape Province, and the Mpumalanga Province. The sugar processes that the

study is concerned with are the sugar-growing phase, the harvesting phase, and the milling phase. The following subsystems for SLCA were taken into account:

- Growing Phase: Sugar cane is grown in various stages. The first is land preparation, where the soil is fed with fertilizers and enough moisture to accommodate and grow the cane stalks. The second stage becomes the germinating stage, where only about two leaves appear on the stem of the planted cane. The next stages are the tillering, grand growth and maturation stages. These vary from 15 to 20 days and 3 months from the cane plantation day to the stage where the cane stalks grow to maturity. The final stage is the cane cutting, where the matured cane stalks are prepared for transportation and processing.
- Milling Phase: Sugar milling is concerned with the processing of the cane stalks, cane preparation, milling, diffusion, evaporation, sugar boiling, separation of crystals from molasses,, sugar drying and sugar refining.

3 Inventory Analysis

3.1 Data Collection

A. The collection of data following the following steps: Read through all of the transcripts carefully
B. Wrote thoughts about each document, without focusing on the substance of the information, rather on the underlying meaning,
C. Made a list of all the topics, clustered together similar topics, arranged these topics into columns that were arrayed as major topics, unique topics, and leftovers.
D. Abbreviated the topics as codes and wrote the codes next to the appropriate segments of the text. Checked if new categories of codes emerged.
E. The selected topics for workers were freedom of association, wages, gender equality, working conditions, and health and safety. The topics selected for the communities were crime, health and safety, access to products and services, community engagement, local employment, secure living conditions, cultural heritage, service facilities, and environment.
F. Recorded the existing data.
G. Data analysis, which was handled by Statkon.

Data for this qualitative study was collected, using field research, historical comparative research, interviews and questionnaires. Table 1 indicates the various areas researched and the relative techniques used.

Table 1 Research techniques used

Characterization	Growers and millers	Technique used to gather data
Health and safety	• Exposure to physical hazards • Protective equipment available	Questionnaire, interview and field research
Wages	• Satisfaction of wages and commission • Availability of wage-related incentives • Basic expenditure of wages	Questionnaire, historical comparative data, interview
Gender equality	• The ratio of men to women in the workplace • Treatment of men to woman in the workplace • Favoritism in company policies based on gender	Questionnaire
SLCA methodology	Applications and approach	Historical comparative data

3.1.1 Field Research

The researcher obtained access to the sugar mills where sugar cane stalks are transported for processing, and observed the operations at the sugar mills and interacted with its employees. During these observations, he focused intensely on how the sugar mill employees handle the machinery and equipment in the mill, while relating that to the societal implications. According to Neuman (2000), field research is usually used for exploratory and descriptive studies; therefore, this type of data collecting technique was best suited to this study. Field research allowed the researcher to obtain first-hand experience but at times he was seen as intrusive by the workers. The workers were then notified about the observations that were taking place, which made them feel as though they were a crucial part of the observation process, thus allowing them to accommodate and cooperate with the researcher.

3.1.2 Historical Comparative Research

The researcher, via this technique, was able to examine the aspects of the social life cycle of the sugar industry operations that had been researched before. The technique helped him to be able to build on a theory that already existed within the sugar industry and to also remain relevant and significant in terms of social implications. The type of historical data varied from published journals, to relevant textbooks and other articles that focused on the subject. This technique combined theories that already existed on the subject and the data collected by the researcher, Neuman (2000); he was also able to compare the methods that were used to evaluate the social implications of the sugar industry in the past, thereby helping to identify the best method to be used for this research. Although the method allowed

the researcher to analyze the information at a convenient time, there was also protected information that was not available to the public. To access this information, the researcher had to use interviews and questionnaires to obtain the private information, (see Appendix A).

3.1.3 Interviews

Interview questions were also used as another data-gathering technique, and various workers of both the sugar mills and the sugar growers were interviewed. The interviewees involved external affairs members at the South African Sugar Association (SASA). Some of the interviews were conducted by telephone, while all the interviews in the Kwa-Zulu Natal Province were conducted in person.

Interviews were both semi-structured and unstructured; this means that the researcher began with a set of topics that were of high importance, but also allowed the interview subjects to lead the conversation to whichever direction made the most sense to the researcher, so the researcher had to be open to other issues that arose during interviews. This type of interview enabled the researcher to explore, in depth, all issues that arose. Based on the theory by Lune et al. (2010), the conversation between the researcher and the person being interviewed leads to answers that even the interviewee was not initially aware of; this then becomes helpful to the researcher, as he is able to broaden his research horizons and it helps to get to the core of the problem. The researcher also interviewed some of the members of the South African Sugar Technologist Association, about their views on the social aspects in the sugar industry that have not been attended to, as well as on their opinions about what could be done to overcome these implications. Interviews are useful when informants cannot be directly observed; however, interviews may also provide indirect information that is filtered through the views of the interviewees (O'Leary 2010). The interviews thus involved numerous participants who allowed for a variety and differences in information and opinions. In total, 10 high-ranking individuals were interviewed.

3.1.4 Questionnaires

A total of 300 questionnaires were distributed to the various sugar mills and sugar growers and to their various communities. These questionnaires were allocated equally to the KwaZulu-Natal (KZN), Mpumalanga (MP) and Eastern Cape (EC) Provinces. Table 2 illustrates the distribution of questionnaires among the three provinces and their communities.

The data for the study was collected using a questionnaire (see Appendix A). One set was used to gather data from the employees of the sugar industry, specifically the sugar millers and sugar growers; the other set was directed to the local communities, which are directly and indirectly impacted by the operations of both

Table 2 The distribution and number of questionnaires in the provinces

Provinces	Millers	Growers	Community
Kwa-Zulu Natal	25	25	50
Mpumalanga	25	25	51
Eastern Cape	25	25	49
Total	75	75	150
Overall total	300		

the sugar millers and the sugar growers. Both sets of questionnaires were distributed to the three main sugar growing and milling areas in South Africa, i.e., KwaZulu-Natal, Mpumalanga, and the Eastern Cape.

3.2 Data Analysis

3.2.1 Statkon

The University of Johannesburg Statkon facilitated the design of questionnaires and the distribution thereof. The completed questionnaires were then collected and analyzed for the study using the Statistical Package for the Social Science software (SPSS). SPSS is one of the most popular statistical packages; it can perform highly complex data manipulation and analysis with simple instructions and is designed for both interactive and non-interactive (batch) uses. SPSS has scores of statistical and mathematical functions, scores of statistical procedures, and a very flexible data handling capability. It can read data in almost any format (e.g., numeric, alpha-numeric, binary, dollar, date, and time formats) SPSS (2012). This software was used to analyze the data into information from the 300 respondents' questionnaires.

Table 2 indicates the factor analysis of the community's services and their quality; factor analysis is used to find factors among observed variables. When data contains many variables, factor analysis is used to reduce the number of variables. Factor analysis groups together variables with similar characteristics, and with it, the researcher is able to produce a small number of factors from a large number of variables—which explains the observed variance in the larger number of variables. The factor analysis was determined, based on the availability of the following community services and their quality, as indicated in Table 3:

B1. Quality housing
B2. Local schools
B3. Day care centres
B4. Health facilities
B5. Convenient transportation
B6. Electricity
B7. Safe water

Table 3 Factor matrix based on community services

Factor matrix							
	Factor						
	1	2	3	4	5	6	7
B3.2	0.536		0.390		−0.270		
B13.2	0.526			−0.349	0.402		
B6.2	0.489					−0.294	−0.257
B5.2	0.478						
B9.2	0.468			0.328			−0.330
B11.2	0.463				−0.256		
B4.2	0.453						
B10.2	0.452						
B18.2	0.449						
B12.2	0.446	−0.314		−0.255			
B2.2	0.439		0.270			0.304	
B17.2	0.423						
B20.2	0.413			0.295			
B21.2	0.394				0.346		
B15.2	0.380						
B8.2	0.357			−0.270			
B1.2	0.330						
B7.2	0.308						
B19.2	0.570	−0.631	−0.415				
B23.2	0.541	−0.604	−0.410				
B16.2	0.450	0.534	−0.572				
B22.2	0.523	0.495	−0.555				

B8. Grocery stores
B9. Response time of police to emergencies
B10. Response time of fire stations to emergencies
B11. Street lights
B12. Timely garbage collection
B13. Religious facilities (churches)
B14. Community councils
B15. Entrepreneurial businesses
B16. Youth development facilities
B17. Education
B18. Cultural activities
B19. Recreational activities
B20. Opportunities for adult employment
B21. Opportunities for youth employment
B22. Youth development facilities
B23. Recreational facilities and parks.

Table 4 Descriptives based on the 300 questionnaires distributed to millers and growers

Descriptives					
A2				Statistic	Std. error
A8	Millers	Mean		2.95	0.117
		95 % Confidence interval for mean	Lower bound	2.71	
			Upper bound	3.18	
		5 % trimmed mean		2.94	
		Median		3.00	
		Variance		1.037	
		Standard deviation		1.018	
		Minimum		1	
		Maximum		5	
		Range		4	
		Interquartile range		1	
		Skewness		0.419	0.276
		Kurtosis		−0.069	0.545
	Growers	Mean		2.46	0.081
		95 % confidence interval for mean	Lower bound	2.30	
			Upper bound	2.62	
		5 % trimmed mean		2.41	
		Median		2.00	
		Variance		0.455	
		Standard deviation		0.674	
		Minimum		1	
		Maximum		4	
		Range		3	
		Interquartile range		1	
		Skewness		0.890	0.287
		Kurtosis		0.090	0.566

Table 4 indicates the descriptives based on the 300 questionnaires distributed to millers and growers, and thus summarizes the variables in terms of the median, range and interquartile range.

4 Case Study

The South African Sugar Association is an autonomous organization and operates free of government control. In terms of the Sugar Act and Sugar Industry Agreement, statutory powers of self-governance are granted to the sugar industry. The South African Sugar Association's administrative and industrial activities and organizations are financed from the proceeds of the sale of local and export sugars.

Table 5 Total cane/sugar production: 2005/2006–2012/2013 (SASA 2013)

Season	Cane crushed	Sugar produced	
		National market	International market
1994/1995	15 683 277	1 310 328	347 507
1995/1996	16 713 649	1 283 282	375 653
1996/1997	20 950 894	1 264 066	995 630
1997/1998	22 154 775	1 310 352	1 093 278
1998/1999	22 930 324	1 285 001	1 353 155
1999/2000	21 223 098	1 194 763	1 329 897
2000/2001	23 876 162	1 231 442	1 490 120
2001/2002	23 876 162	1 239 651	1 163 592
2002/2003	23 012 554	1 278 720	1 475 899
2003/2004	20 418 933	1 356 400	1 055 631
2004/2005	19 094 760	1 210 416	1 016 453
2005/2006	21 052 266	1 261 808	1 238 696
2006/2007	20 278 603	1 340 524	886 329
2007/2008	19 723 916	1 399 657	873 842
2008/2009	19 255 404	1 438 587	821 657
2009/2010	18 655 089	1 414 273	766 177
2010/2011	16 015 649	1 583 457	325 779
2011/2012	18 655 089	1414 273	766 177
2012/2013	16 015 649	1583 457	325 779

Its affairs are administered by the Council of the SA Sugar Association (SASA 2013) (Table 5).

The communities that surround the sugar millers and growers in South Africa are directly affected by its activities. The communities analyzed have poor housing and school structures, and there are not enough health facilities or convenient public transportation.

5 Impact Assessment

The life cycle impact assessment presents the general framework for a social and socioeconomic life cycle impact assessment (SLCIA) following the general guidelines of ISO 14 044 (2006). This section is concerned with the selection of the impact categories and subcategories, and the characterization methods and models UNEP (2009).

Table 6 Characterization of the study

Factors	Wages	Gender equality	Health and safety
Millers	X	X	X
Growers	X	X	X

5.1 Characterization

The characterization for the study was done as indicated in Table 6.

The results obtained were based on wages, gender equality, and health and safety. These factors were identified as relevant areas of concern within the sugar industry for both millers and growers.

5.2 Wages

5.2.1 Minimum Wage

A minimum wage is the lowest hourly, daily or monthly wage that employers may legally pay their employees. It often applies to unskilled or semi-skilled workers in the service industry, in factories, or in manufacturing plants. The basic conditions of the Employment Act permit the Minister of Labor to set minimum terms and conditions of employment, including minimum wages. In South Africa, the minimum wage is directed at those who are often most vulnerable in the workplace. Vulnerable sectors are those with no union or very little union activity and where wages tend to be low (Waddell and Burton 2006). Figure 1 illustrates wages paid based on the type of work being done in the sugar industry.

The harvesting staff accounts for 27.2 % of the wage bill, followed by permanent field workers (22.4 %), drivers (13.8 %), and general staff (12.5 %). General staff includes mechanical maintenance, clerks, indunas and section managers. Seasonal field workers and other staff make up the remaining 24 % of the expenditure on wages. Other staffs include cooks, domestics, security personnel and builders.

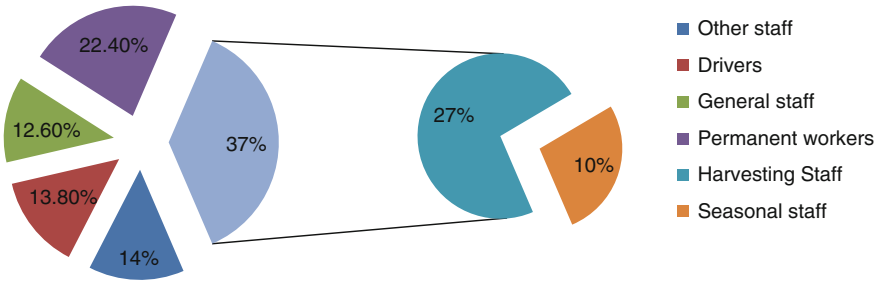

Fig. 1 Wages paid based on type of workers, SASA (2013)

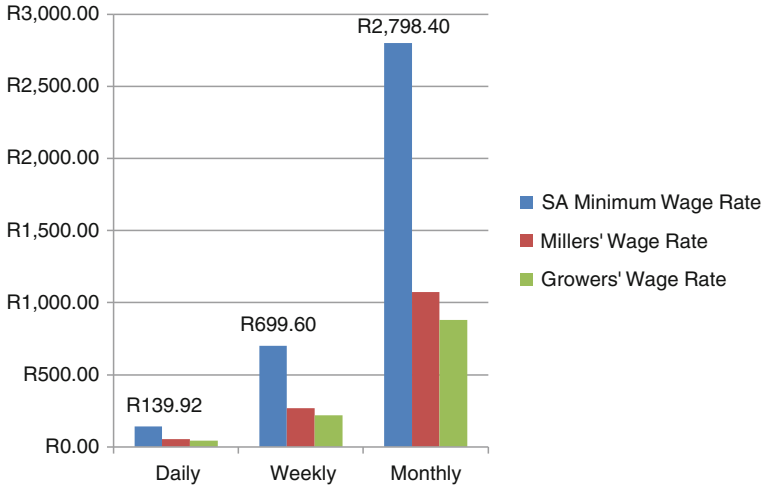

Fig. 2 South African minimum wage rate compared to sugar millers and growers

The South African sugar growers to have a higher wage compared to the South African sugar millers. The growers' hourly wage was R3.66, which came to R878, 40 per month, when they worked 12 h a day, 5 days a week. However, the millers' minimum wage was R4.47 per hour, which came to R1072.80 a month, when also working 12 h a day, 5 days a week.

The wage rate of the workers in the South African sugar industry is lower than the minimum wage prescribed by the Basic Conditions of Employment Act, which, for sugar millers and growers, was R132.92 per day; this means that they should earn R11.08 per hour. The current wage rate for millers is R53.64 per day, which equals R4.47 per hour. The sugar millers and growers are thus being paid R6.61 less than the prescribed minimum wage, as indicated in Fig. 2.

South African farmers have recently embarked on wage-related strikes. Farm workers, non- government organizations, and unions operating under the banner of the Farm Worker Coalition handed over a memorandum in which they made various allegations against farmers; in it, they alleged that farmers are applying for an exemption from paying the minimum wage. They also alleged that workers are forced to sign forms that show that they are happy to get less than R105 per day (Statistics SA 2013).

5.2.2 Wage-Related Incentives

Wage incentives are necessary to compensate for the low wages that workers earn. With wage incentives, workers would be able to meet more of their needs; the incentives could be in the form of overtime. This is where workers have the opportunity to work beyond their allocated times, at a defined rate per hour or per

output, allowing for an increase in the workers' earnings and encouraging hard work and dedication. The sugar millers and growers in South Africa reported a 60 % absence of wage incentives, which means that the workers' sole income is from their standard wages, without any compensation from the employers. This also means that irrespective of the workers' output, they earn only the standard rate. This type of system does not encourage or motivate workers to work harder, or put more effort into their duties and tasks. The 40 % of workers, who account for 60 of the 150 workers questioned, indicated that they earn wage-related incentives in a form of commission and overtime, thereby creating a positive working environment, and motivating them to be more dedicated and committed to their work.

Further analysis indicated that both the millers and the growers do not show much variation in terms of differences in offering wage-related incentives. The growers were expected to have a higher percentage of such incentives, because of their type of work. They provide mills with the sugar cane, so it was expected that they would be offered incentives based on the number of tons of sugar cane they provide; however, the cross-tabulation analysis proved otherwise. Of the 77 millers that responded to the incentive question, 49 stated that they do not have incentives, and 39 of 69 growers concurred with the millers, as indicated in Table 7. It was thus established that 36.4 and 43.5 % of millers and growers, respectively, offer incentives to their workers. This percentage is somewhat low, given the high rate of dissatisfaction with wages among both the millers and the growers. An increase in the presents of incentives would lead to a decrease in the dissatisfaction rate of both millers and growers with regard to their wages.

More than 50 % of the workers in total reported that their wages had been increased in the last 2 years, as shown in Table 7. Although this is a positive factor for the employers, this increase did not change the workers' dissatisfaction with their wages. The researcher concluded that the increase in wages had been satisfactory at the time that it occurred, but became menial as the standard of living increased yearly. With an increase in wages on a yearly basis, the workers' dissatisfaction rate could decrease. During an interview with the employer, it was discovered that sugar production had decreased in the past 4 years due to some environmental effects; this has therefore made it difficult for the employers to increase their workers' wages, as they themselves were struggling to keep profits at a desired rate.

Table 7 Cross-tabulation based on wage rate

	Issues	Millers		Growers	
		Yes	No	Yes	No
Wages	Minimum wage rate	33	44	54	15
		42.9 %	57.1 %	78.3 %	21.7 %
	Wage satisfaction	19	58	9	60
		24.7 %	75.3 %	13 %	87 %
	Incentives	28	49	30	39
		36.4 %	63.6 %	43.5 %	56.6 %

5.2.3 Workers' Expenses

The workers indicated the areas in which they spend their wages. The expenses were classified as food, water, electricity, housing, transportation, health, education, cell phones, entertainment, paying off debts, and other expenses that were classified as sundry. Table 8 illustrates the various areas in which both the millers and growers spend their wages. The descriptives are indicated as follows:

C2.1 Food
C2.2 Water
C.2.3 Electricity
C2.4 Housing
C2.5 Transportation
C2.6 Healthcare
C2.7 Education
C2.8 Cell phone
C2.9 Entertainment
C2.10 Savings.

It was found that on average, both the millers and growers spend most of their wages on food and housing; 16.16 % is spent on food, whereas 13.36 % is spent on housing. The workers also indicated that less is spent on cell phones and entertainment −5.15 and 6.58 % respectively. They spend 9.61 % on education, 9.50 % on transportation, and 9.70 % of their wages on outstanding debts. Water and electricity was placed at 8.02 % of the wages earned.

These values indicate that the workers spend their wages on the basic minimum necessities. The excessive expenditure on food is also influenced by the constant increase in petrol and food prices in South Africa. They are unable to invest more into their healthcare, which is important because they have labor-intensive jobs that are detrimental to the long-term health of the workers.

5.3 Gender Equality

Female workers have been vulnerable to males all across many industries. It was reported by (Murray and Van Walbeek 2007) that female workers in the apparel industry reported that some employers conduct daily body searches to look for stolen goods. Female factory workers reported that male security guards fondle them as they leave the factories at night.

Twenty-one women reported that the daily body search is not only too invasive but also makes them vulnerable to street crime. "We are searched every day leaving the factory," one female machinist reported. "[s]he wants to see under our skirts, inside our shirts, and sometimes we are late due to all the delays from the searching. It's dangerous to go home late. Women have been raped walking home from the transportation (Murray and Van Walbeek 2007). The country is facing a

Table 8 Descriptives indicating the areas in which workers spend their wages

Descriptives					
A2				Statistic	Std. Error
C2.1	Millers	Mean		22.16	1.030
		95 % confidence interval for mean	Lower bound	20.09	
			Upper bound	24.22	
		5 % trimmed mean		22.03	
		Median		20.00	
		Variance		61.502	
		Standard deviation		7.842	
		Minimum		5	
		Maximum		40	
		Range		35	
		Interquartile range		10	
		Skewness		0.146	0.314
		Kurtosis		0.195	0.618
	Growers	Mean		25.36	1.606
		95 % confidence interval for mean	Lower bound	22.14	
			Upper bound	28.58	
		5 % trimmed mean		24.64	
		Median		20.00	
		Variance		144.416	
		Standard deviation		12.017	
		Minimum		10	
		Maximum		60	
		Range		50	
		Interquartile range		19	
		Skewness		0.728	0.319
		Kurtosis		0.030	0.628

(continued)

Table 8 (continued)

Descriptives					
A2				Statistic	Std. Error
C2.2	Millers	Mean		9.91	0.970
		95 % confidence interval for mean	Lower bound	7.96	
			Upper bound	11.85	
		5 % trimmed mean		9.23	
		Median		10.00	
		Variance		49.895	
		Standard deviation		7.064	
		Minimum		2	
		Maximum		30	
		Range		28	
		Interquartile range		5	
		Skewness		1.690	0.327
		Kurtosis		2.853	0.644
	Growers	Mean		8.69	0.836
		95 % confidence interval for mean	Lower bound	7.00	
			Upper bound	10.39	
		5 % trimmed mean		8.44	
		Median		5.00	
		Variance		27.271	
		Standard deviation		5.222	
		Minimum		2	
		Maximum		20	
		Range		18	
		Interquartile range		5	
		Skewness		1.169	0.378
		Kurtosis		0.507	0.741

(continued)

Table 8 (continued)

Descriptives					
A2				Statistic	Std. Error
C2.3	Millers	Mean		8.55	0.464
		95 % confidence interval for mean	Lower bound	7.62	
			Upper bound	9.48	
		5 % trimmed mean		8.47	
		Median		10.00	
		Variance		10.973	
		Standard deviation		3.312	
		Minimum		1	
		Maximum		15	
		Range		14	
		Interquartile range		5	
		Skewness		0.109	0.333
		Kurtosis		−0.401	0.656
	Growers	Mean		10.08	1.267
		95 % confidence interval for mean	Lower bound	7.51	
			Upper bound	12.64	
		5 % trimmed mean		8.83	
		Median		10.00	
		Variance		62.599	
		Standard deviation		7.912	
		Minimum		5	
		Maximum		40	
		Range		35	
		Interquartile range		5	
		Skewness		2.538	0.378
		Kurtosis		6.720	0.741

(continued)

Table 8 (continued)

Descriptives					
A2				Statistic	Std. Error
C2.4	Millers	Mean		18.94	1.772
		95 % confidence interval for mean	Lower bound	15.38	
			Upper bound	22.50	
		5 % trimmed mean		18.17	
		Median		15.00	
		Variance		156.996	
		Standard deviation		12.530	
		Minimum		2	
		Maximum		60	
		Range		58	
		Interquartile range		20	
		Skewness		1.060	0.337
		Kurtosis		0.922	0.662
	Growers	Mean		19.08	1.463
		95 % confidence interval for mean	Lower bound	16.16	
			Upper bound	22.01	
		5 % trimmed mean		18.89	
		Median		20.00	
		Variance		126.217	
		Standard deviation		11.235	
		Minimum		0	
		Maximum		40	
		Range		40	
		Interquartile range		20	
		Skewness		0.098	0.311
		Kurtosis		−1.125	0.613

(continued)

Table 8 (continued)

Descriptives					
A2				Statistic	Std. Error
C2.5	Millers	Mean		13.91	1.208
		95 % confidence interval for mean	Lower bound	11.49	
			Upper bound	16.33	
		5 % trimmed mean		12.95	
		Median		10.00	
		Variance		80.269	
		Standard deviation		8.959	
		Minimum		5	
		Maximum		40	
		Range		35	
		Interquartile range		10	
		Skewness		1.583	0.322
		Kurtosis		2.198	0.634
	Growers	Mean		13.60	1.049
		95 % confidence interval for mean	Lower bound	11.50	
			Upper bound	15.70	
		5 % trimmed mean		12.91	
		Median		10.00	
		Variance		68.277	
		Standard deviation		8.263	
		Minimum		3	
		Maximum		40	
		Range		37	
		Interquartile range		5	
		Skewness		1.556	0.304
		Kurtosis		2.350	0.599

(continued)

Table 8 (continued)

Descriptives					
A2				Statistic	Std. Error
C2.6	Millers	Mean		10.11	2.272
		95 % confidence interval for mean	Lower bound	5.44	
			Upper bound	14.78	
		5 % trimmed mean		8.08	
		Median		10.00	
		Variance		139.410	
		Standard deviation		11.807	
		Minimum		2	
		Maximum		66	
		Range		64	
		Interquartile range		5	
		Skewness		4.379	0.448
		Kurtosis		21.005	0.872
	Growers	Mean		8.75	0.970
		95 % confidence interval for mean	Lower bound	6.76	
			Upper bound	10.74	
		5 % trimmed mean		8.50	
		Median		10.00	
		Variance		26.343	
		Standard deviation		5.133	
		Minimum		2	
		Maximum		20	
		Range		18	
		Interquartile range		5	
		Skewness		0.649	0.441
		Kurtosis		−0.086	0.858

(continued)

Table 8 (continued)

Descriptives					
A2				Statistic	Std. Error
C2.7	Millers	Mean		16.08	1.978
		95 % confidence interval for mean	Lower bound	12.07	
			Upper bound	20.10	
		5 % trimmed mean		14.78	
		Median		15.00	
		Variance		140.821	
		Standard deviation		11.867	
		Minimum		4	
		Maximum		60	
		Range		56	
		Interquartile range		15	
		Skewness		1.690	0.393
		Kurtosis		4.159	0.768
	Growers	Mean		9.39	1.020
		95 % confidence interval for mean	Lower bound	7.32	
			Upper bound	11.46	
		5 % trimmed mean		9.01	
		Median		10.00	
		Variance		37.444	
		Standard deviation		6.119	
		Minimum		0	
		Maximum		30	
		Range		30	
		Interquartile range		5	
		Skewness		1.413	0.393
		Kurtosis		2.830	0.768

(continued)

Table 8 (continued)

Descriptives					
A2				Statistic	Std. Error
C2.8	Millers	Mean		7.00	0.570
		95 % confidence interval for mean	Lower bound	5.85	
			Upper bound	8.15	
		5 % trimmed mean		6.66	
		Median		5.00	
		Variance		13.952	
		Standard deviation		3.735	
		Minimum		3	
		Maximum		25	
		Range		22	
		Interquartile range		5	
		Skewness		2.814	0.361
		Kurtosis		11.876	0.709
	Growers	Mean		8.48	1.078
		95 % confidence interval for mean	Lower bound	6.30	
			Upper bound	10.65	
		5 % trimmed mean		7.69	
		Median		5.00	
		Variance		51.092	
		Standard deviation		7.148	
		Minimum		0	
		Maximum		30	
		Range		30	
		Interquartile range		5	
		Skewness		2.019	0.357
		Kurtosis		3.904	0.702

(continued)

Table 8 (continued)

Descriptives					
A2				Statistic	Std. Error
C2.9	Millers	Mean		10.23	1.043
		95 % confidence interval for mean	Lower bound	8.13	
			Upper bound	12.33	
		5 % trimmed mean		9.56	
		Median		10.00	
		Variance		52.180	
		Standard deviation		7.224	
		Minimum		2	
		Maximum		40	
		Range		38	
		Interquartile range		10	
		Skewness		1.777	0.343
		Kurtosis		4.915	0.674
	Growers	Mean		9.15	0.802
		95 % confidence interval for mean	Lower bound	7.54	
			Upper bound	10.76	
		5 % trimmed mean		8.76	
		Median		10.00	
		Variance		34.695	
		Standard deviation		5.890	
		Minimum		0	
		Maximum		30	
		Range		30	
		Interquartile range		5	
		Skewness		1.363	0.325
		Kurtosis		1.993	0.639

(continued)

Table 8 (continued)

Descriptives					
A2				Statistic	Std. Error
C2.10	Millers	Mean		13.63	1.012
		95 % confidence interval for mean	Lower bound	11.59	
			Upper bound	15.67	
		5 % trimmed mean		13.39	
		Median		13.00	
		Variance		44.049	
		Standard deviation		6.637	
		Minimum		1	
		Maximum		30	
		Range		29	
		Interquartile range		10	
		Skewness		0.414	0.361
		Kurtosis		0.052	0.709
	Growers	Mean		14.56	0.977
		95 % confidence interval for mean	Lower bound	12.60	
			Upper bound	16.52	
		5 % trimmed mean		14.23	
		Median		13.00	
		Variance		49.585	
		Standard deviation		7.042	
		Minimum		5	
		Maximum		30	
		Range		25	
		Interquartile range		10	
		Skewness		0.489	0.330
		Kurtosis		−0.586	0.650

(continued)

Table 8 (continued)

Descriptives					
A2				Statistic	Std. Error
C2.11	Millers	Mean		11.60	2.839
		95 % confidence interval for mean	Lower bound	3.72	
			Upper bound	19.48	
		5 % trimmed mean		11.61	
		Median		10.00	
		Variance		40.300	
		Standard deviation		6.348	
		Minimum		3	
		Maximum		20	
		Range		17	
		Interquartile range		11	
		Skewness		−0.020	0.913
		Kurtosis		0.155	2.000
	Growers	Mean		13.75	5.543
		95 % confidence interval for mean	Lower bound	−3.89	
			Upper bound	31.39	
		5 % trimmed mean		13.33	
		Median		10.00	
		Variance		122.917	
		Standard deviation		11.087	
		Minimum		5	
		Maximum		30	
		Range		25	
		Interquartile range		19	
		Skewness		1.720	1.014
		Kurtosis		3.265	2.619

monumental task in overcoming poverty: 56 % of the population lives below the poverty line, and there is an unemployment rate in excess of 40 %, compounded by an increasing number of youths leaving school who are looking for white-collar jobs.

Gender equality does not only refer to companies with an equal number of males and females within the company, but also means giving the same opportunities and roles to individuals irrespective of their gender. Gender inequality is prevalent in companies where intense, hard labor is concerned, as well as in industries where heavy machinery is handled. The introduction of women's empowerment has been predominant as more women enter the workplace. This empowerment seeks to provide women with the skills and abilities required in the workplace, because the domination of men, especially at the executive levels, has created an imbalance between men and women.

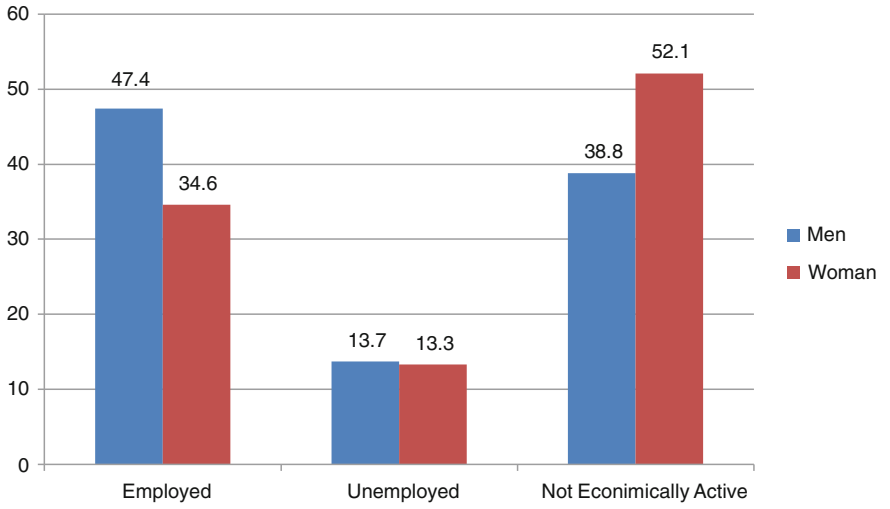

Fig. 3 Distribution of men to women in the labor market. Stats SA (2012)

The distribution of men to women in the South African labor market is different. According to Statistics South Africa (2012), this is shown in Fig. 3, where we see that the employment rate for men was higher than that for women by more than 12 %. Even though the unemployment rate between woman and men in 2011 was almost equal, as men had a 13.7 % unemployment rate and women had 13.3 %, much deviation was recorded with regard to the population that is not economically active. This category comprises housewives, students, scholars and pensioners. It was reported that 38.8 % of men were not economically active, whereas 52.1 % of women were in the same category; there was a total difference of 13.3 % between men and women in South Africa in this regard.

The variation in the labor market statistics indicates the imbalance of skill development between men and women, the imbalance in the hiring and training between men and women, and a general inequity in industry with regard to men and women.

5.3.1 The Ratio of Employed Men to Women

It was determined that the ratio of men to women among the sugar millers and growers was 60:40 on the whole; this means that 60 % of the workers were males. Although this is an acceptable ratio, the development of women's skills is not discouraged. Sixty-nine workers reported a ratio of 60:40 of men to women in their workplaces, whereas 31 workers, who account for 20.5 % of the interviewed workers, indicated a ratio of 80:20. This is illustrated in Table 9.

Table 9 The ratio of men to women at the workplace is approximately

		Frequency	Percent	Valid percent	Cumulative percent
Valid	50:50	16	10.6	10.9	10.9
	60:40	69	45.7	46.9	57.8
	40:60	27	17.9	18.4	76.2
	80:20	31	20.5	21.1	97.3
	20:80	4	2.6	2.7	100.0
	Total	147	97.4	100.0	
Missing	System	4	2.6		
Total		151	100.0		

This ratio is unacceptable, since it means that these specific employers are more focused on employing men than women. The reason for this has been that the tasks of the various millers and growers have been seen as masculine tasks as opposed to feminine tasks; this then becomes the motivation for employers to hire men instead of women.

5.3.2 Unequal Treatment of Workers in the Workplace

Gender discrimination refers to when an individual is deprived of certain opportunities based on his or her gender. This type of discrimination is prevalent in sectors that are dominated by one gender, so the entry of the opposite gender is challenged and discriminated against. Although 60.4 % of both the millers and growers indicated that they had never been discriminated against in the workplace due to gender, a total of 39.6 % of workers (59 of 149 questioned workers), as is shown in Table 10. This means that almost 40 % of the workers were discriminated against in their workplaces—a percentage that matched the ratio of men to women, which was 60:40. It can thus be assumed that the discrimination that had occurred was mostly against the female workers.

Table 10 Gender inequality rates

Have you experienced any of the following forms of gender inequality at work?				
		Yes	No	Total
D2.1 Gender discrimination	Count	59	90	149
	Row N %	39.6 %	60.4 %	100.0 %
D2.2 Lower salary due to your gender	Count	18	131	149
	Row N %	12.1 %	87.9 %	100.0 %
D2.3 Unequal workplace treatment	Count	107	42	149
	Row N %	71.8 %	28.2 %	100.0 %
D2.4 Harassment or bullying due to your gender	Count	31	118	149
	Row N %	20.8 %	79.2 %	100.0 %

Gender discrimination in the workplace includes earning a lower salary due to the individual's gender, getting unequal work treatment due to gender, or harassment or bullying because an individual is of a specific gender. A menial 12.1 % of workers in total indicated that they had never been paid lower wages because of their gender, as workers are prone to engage an employer with regard to wages as opposed to any other workplace issues that may arise. The payment of wages was discovered as public knowledge in the workplaces, therefore it would be difficult for employers to discriminate in this regard. Even though only 20.8 % of workers indicated that they were bullied or harassed in the workplace because of gender, 71.8 % reported that they had at some stage received in equal treatment due to gender. This high rate had been attributed to the perceptions of the workers with regard to their employers. It was discovered that the workers perceived their employers as favoring certain genders, so they felt that they had received unequal workplace treatment. This conclusion came about as many of the workers that reported that they had received unequal treatment at the workplace could not identify an occasion or even that such an incident had occurred.

5.3.3 Areas of Inequality Among Sugar Workers

Gender equality was further analyzed using basic features of an organization. This lead to the realization that in terms of recruitment and selection for certain positions, the workers felt that women were treated more favorably than men. This is in contradiction to the existing ratio of men to women in the workplace. Given favorability towards women in the organization, the ratio would have been higher for women as compared to men. This then also indicated that the workers' perceptions about the organizations' operations are not always accurate, but have a damning effect on how the workers view the employers and their organizations. With regard to remuneration and training and development, it was found that the men are more favorable as compared to women. Some 82 of 148 workers in total, who account for 55 % of the questioned workers, stated that men were remunerated better than women in the organization, and are also favored with regard to training and development. This, however, did not feature as discrimination in salary due to gender, when analyzed by workers. This is because 60.4 % indicated that they had never been discriminated in pay; however, 55 % indicated that men are paid more than woman. This means that the workers view this type of discrimination as a norm in their industry, and so do not dispute or query it. The workers also indicated that it was normal for men to be favored when it came to training and development, even though it was earlier indicated that women are favored with regard to recruitment and selection, as illustrated in Table 11.

A larger group of workers indicated that women and men were treated equally in terms of promotional opportunities and performance appraisal. It was necessary to do a further analysis where the growers and the millers were analyzed in isolation to identify the prevalence of gender equality or lack thereof within the two bodies.

Table 11 Favorability between men and women

In your opinion and experience, which of these factors are favorable to either men or women within the organization?					
		Men and women treated equally	Men treated more favorably than women	Women treated more favorably than men	Total
D3.1 Recruitment and selection	Count	54	39	57	150
	Row N %	36.0 %	26.0 %	38.0 %	100.0 %
D3.2 Remuneration	Count	57	82	10	149
	Row N %	38.3 %	55.0 %	6.7 %	100.0 %
D3.3 Appraisal/ performance management	Count	102	34	10	146
	Row N %	69.9 %	23.3 %	6.8 %	100.0 %
D3.4 Training and development	Count	51	82	16	149
	Row N %	34.2 %	55.0 %	10.7 %	100.0 %
D3.5 Promotion opportunities	Count	83	47	18	148
	Row N %	56.1 %	31.8 %	12.2 %	100.0 %
D3.6 Family-friendly policies	Count	35	14	95	144
	Row N %	24.3 %	9.7 %	66.0 %	100.0 %
D3.7 Flexible working hours	Count	44	24	76	144
	Row N %	30.6 %	16.7 %	52.8 %	100.0 %
D3.8 Policies and procedures (e.g., grievance and disciplinary policies)	Count	100	26	23	149
	Row N %	67.1 %	17.4 %	15.4 %	100.0 %

It was found that 63.2 % (48 workers) male sugar millers were treated more favorably as compared to women in terms of remuneration. This means that the men working at the sugar mills earned higher wages than their female colleagues. Some 47.8 % (33 workers) of the growers in the sample indicated that men and women are treated equally when it comes remuneration; however, 46.4 % (32 workers) still felt that men had higher wages. Table 12 also shows how only a small percentage of the millers and the growers feel that women are favored in wage payments, this small group ranges between 5.8 and 7.9 % (4–6 workers).

A predominate percentage of men over woman was also found in relation to the training and development of workers, among both the sugar mills and sugar growers. This is indicated in Table 13. Many of the millers and growers reported that the male employees were favored when there was going to be training and development of workers. Forty-five of the 76 interviewed millers, and 34 of the 69 interviewed growers, stated that men are favored over women in training and development. Only 3 of the millers and 13 of the growers felt that men and woman are treated equally in training and development, which comes to 3.9 %—3 millers and 18.8 %—13 growers.

Table 12 Remuneration

Crosstab						
			D3.2			Total
			Men and women treated equally	Men treated more favorably than women	Women treated more favorably than men	
A2	Millers	Count	22	48	6	76
		% within A2	28.9 %	63.2 %	7.9 %	100.0 %
	Growers	Count	33	32	4	69
		% within A2	47.8 %	46.4 %	5.8 %	100.0 %
Total		Count	55	80	10	145
		% within A2	37.9 %	55.2 %	6.9 %	100.0 %

Table 13 Training and development

Crosstab						
			D3.4			Total
			Men and women treated equally	Men treated more favorably than women	Women treated more favorably than men	
A2	Millers	Count	28	45	3	76
		% within A2	36.8 %	59.2 %	3.9 %	100.0 %
	Growers	Count	22	34	13	69
		% within A2	31.9 %	49.3 %	18.8 %	100.0 %
Total		Count	50	79	16	145
		% within A2	34.5 %	54.5 %	11.0 %	100.0 %

5.4 Health and Safety

It is essential for employers to provide a safe workplace. Every workplace needs to protect its employees from anything that could be life-threatening or harmful to the workers' physical, mental or emotional states. It was found that the workers work in close vacinity with the tools and machanics that transport sugar cane and raw sugar in their operational yards. A high percentage of workers (a total of 84.4 and 90.3 % of those interviewed) were exposed to ventilators and turbines; the most worrisome exposure was to unpleasant smells and dust particles, as illustrated in Table 14.

It was found that in general the workers are exposed to flow in pipes, lime milling, compressors, and heat and cold radiation. All these create some sort of unpleasant sounds and smells that the workers require protection from when they are exposed to them for long periods of time. There was a total of 51.7 % of workers from both the millers and the growers that were exposed to flow-in-pipes.

Table 14 Frequencies and descriptives for health and safety

F1. Are you exposed to any of the following physical hazards in terms of health and safety at your workplace?				
		Yes	No	Total
F1.1.1 Transportation	Count	133	15	148
	Row N %	89.9 %	10.1 %	100.0 %
F1.2.1 Flow in pipes	Count	75	70	145
	Row N %	51.7 %	48.3 %	100.0 %
F1.3.1 Lime milling	Count	73	71	144
	Row N %	50.7 %	49.3 %	100.0 %
F1.4.1 Ventilators	Count	124	23	147
	Row N %	84.4 %	15.6 %	100.0 %
F1.5.1 Turbines	Count	131	14	145
	Row N %	90.3 %	9.7 %	100.0 %
F1.6.1 Compressors	Count	93	38	131
	Row N %	71.0 %	29.0 %	100.0 %
F1.7.1 Unpleasant smells	Count	73	15	88
	Row N %	83.0 %	17.0 %	100.0 %
F1.8.1 Heat and cold radiation	Count	69	21	90
	Row N %	76.7 %	23.3 %	100.0 %
F1.9.1 Dust	Count	57	72	129
	Row N %	44.2 %	55.8 %	100.0 %
F1.10.1 Do you have cuts/dry skin/peeling?	Count	25	115	140
	Row N %	17.9 %	82.1 %	100.0 %

Seventy-seven of the 144 interviewed workers reported exposure to lime milling, 93 reported exposure to compressors—which accounts for 71 % of the those interviewed. Some 76.7 % of the workers further reported that they are exposed to heat and cold radiation while they work; this is shown in Table 14.

The workers at the sugar growing plants are exposed to manure and other pesticides and herbicides that are applied to the ground in preparation for the planting of the sugar cane stalks. These chemicals create unpleasant smells for the workers and for other residents who live close to the sugar cane growing areas. The sugar millers deal with the processing of the sugar cane stalks to sugar granules; during this process, thick and sticky air is created, which is unpleasant for the workers and requires masks to protect them from it. This was discovered during observations at these processing mills. It was established that of the 88 workers that were asked if they were exposed to unpleasant smells, 73 indicated that they were frequently exposed, while only 15 of them said that they were not exposed to any unpleasant smells.

Dust particles for the growers are intensified due to the frequent exposure to the soil and the cane leaves. During windy seasons, the soil repels dust particles, and the sugar cane leaves release small pieces of itself that cause dust for the workers,

who have to cover their eyes and nostrils to protect themselves from these particles. The raw sugar also creates dust after it is processed which means that both the millers and the growers require protective equipment while they are exposed to the particles. Of 129 workers, 57—who account for 44.2 % who responded in terms of exposure to dust particles—indicated that they were frequently exposed to dust particles, both from the sugar mills and the sugar growing plants.

Every workplace should be designed in a way that does not create strain for the workers, both physically and mentally. The workplace should always be ergonomically created to suit the human body, creating minimal strain to both the body and the mind. An inappropriately designed workplace can cause fatigue and even physical harm to the workers, making it difficult for them to perform their duties adequately. When workers of any company are physically harmed at the workplace, it is a sign of either an inappropriate handling of work equipment or tools, or inappropriate design of the work area or task.

The South African sugar millers and sugar growers indicated that due to their work activities, they suffer from various types of bodily strains, including neck, shoulder, elbow, hip, wrist, hand, knee, ankle and foot pains, as shown in Table 15. The top three physical harm areas caused by the workers' tasks were backaches, which were highest rated, at 26.5 %; shoulder pains, at 18.2 %; and hips, at 10.4 %. These were the three areas that the workers determined to be the most physically problematic. It was found, through observation, that the workers handle heavy materials, and are involved in tasks that require them to bend for long periods.

During observations, it was found that many of the sugar growers' activities required the workers to bend to the ground. These activities include preparation of the ground, where the worker has to bend to ensure proper usage of the rake. They also need to be in a bending position when planting sugar cane stalks in the ground. These were the activities that caused major backaches for workers, hence the increased percentage of backaches. The millers work mainly with heavy machinery, which requires a lot of manpower for them to work at full efficiency, so the workers have to exert extra strength to operate these machines. The large percentage of shoulder pains found among the millers was due to the use of the heavy machinery that their work requires.

Some 12.5 % of the millers indicated that they have pains in their wrists due to their specific jobs, while only 5 % of growers indicated pain in that area. Only 23 of the millers interviewed, and 18 of the growers, reported on disturbances in their hands caused by their work, while a total of less than 6 % indicated strain in their knees and ankles, and less than 5 % (from both the millers and growers) indicated shoulder strain. This is the lowest amount of physical harm that was reported by the workers and that was observed by the researcher.

Table 15 Physical harm caused by workers' tasks

Cross tabulation													
													Total
		Back	Shoulder	Elbow	Hip	Wrist	Hand	Knee	Ankle	Wrist	Foot	Other	
Millers	Count	64	46	10	31	33	23	16	12	11	12	5	263
	% within A2	24.3 %	17.5 %	3.8 %	11.8 %	12.5 %	8.7 %	6.1 %	4.6 %	4.2 %	4.6 %	1.9 %	
	% of Total	15.1 %	10.9 %	2.4 %	7.3 %	7.8 %	5.4 %	3.8 %	2.8 %	2.6 %	2.8 %	1.2 %	62.2 %
Growers	Count	48	31	9	13	8	18	9	4	11	9	0	160
	% within A2	30.0 %	19.4 %	5.6 %	8.1 %	5.0 %	11.3 %	5.6 %	2.5 %	6.9 %	5.6 %	0.0 %	
	% of Total	11.3 %	7.3 %	2.1 %	3.1 %	1.9 %	4.3 %	2.1 %	0.9 %	2.6 %	2.1 %	0.0 %	37.8 %
Total	Count	112	77	19	44	41	41	25	16	22	21	5	423
	% of Total	26.5 %	18.2 %	4.5 %	10.4 %	9.7 %	9.7 %	5.9 %	3.8 %	5.2 %	5.0 %	1.2 %	100.0 %

6 Interpretation

Life cycle interpretation is the process of assessing results in order to draw conclusions (Baumann and Tillman 2004). In accordance with the goal and scope of the study, this phase has several objectives: to analyze the results and conclusions, to explain the limitations of the study, provide recommendations, and report adequately (UNEP 2009). It was found that the level of crime was significantly higher during certain sugar growth seasons, and that there was a concentration of men in some of the sugar industry's position as compared to women. Recommendations were made with reference to gender equality, working conditions, health and safety, and crime in the South African sugar industry.

6.1 Wages

6.1.1 Minimum Wage

It is recommended that the workers learn what the minimum wage rates are for their industry in order to prevent their exploitation by the employers, and to empower them with regard to their wage rights in the workplace. The education of workers regarding minimum wage rates will also prevent protest and wage disputes between workers and employers, as the workers would be able to make informed decisions about the wage rates before signing an employment contract. The employers are also urged to provide workers with their rightful wage rates as prescribed by the basic conditions of the Employment Act.

6.1.2 Wage-Related Incentives

The employers are also encouraged to provide wage-related incentives for their workers; these include overtime and target-based commissions, both of which have been proven to increase the motivation of workers while also increasing productivity levels. Such incentives will also increase the worker's wages, thereby decreasing their dissatisfaction level with their current wages; they also serve as supplements to the workers' wages, enabling them to expand their expenditure scale and contribute more to the country's economy. Wage-related incentives are essential, as they enable the workers to be in control of the amount of money they earn, which in turn provides the opportunity for them to control their income and expenditure ratios.

6.1.3 Worker's Expenses

It is recommended that the employers provide financial management workshops for the workers. These will help them manage their finances better, which will in turn lower their dissatisfaction level regarding wages. The content of these workshops should be based on how to draw up budgets, how to manage debts, and how to save money wisely. The ability of workers to manage their finances will have a positive effect on the level of satisfaction of the workers with regard to their wage rates.

6.2 Gender Equality

6.2.1 Ratio of Men to Women Employed

It recommended that the 60:40 ratio of men to women that is prevalent among both millers and growers is adequate because the tasks that are carried out at both the mills and growing plants involve the use of heavy machinery and is labor-intensive. These tasks have been defined as labor- concentrated and thus more suited for masculine physical abilities as compared to feminine abilities. The employers are, however, encouraged to treat workers equally within the workplace, irrespective of gender, thereby providing an environment where both genders are equally exposed to the same opportunities within the workplace.

6.2.2 Unequal Treatment of Workers in the Workplace

The employer should provide the same opportunities for both male and female workers. The empowerment of women is then necessary in this regard to allow the women's level to be the same as men's. Gender equality does not discriminate against any gender, so it is suggested that the employer not discriminate against women in terms of remuneration, training, or development and promotion opportunities. Furthermore, the employers are encouraged to train women to efficiently handle the heavy machinery and tools, an approach that would also encourage the balance between men and women within the workplace, and provide both genders with the same opportunities without discrimination.

The provision of the same opportunities will enable the development of both genders and thus increase competition among the workforce. Competition among workers enables the advancement of innovation, creativity and improvement in both work practices and operations, and the equal treatment of workers will also allow both genders to be empowered based on capabilities related to the job tasks and not based on gender, thus eradicating discrimination in that regard. Finally, employers are encouraged to learn, through workshops and seminars, how to treat the workers equally.

6.3 Health and Safety

The workers should be provided with protective equipment for their jobs. Many of the growers reported that they work under severe weather conditions; protective equipment would be able to ease the exposure to these conditions. It is recommended that the employers conduct fire drills for their workers to help them know how to act in case of fire; this will enable both the workers and the millers to take protective measures when it comes to security in the workplaces. It is also recommended that the employers provide training for their workers with regard to physical movements that limit the strain on their muscles. The workers of both the mills and sugar plants have labor-intensive jobs; this has led to many of them suffering from backaches and stiff fingers. Knowing the evacuation routes of a building will help in the event of a power outage, gas or chemical leak, or other emergency situation that can occur at the office (Walliman 2001). Fire drills ensure that employees exit the building in a timely fashion and know their team's designated meeting area, which helps the rescue effort in the event that an employee is unaccounted for during an actual emergency.

6.4 Limitation of the Study

One of the limitations of the study was the lack of consensus in the literature with regard to the application of SLCA. There are variations in data where the four phases of LCA are concerned, creating a challenge in the application of the methodology. It is thus recommended that the UNEP (2009) methodology be adopted as the basis for guidelines, since it has been validated by various accredited authors and contains a clear outline of the SLCA methodology.

7 Conclusion

The South African sugar industry has thousands of employees, yet it still lacks in providing its employees with the basic necessities to carry out their tasks comfortably. The workers do not practice their rights in the workplace; it was found that almost 40 % of the workers are ignorant of their rights or uninformed. The employers of both the millers and growers do not infringe on the rights of their employees in any way, but neither do they educate them in terms of their rights in the workplace. The millers as well as the growers are not satisfied with their wages, a common problem in South African agriculture. The furtherance of women has not been as significant as that of men in the industry; this is evident in the imbalance of gender among the workers.

The SLCA results have to be communicated effectively to decision-makers, using well-structured reports and high-quality data. Summaries and conclusions must be explicit and well-marketed, and the reports should be customized to the type of audience targeted. An independent critical review, by internal and external experts and by interested parties, enhances the quality and credibility of the assessment. The gathering of data for the SLCA was intense and at times confusing, because large amounts of data were collected before it was categorized according to the UNEP guidelines.

It is suggested that future research be conducted based on the rate of accidents in the sugar plants that is caused by the lack of emergency exits. The indication of water availability among the communities surrounding the sugar mills and sugar plants also requires further analysis. Furthermore, future research is suggested through SLCA case studies; the production of teaching materials; the development of tools; documenting and communicating the relationship with other models and methodologies in the same area; detailing stakeholder approaches; creating models for the presentation of the results; the development of SLCA consequential methodology; ways to identify socially significant processes with less expense and effort; the development of subcategories; the development of databases; the development of impact assessment methodologies such as cause-and-effect assessment; developing inventory indicators; methods for interpreting data; and structuring guidance on review processes to ensure high-quality studies. The fine-tuning of SLCA will continue, since more methodological improvements are needed and this effort will contribute to it, (Benoit and Mazijn 2009).

Appendix A: Workers' Questionnaire

Section A: Demographics—worker's questionnaire

Province	1.KwaZuluNatal	2.Mpumalanga	3. Eastern Cape			
Occupations	1. Millers	2. Growers	Transporters			
Age	1. Under 18	2. 18–24	3. 25–32	4. 33–40	5. 41–47	6. 48 and above
Gender	1. Male	2. Female	3. Transgender			
Education	1. Grade 1–7	2. Grade 8–12	3. Certificate/National diploma	4. Degree	5. Post Graduate Degree	
Employment	1. Permanent	2. Temporary	3. Contract	4. Seasonal		
Employment duration	1. 0–3 Years	2. 3–7 years	3. 7–10 years	4. Over 10 years		
Quality of life (optional)	1. Poor	2. Fair	3. Good	4. Very Good	5. Excellent	

Section B: Freedom of association

1. Please answer the following questions regarding your freedom of association in your workplace.

1.1 Do you have the organizational freedom to join any association?	YES	NO
1.2 Are you a member of any association?	YES	NO
1.3 Do your employers provide full independence and freedom in the functioning of your association?	YES	NO
1.4 Do you have the freedom to organize unions?	YES	NO
1.5 Do you have the freedom to industrial action?	YES	NO
1.6 Do you have the freedom to engage in collective bargaining?	YES	NO

2. Given the opportunity, which **3 main** subjects would you like to discuss in a collective bargaining negotiation with your employer?

Wages		Maternity leave	
Hours per week		Paternity leave	
Overtime payment		Educational leave	
Rest periods		Pension	
Compassionate leave		Funeral expenses	
Accident insurance		Others…. (Please state)	
Health care		……..	
Severance pay		……..	

Section C: Wages

1. Please answer the following questions regarding your wages.

1.1 Based on your income, do you feel that your wages should be increased?	YES	NO
1.2 Are you satisfied with the wages that you earn?	YES	NO
1.3 Do you have wage-related incentives (overtime, commission, etc.)?	YES	NO
1.4 Have your wages increased in the past two years?	YES	NO

2. State by means of a percentage which of the following basic necessities you spend your wages on. *Please ensure that the percentages add up to 100 %.*

Food	
Water	
Electricity	
Housing	
Transportation	
Healthcare	
Education	

(continued)

(continued)

Mobile phone	
Entertainment	
Savings	
Other… (Please state)	
……..	

Section D: Gender Equality

1. Please answer the following questions regarding Gender Equality in your workplace

1.1 The ratio of MEN to WOMEN at the workplace is approximately

50:50	60:40	40:60	80:20	20:80

2. Have you experienced any of the following forms of gender inequality at work?

2.1 Gender discrimination	YES	NO
2.2 Lower salary due to your gender	YES	NO
2.3 Unequal workplace treatment	YES	NO
2.4 Harassment or bullying due to your gender	YES	NO

3. In your opinion and experience, which of these factors are favorable to either men or women within the organization?

	Men and women treated equally	Men treated more favorably than woman	Women treated more favorably than men
Recruitment and selection			
Remuneration			
Appraisal/performance management			
Training and development			
Promotion opportunities			
Family-friendly policies			
Flexible working hours			
Policies and Procedures (e.g., grievance and disciplinary policies)			

Section E: Working Conditions

1. Please answer the following questions regarding your freedom of association in your workplace.
1.1 Do you have access to the following facilities at your workplace?

Separate toilets for men and women	Yes	No
Clean drinking water	Yes	No
Rest facilities (cafeteria, etc.)	Yes	No
Changing rooms	Yes	No
Personal lockers for your personal items	Yes	No
Emergency exits	Yes	No
Showers	Yes	No
All necessary protective clothing (gloves, rubber boots, helmets, etc.)	Yes	No
Protective measures in place from outside danger	Yes	No
Protection from climate conditions (rain, heat)	Yes	No

Section F: Health and Safety

1. Are you exposed to any of the following physical hazards in terms of **Health and Safety** at your workplace?

Transportation	YES	NO	If YES, do you have protective equipment for it?	YES	NO
Flow in pipes	YES	NO	If YES, do you have protective equipment for it?	YES	NO
Lime milling	YES	NO	If YES, do you have protective equipment for it?	YES	NO
Ventilators	YES	NO	If YES, do you have protective equipment for it?	YES	NO
Turbines	YES	NO	If YES, do you have protective equipment for it?	YES	NO
Compressors	YES	NO	If YES, do you have protective equipment for it?	YES	NO
Unpleasant smells	YES	NO	If YES, do you have protective equipment for it?	YES	NO
Heat and cold radiation	YES	NO	If YES, do you have protective equipment for it?	YES	NO
Dust	YES	NO	If YES, do you have protective equipment for it?	YES	NO
Do you have cuts/dry skin/peeling?	YES	NO	If YES, do you have protective equipment to avoid it?	YES	NO

1.2 Please state which joint(s) have bothered you due to your daily ***work-related*** tasks?

Back	
Shoulder	
Elbow	
Hip	
Wrist	
Hand/fingers	
Knee	
Ankle	
Wrist	
Foot/toes	
Other……	

Thank you for your participation. God Bless!

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Social Life Cycle Assessment Application: Stakeholder Implication in the Cultural Heritage Sector

G. Arcese, L. Di Pietro and R. Guglielmetti Mugion

Abstract The word "sustainability" is often used to refer to equity within and between generations, as explained in the Brundtland Report (1987). The clarification of the concept in the triple bottom line is often used to illustrate the need to investigate the social, environmental, and economic decisions. The classification of stakeholders is still controversial and not universally agreed upon in the various analysis models, are a common point balance categories: customers, staff, suppliers, and the local community (Hinna 2005; Schwartz 2006a). The Social Life Cycle Assessment (SCLA) methodology can be described as a tool that allows a strategic vision and management of the social sustainability of the product and takes the form of an analysis that lets the company observe the social impact of the product through its sustainability evaluation throughout its life cycle (Benoit et al. Int J Life Cycle Assess 15, 156–163, 2010). The possible solution to this gap can be represented by models of assessment of social impacts based on Life Cycle Thinking, and especially through the application of the Social Life Cycle Assessment (SLCA) methodology that is suitably integrated with the models until now mentioned in the literature (UNEP/SETAC, United Nations Environment Program, Paris SETAC Life Cycle Initiative United Nations Environment Programme, 2009b). The evaluation of the life cycle for the social aspects (social LCA) is a framework that allows the generation, organization, evaluation and communication of social impacts on the life cycle of a product, process, or service. The aim of this study is to create a framework for the social impact evaluation in the cultural heritage sector, through the association of existing Social Life Cycle Assessment tools with data resulting from social evaluation of the relationship between cultural services and stakeholders in order to point out the criticalities of the cultural heritage sector. This study introduced a theoretical framework for the evaluation of social impact on the cultural heritage

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sector, through the application of SLCA methods, and shows how it could be possible to classify the stakeholder subcategories in order to consistency. It is the preliminary approach of an integrative support to the SAM methods for SLCA.

Keywords Social life cycle assessment · Stakeholders' management · Social evaluation tools · Cultural heritage sector · Case study

1 Introduction: Comes Towards Social Pillar

The reputation of the concept of "sustainability" arises from the Brundtland Report (1987) in which it is defined as "ensures that society meets the needs of the present without compromising the ability of future generations to meet their own needs". There were different ways to define sustainability, but the most important comes from the Bruntland Report, which defines the three pillars of sustainability: environmental, economic, and social.

Concerning the social aspects of sustainability, business companies have raised the need to be fused on social aspects of their activities for various reasons (Lee 2008). According to Valente et al. (2013), the idea of social sustainability is difficult to define, because it is not clear what the meaning is. In particular:

- Black (2004) explains social sustainability as "*the extent to which social values, social identities, social relationships and social institutions can continue into the future*" (Valente et al. 2013).
- Torjman (2002) tags it as "*from a social perspective in particular, human well-being cannot be sustained without a healthy environment and is equally unlikely in the absence of a vibrant economy*" (Valente et al. 2013).
- Gilbert and Cordey-Hayes (1996) recognize the social pillar in "*the social sustainability requires that the cohesion of society and its ability to work towards common goals be maintained. Individual needs, such as those of health and well-being, nutrition, shelter, education and cultural expression should be met*" (Valente et al. 2013).
- The World Bank (2006), in the end, confers an economic dimension to social sustainability, where the capital (human and social) influences the national welfare.

It is clear that a definition of social sustainability is quite challenging (Valente et al. 2013).

In recent years, the attention paid by scientists to business studies regarding governance has increased and the "corporate governance" definition has broadened considerably and started to cover some aspects traditionally seen as being part of corporate social responsibility (CSR). This is based on the assumption that such standards increase legitimacy among stakeholder.

The SA8000 (SAI 2013) was the first auditable social standard and is based on the international workplace norms of the International Labor Organization (ILO) as well as the Universal Declaration of Human Rights of the United Nations in order to improve the working conditions in everyday life. The CSR and the Social Accountability and its standards, such as SA8000 (SAI 2013), have been theorized and standardized to support the social ethical engagement of companies that seek to find a consensus; economic reasons also fostered the development of this standard (Benoît et al. 2010).

As the economist Milton Friedman wrote, "There is one and only one social responsibility of business—to use its resources and engage in activities designed to increase its profits so long as it … engages in open and free competition, without deception or fraud" (1962). The only certain thing, as it emerges from the definition, is that sustainable development is based on three principal dimensions: economic, environment, and social. The best way to graphically show the relationship among these dimensions has always been as shown in Fig. 2. This diagram suggests that the "sustainability" is the small area in the center where all three circles overlap. The main problem related to this idea is that apart from the portions where the three circles overlap, none of the three dimensions is meant to be more important than another other (Fig. 1).

Moreover, as observed by Pizzirani et al. (2014), some authors (e.g., Hawkes 2001; UNESCO 2001; Saastamoinen 2005; Nurse 2006) refer to the "quadruple bottom line", considering culture the fourth pillar of sustainability alongside economic, social and environmental considerations. Payne and Raiborn (2001) could have solved the matter by reforming the diagram with a concentric approach. In this way, it acquires a different meaning—for instance, that an economy cannot exist without a society and no human society can subsist without a natural environment.

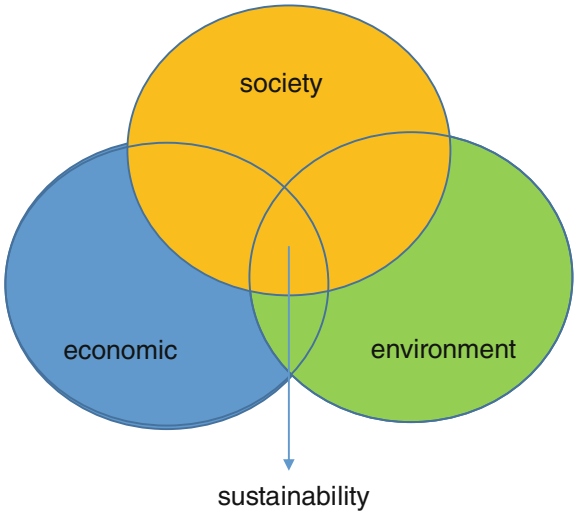

Fig. 1 Venn diagram of sustainable development: *Source* Adams, W.M. "The Future of Sustainability: Re-thinking Environment and Development in the Twenty-first Century." (Report of the IUCN Renowned Thinkers Meeting, 2006)

In other words, businesses recognize the synergistic relationship between them and the environment/society in which they operate. It would be irrational to suggest that businesses could exist without society and equally irrational to suggest that society could exist as well as, better than, or at all in the absence of business. This means that business and society need each other for practical reasons: businesses want to provide goods and services that society needs and/or wants.

McDonough (1992) considers the Hannover Principle for design the sustainability in nine key points:

1. Insist on the rights of humanity and nature to co-exist
2. Recognize interdependence!
3. Respect relationships between spirit and matter
4. Accept responsibility for the consequences of design
5. Create safe objects of long-term value
6. Eliminate the concept of waste
7. Rely on natural energy flows
8. Understand the limitations of design
9. Seek constant improvements by the sharing of knowledge.

These values reflect the ethics underlying the policies, strategies, and general business and should be integrated in the company through leadership and social commitment, i.e., a process aimed at achieving the objectives of environmental, economic, social and institutional improvement, both locally and globally. The main issue is linked to the difficulties of the businesses of linking their Corporate Social Responsibility (CSR) to their Corporate Financial Performance (CFP). This process has gone through various stages and it has not yet found its final equilibrium.

In the 1950s and 1960s, the classic formulation, which considers the relationship "exclusive," was overridden: The company is an economic entity created for the sole purpose of exchanging goods and services for a profit. In this perspective, the businesses have no responsibility to create wealth for the community, but if they focus on their end to produce wealth, this behavior generates benefits for society as a whole. Afterwards (in the 1970s and 1980s) the relationship become "inclusive," that is, where CSR and CFP are not mutually exclusive but rather coexist up to the point where the two concepts overlap in some cases. In the 1990s, CSR was characterized by the integration of the two concepts: businesses get better financial results if they behave in a socially responsible way because this helps improve their image and increases customer loyalty (Merli 2012).

Actually, regarding this third stage there are two opposing visions. The first identifies a trade-off between social responsibility and economic competitive performance, so companies that take on socially responsible conduct begin at a disadvantage, compared to competitors that do not include the social purposes in their management. In the short term, socially responsible businesses will have to bear the economic costs, among them the lack of immediate economic revenue. Then it configures an actual "social dumping" firms with greater attention to CSR may in fact be penalized. The second vision, instead, identifies synergies between

social strategies and competitive and economic results: socially responsible investments help improve the strategic positioning of the company compared to its competitors, in terms of social legitimacy, reputation, visibility and image, to generate positive indirect effects on its economic performance (Aupperle et al. 1985).

The three main areas where synergies can take place are the purchasing decisions of consumers, the motivation of employees, and investment decisions on the capital market. Some academics maintain that "… the effect of CSR is not to send a signal of complete altruism (lack of a profit motive or a wholly other-regarding orientation) toward stakeholders, but rather CSR activities signal that the firm is not completely self-interested, that its leaders can, do, and will consider impacts on others or the social good in their decisions; in short, that managers and their firms possess an 'other-considering' disposition toward their various stakeholders" (McGuire et al. 1988; Villafrate 2014).

In the literature, there is a gap between CSR analysis and SLCA application. The gap in the literature is even wider if we consider the applications in specific sectors, such as that of cultural heritage.

In this chapter we present an overview of the problems inherent to the topic and we analyze the possibility of evaluating social sustainability for the cultural heritage sector. In order to do so, we discuss CSR standards and social impact evaluation, and we present a theoretical framework for the application of SLCA in the cultural heritage sector based on our past studies and experiences. We have chosen this topic because of the sustainability of tourism and, in particular, because the cultural heritage sector, while very important, has not been studied; this is very important for the economic development of the Third World nations and, at the same time, for the consolidation of the tourism model in the industrialized world.

2 Materials and Methods

In order to better identify the methodologies for evaluating social performance, it is necessary to mention the "Stakeholder Theory" and its closely related social responsibility. The Stakeholder Theory is based on the acknowledgement of the existence of bidirectional and plural relationships between the firm and its environment. Effectively, there are many different definitions of stakeholders, but the father of the stakeholder theory is considered to be R. Edward Freeman, who in 1984 developed the first representation of it in order to propose "strategic management," which is based on such concepts as corporate planning, systems theory, and organization theory.

Fassin (2009) distinguishes three categories of stakeholders:

- Stakeholders: the people who actually have a stake in the company;
- Stakewatchers: members of groups that can put pressure on the company, as representatives of the first group of stakeholders (trade unions, consumer associations, etc.); and

- Stakekeepers: people who have an interest in more indirect but are still able to influence the company (governments, regulators, press, media, etc.).

The concept of stakeholders helps elucidate how the company's success is tied to the quality of the relationships with the various groups with which it exchanges goods and services, or otherwise comes in contact. The company is then immersed in a continuous process of communication that requires a constant effort in building relationships with stakeholders and no more than mere corporate communication (Merli 2012; Villafrate 2014).

The social aspect connected to the stakeholder approach gained importance as corporations began not only to focus on corporate achievements but also on promoting societal objectives. To determine a significant change in direction, they also contributed to the heavy legacy of an unscrupulous management, which was intended only for profit and growth.

For the past two decades, the responsible and sustainable approach is configured not as a cost, but rather as a strategic investment that is fully integrated with the overall purpose of a commercial nature. In fact, with time this strategy should be able to achieve a double objective: gaining the respect and confidence of all those who are interested in the fate of the company, the so-called stakeholders, while generating new wealth for the enterprise.

In a certain system, the companies were forced by the public to change their approaches to globalization. Globalization and the world economy express themselves in the forms of repositioning production facilities and global rearrangement of international specialization. The repositioning and rearrangement take shape by means of trade and direct investments. The non-homogeneity of the approaches to social sustainability, as repeatedly found in the bibliography, are especially evident by a plurality of standard methods of analysis and not harmonized between them (Arcese et al. 2013).

The codes and standards thus represent the essential core of corporate social responsibility, as they contain the principles and rules of the behavior on which it is built. This guide, *Social Responsibility Management Tools—A Contribution to Sustainability*, provides information from various public sources. The online "Sustainability Compendium" allows for the management tools to be constantly updated with the most relevant social and environmental responsibility issues in the country and in the world (Table 1).

The classification of stakeholders, not yet harmonized in the various analysis models, are a common point balance in these categories: customers, staff, suppliers and the local community (Hinna 2005; Schwartz 2006b). The SLCA methodology could be a complement for the social sustainability performance evaluation (Arcese et al. 2013).

Table 1 Social Responsibility (SR) management tools available in the world: an overview

ISO26000
ISO—International Organization for Standardization
The ISO 26000 will be an international standard providing guidelines for social responsibility (SR). Differently from ISO 9001 and ISO 14001, it will not be a certification standard, at least in its first version
Objective
It is aimed at providing social responsibility guidelines (it will not, therefore, be for use as a certification standard) and help organizations of different sizes and purposes—small, medium-sized and large companies, governments, civil society organizations, among others, to integrate SR into their management. For being applicable to more than just private companies, ISO 26000 shall use the terminology social responsibility (SR) instead of corporate social responsibility (CSR)
ISO 14064/65
ISO—International Organization for Standardization
International standards providing guidelines and procedures for CDM (Clean Development Mechanism) projects implementation provided for in the Kyoto Protocol, encompassing concepts of climate change, GHG emissions and removals
Objective
ISO 14064 is aimed at conferring reliability and transparency to companies' existing CDM projects or under development, and at valuing their carbon credits
ISO 14064's objectives are:
• Improving environmental reliability of GHG quantification • Promoting consistency, transparency and credibility in GHG quantification, monitoring, reporting and verification especially concerning GHG emission reductions and GHG removal enhancements • Supporting the design, development and implementation of comparable and consistent GHG schemes or programs • Enabling organizations to identify and manage GHG-related liabilities, assets and risks • Facilitating the trade of GHG allowances or credits
FSC Principles, Criteria and Standards
FSC—Forest Stewardship Council
In order to promote the discussion about sustainable use of forests, this organization has established principles, criteria and standards regarding economic, social and environmental issues
Objective
The FSC standards are currently widely diffused and represent a sound global forest management system aimed at sustainability
ValuesManagementSystemZfW—VMSZfW
DNWE—German Business Ethics Network
It is the German values management standard that integrates the moral dimension of economic transactions and questions of value into firms' strategies, policies, and procedures (process-oriented standard)
Objective
To provide a sustainable safeguard for a firm and its development, in all dimensions (legal, economic, ecological and social)

(continued)

Table 1 (continued)

ISO26000
It aims at sustainable management by integrating the firm's economic, moral, legal, and political dimensions
According to the organization, "credibility and moral reputation are the prerequisites of corporate success in its relation to markets and the society"
AS 8003 Standards Australia
Australian Standards Corporate Social Responsibility
The AS 8003 standard is one of the first in the world focused on the implementation of corporate social responsibility integrated into the company's policies and culture. It belongs to a set of governance commitments
AS 8003, as well as other products and services developed by Standards Australia, is published and distributed by the Standards Web Shop to associate companies only
AS 8000 Good Governance Principles
AS 8001 Fraud and Corruption Control
AS 8002 Organizational Codes of Conduct
AS 8003 Corporate Social Responsibility (this standard)
AS 8004 Whistleblower Protection Programs for Entities
Objective
This Standard sets out essential elements for establishing, implementing and maintaining an effective Corporate Social Responsibility Program within an entity and provides guidance in using these elements:
• Provides the process for an entity to establish and maintain a culture of social responsibility through a committed, self-regulatory approach • Provides a framework for an effective Corporate Social Responsibility Program, the performance of which can be monitored and assessed
Standard Israel—SI 10000
SII—Standards Institution of Israel
The SI 10000 standard addresses "social responsibility practices and engagement with the community"
Objective
Specific requirements regarding social responsibility practices and engagement with the community are aimed at enabling the companies to:
• Develop, maintain and strengthen policies and procedures to control their SR actions and interaction with the community • Show stakeholders that community-oriented policies and procedures are being complied with pursuant to the standard's requirements
ABNT NBR 16001
ABNT Associação Brasileira de Normas Técnicas
(Brazilian Association of Technical Standards)
It is a Brazilian social responsibility standard of a management system nature with certification purposes
OBJECTIVE This standard sets the minimum requirements regarding a social responsibility management system, which enable companies to design and implement policies and OBJECTIVEs that take

(continued)

Table 1 (continued)

ISO26000
into account legal and other requirements, their ethical commitments, and their concerns regarding:
• Promotion of citizenship • Promotion of sustainable development; and • Transparency
ECS 2000—Ethics Compliance Management System Standard
Japan Society for Business Ethics Study
The ECS 2000 is a standard that aids and supports the establishment of ethical compliance management systems in corporations and other organizations, according to the principles of Human Rights, Freedom and Interdependent Prosperity (zenpozen) within the market economy
Human rights and freedom are the basic principles of democracy, without which a capitalist economy becomes impossible
Objectives
This standard aims to enable organizations to find better ways to prevent unfair business practices and illegal behavior by their own board members, which violate the Code or Policy of Ethics. Therefore, it enables the identification of these violations and the people responsible for these actions. In order to achieve it, it is necessary to:
• Establish and manage an ethical-legal compliance management system • Create an internal ombudsman (collection of suggestions and criticism) for stakeholders and also create a Code of Ethics (in case there is not one) and a work philosophy
Det Sociale Indeks (The Social Index)
Ministry of Social Affairs (Denmark)
Det Sociale Indeks is a certifiable social responsibility management tool focused on the relationship between organizations and their employees as one stakeholder group
Objective
The Social Index is the first process tool aimed at private or state-owned organizations of all sizes willing to advance their social responsibility level regarding their workforce. The tool focuses on the dialogue between employees and the organization, giving the latter an opportunity to become certified as a socially responsible workplace, and communicate to the surrounding community the extent of its social responsibility
The Social Index is an evaluation tool which generally serves the following purposes:
• Evaluating the organization's status regarding social responsibility • Developing specific plans for improvement that can be included in corporate social responsibility strategy • Communicating to the society the organization's social commitment
The Social Index connects the organization's general policies, the implementation status, results and follow-up. The tool is flexible and can be adapted to the needs and circumstances of each organization
By going through the Social Index process, the organization will obtain an overview of its strengths and challenges. The tools can also serve as the basis for future work in the social responsibility field
Sistema de gestión Ética Y responsabilidad Social (Ethical and Social Responsibility Management System)—SgE
Forética (Spain)—Forum for the Evaluation of Ethical Management

(continued)

Table 1 (continued)

ISO26000
A voluntary auditable and certifiable standard that enables the assessment of the organizations' ethical and responsible management and establishment of a management system
Objective
Introducing ethical and auditable values in the management areas of an organization of any size or sector willing to make social commitments, and allowing the assessment and verification of such commitments made by the top management regarding social responsibility
The standard presents criteria that allow establishing, implementing and assessing the organizations' Ethical and Social Responsibility Management System as proposed by Forética, which, in turn enables organizations to manage (planning, monitoring and assessing), according to their values, their relations with all stakeholder groups. The system ensures the strategic integration of organizational values into the operations by focusing on processes, assessments and improvement plans
Occupational Health and Safety Assessment Series 18001—OHSAS
US Department of Labor—Occupational Safety & Health Administration
It is an auditable and certifiable occupational health and safety management system specification
Objective
The purpose of this standard is to help companies in the control of employees' health and safety risks. The OHSAS 18001 is a standard for Occupational Health and Safety (OH&S) management systems. The certification by this standard ensures the company's commitment to reducing environmental risks and continuously improving its employee's performance in occupational health and safety
The development of this standard has taken into account some existing national standards, such as the BS 8800, from England. The standard is based on the concept that an organization must periodically assess and evaluate its OH&S management system, so as to identify areas for continuous improvement and implement the necessary actions. For this reason, it does not establish definitive requirements for Occupational Health and Safety performance, but it demands that the organization fully comply with applicable laws and regulations and commit to the continuous improvement of processes
For not setting strict standards, two organizations developing similar activities, but with different levels of OH&S performance, can meet the standard's requirements
Social Accountability 8000
SAI—Social Accountability International
The SA8000 Standard is an auditable certification standard based on international workplace norms aimed at improving working conditions
Objective
SA8000 is increasingly recognized worldwide as a system for implementation, maintenance and verification of humane working conditions and assurance of workers' rights. It is designed especially for companies that own purchasing or production units in countries where it is necessary to assure that products are ethically made
SD 21000
Association Française de normalisation—AFNOR (French Association of technical Standards)
What it is

(continued)

Table 1 (continued)

ISO26000
SD 21000 represents the French contribution to the international debate on the standards for sustainable development organized by ISO bodies. Insofar as this is not a standard, the guide is classified in the legal category of documentary fascicles
Objective
"The SD 21000 is not a recipe for the implementation of sustainable development, but rather a didactic document of sensitization that provide business managers with good questions. It supports strategic thinking that allows the identification of 'significant' challenges and the establishment of measures to advance the control of stakeholder relations, and the integration of management and information systems (assessment, indicators, reporting). It is based on a transaction mechanism on challenges that are not exclusively economic"
The guide seeks to address two issues:
• Help businesses to implement sustainable development strategies • Organize a system for strategic transaction with external stakeholders and develop actions based on significant challenges
Good Corporation
A Good Corporation Ltd. (UK)
What it is
It is a certification distributed by a private company—Good Corporation—to organizations that disclose socially responsible practices and improvements in social, ethical and environmental issues, according to a set of defined criteria
Objective
Good Corporation provides companies with an independent and confidential assessment that help them protect their reputation and foster responsible business practices. The certification is designed for companies of any sector or size. In order to be certified, the company has to provide evidence of the adoption of good practices to manage employees, customers, suppliers, shareholders, community and environmental groups
Q-RES
CELE (Italy)—Center for Ethics, Law & Economics
Management model for corporate social and ethical responsibility that can be adapted to private companies, public organizations and associations, based on the concept of strategic, fair and efficient management of stakeholder relations. Principles of business ethics. Business ethics suggest that a balancing criterion my take the form of a fair and efficient 'social contract' between the company and all stakeholders. The social contract is not a real contract; rather, it is an ideal one: it is a touchstone. It is grounded on a concept of justice whereby what is fair is what people rationally and consensually accept with unanimity
To reach a fair agreement, the following conditions must be satisfied:
• The interests of all parties must be considered • All parties must be informed and not deceived • No one must have been or be subject to abuse of power or embarrassment; and • Agreement must be reached on a voluntary basis through rationality
Objective
The Q-RES project aims to develop a quality corporate social and ethical responsibility standard that can be certifiable and able to safeguard an organization's social and ethical reputation, besides building trust in stakeholder relations. The idea is that companies known as socially and

(continued)

Table 1 (continued)

ISO26000
ethically responsible can enjoy better relations with their stakeholders and have a competitive edge in terms of reputation, trust and credibility
British Standard 8555—BS 8555
The Acorn Trust
Set of environmental management standards focused on SMEs (Small and Medium-Sized Enterprises)
Objective
Phased implementation of an environmental management system aimed at continuous improvement. Following through all the phases could lead organizations to being in a position to be assessed against ISO 14001 or EMAS (EU Eco-Management and Audit Scheme)
British Standards 8800—BS 8800
British Standard Institution—BSI
Auditable and certifiable English standard focused on occupational health and safety management systems
OBJECTIVE
Implementation of an effective system to manage issues related to accident prevention and occupational diseases
British Standards 8900—BS 8900
British Standard Institution—BSI
This is not a management system standard. It is a set of guidelines, with no certification purposes, for organizations of all sizes, types and sectors, on the options for managing sustainability through balancing the social capital and the environmental and economic capitals of the business, focusing on continuous performance improvement and accountability
Objective
Mike Low, Director of BSI British Standards said:
"This standard is an important step towards helping organizations realize a sustainable future, while maintaining business performance. A successful approach to managing sustainable development will help ensure that an organization makes high quality decisions that promote continuing and lasting success. These decisions often relate to an organization asking itself the following questions:
• How can you be sure no groups or individuals are disadvantaged or kept in the dark? • How do you deal with others with integrity? • Will organizational decisions lead to irreversible environmental or societal change? • How do you make certain that relevant and reliable information is available in an accessible, low-cost and comparable way? • How are significant interests, influences and beneficiaries recorded, communicated and managed?"
The Sustainable Development Maturity Matrix presented in the BS 8900 helps organizations to answer such questions by providing a means of tracking performance against criteria and continually working toward improvement in each area
Community Mark
Business in the Community—BITC (UK)
It is a certifiable standard for social engagement of British SMEs

(continued)

Table 1 (continued)

ISO26000
Objective
CommunityMark is designed for small and medium-sized businesses (up to 250 employees) willing to obtain the recognition by the society of the public interest activities they carry out and the investments they make for the benefit of the communities where they operate. The tool provides visibility to the company's social action, adding value to its image as a responsible company, hoping that this recognition will contribute to attracting loyal customers
CommunityMark is a national standard or kitemark that does 3 things:
• Recognizes the contribution of small- and medium-sized businesses in their local communities • Provides a model that enables small- and medium-sized businesses to maximize their community involvement to benefit both the business and the community; and • Provides a model that encourages all small-and medium-sized businesses, even those that are not currently involved in their community at all, to get involved to benefit their business and the community
Advantage—a CommunityMark certification enables an SME, for example, to show examples of its local investment practices, thus providing a potential 'shortcut' to completion of local authority tender documents
AA1000
ISEA—Institute of Social and Ethical Accountability
Certifiable international standard consisting of processes and principles focused on stakeholder engagement
Objective
The AA 100 Series define the best accountability practices so as to ensure the quality of accounting, auditing, and ethical social reporting of all types of organizations (public, private, and NGOs of all sizes). The AA1000 process standards integrate the definition and integration of organizational values into the development of performance goals, and into the assessment and communication of organizational performance. Through this process, focused on stakeholder engagement, they link social and ethical issues to strategic management and business operations
Stakeholder engagement is the key point of AA1000. Through stakeholder engagement the organization will prioritize critical points to be addressed, determine indicators and set goals, and choose the reporting system that better suits the company. The series favors organizational learning and innovation. It brings benefits to overall performance—in the social, ethical, environmental and economic aspects—and helps organizations to move towards sustainable development
The standard is certifiable, but does not define certification or actual performance patterns. It specifies the process to be followed in performance reporting, but not the desirable performance levels. Some of the most important contributions of AA1000 are the processes and definitions that support corporate social responsibility practice. Innovation in the way to adopt rules is encouraged, allowing every company to define its own path. This gives more responsibility to the companies. Complying with this standard has been seen as a guarantee for shareholders and other stakeholders that there is consistency in the company's actions

Source Sustainability Compendium: "Social and Environmental Responsibility Management Tools"

3 Social Impacts Evaluation

Social impacts evaluation is one of the cornerstones of product or process sustainability. The SLCA is a method that is used to assess the social and sociological aspects of products, and their actual and potential positive as well as negative impacts along the life cycle. This looks at the extraction and processing of raw materials and their manufacturing, distribution, use, reuse, maintenance, recycling and final disposal. SLCA makes use of generic and site-specific data, can be quantitative, semi-quantitative or qualitative, and complements the environmental LCA and LCC (Benoît et al. 2010).

Discussions on how to handle social and socioeconomic criteria of products throughout a product life cycle started in the 1980s (UNEP/SETAC 2009c). The phases, the analysis, and the framework of the model were established through the drafting of the guidelines of the UNEP and SETAC (2009a, b) and the implementation of the analysis procedure. It may reflect the same phases of a product LCA (Griesshammer et al. 2006).

It can be possible to identify the four main phases related to the requirements of ISO Standard 14044: definition of the objectives and goals, the inventory data, the impacts analysis and the results interpretation. Different from environmental life cycle assessment (ELCA), they play a central role the analysis of stakeholders, which are already considered from the analysis of impacts.

The Stakeholders can be placed into five major groups: the workers, the local community, the society, the consumers, and all the other actors in the system. In this case, Inventory Indicators provide information about a specific subcategory; for example, the contractual agreements related to overtime, is an inventory indicator related to the subcategory of working hours of the worker stakeholder (Ramirez et al. 2014). Jørgensen et al. (2008) explain, for the first time, the association of each stakeholder's category with its objectives and impacts, model and the system boundaries for the single stakeholder impact imputation. After that, the preparation of the inventory of data is referred to the most appropriate indicators.

In 2008, Jørgensen presented matrix structure indicators for the various impact categories and broke them down into subcategories as established by international guidelines (UNEP/SETAC 2009c). The main subcategories of indicators relating to workers was expressed by indicators relating to collective bargaining and freedom of association, labor child, data on salaries and remuneration, working hours, gender discrimination, health-related indicators and social security benefits. The values of the set of indicators should be both qualitative and quantitative in relation to the impact associated with it. It is very important in this scenario that the characterization, in terms of geographic presence and intensity of the impact of a single factor on the territory, feature differently from the LCA, taking into account the influence of the local scenery on social realities.

Waidema in 2006 analyzed the techniques and specific impact assessment in the early stages of the life cycle analysis and other applications already present on the international scene, with a methodology whereby the impacts are quantified in

terms of years of life lost and in relation to life expectancy averages. The data source was usually derived from direct interviews; for this the data are defined as qualitative or semi-quantitative (Weidema 2006).

A very important matter in this kind of data is the comparability of the results for each indicator and performance at various stages of the life cycle of the product. There are several tools in the literature that perform this function—such as the Life Cycle Sustainability Dashboard Traverso and Finkbeiner (2009), and tools for the analysis SLCA designed by The Natural Step and the SAM—Subcategory Assessment Method (Ramirez et al. 2012). In particular, Ramirez et al. have developed the latter in 2012, which allows analyzing the organization's behavior for each subcategory and related stakeholder.

The method presents four levels (A, B, C and D) and evaluates the organization in relation to a basic requirement (BR) fulfillment. In 2012, Ramirez et al. developed the SAM (Subcategory Assessment Method), which allows analyzing the organization's behavior for each subcategory and related stakeholder. These basic requirements are defined, based on international agreements. In order to assess the service in the cultural heritage sector it used SAM.

The application on the case study shows the feasibility of evaluating the service in the cultural heritage sector in relation to subcategories with SAM and how it transforms social information in objective data (Ramirez et al. 2014).

In the analysis with the SAM application, it could be possible to assign the inventory indicators to impacts through social impact pathways, similar to environmental LCA. Similar methods of life cycle impact assessment were first proposed in 2006 by Dreyer et al. who were the first to consider subcategories, but only for the stakeholder "worker." Ciroth and Franze proposed a method in 2009, improving it in 2011, which includes all stakeholders and subcategories, without, however, establishing an objective way to evaluate data in the subcategory and a method to aggregate subcategories into impact categories. Nevertheless, it does not assess all the related subcategories, and evaluates the processes in four different levels: committed behavior, proactive behavior, compliant behavior and risk behavior (Couture et al. 2012; Ramirez et al. 2014).

In order to reduce the variability in the subcategories assessment in Social Life Cycle Impact Assessment Type 1, Ramirez et al. (2012) proposed a Subcategory Assessment Method (SAM), which takes into account the subcategories and related stakeholders presented in the Guidelines for SLCA (UNEP and SETAC 2009a, b). It assesses the social organization involved in the life cycle of the product in relation to the fulfillment of a core requirement (BR), which is defined for each subcategory based on objective references and international.

In order to provide a more objective assessment, SAM is based on a four level scale (A, B, C or D) for each subcategory. The clear definition of these levels is needed to help the practitioner apply uniformly in all the assessments.

Level A: The organization demonstrates proactive behavior by promoting good practices within the value chain, in addition to meeting the BR contract stipulating the activities of its suppliers or partners.

Level B: The organization meets the BR, according to the indicators of methodological sheets or conventionally recognized ones on an international basis (UNEP and SETAC 2010).

Levels C and D: Identify the organizations that do not comply with the BR. The difference between them depends on the conditions of the background—social, preferably in the context of the country or area, and when this is not available, the information from the same organization (Ramirez et al. 2012).

Following the application of the originators of the methodology, it is useful to associate them with the levels' numerical values (A = 4, B = 3, C = 2, D = 1) which correspond to a scale of semi-quantitative assessment of the levels, allowing the graphical representation.

4 The Theoretical Framework for the Application of SLCA in the Cultural Heritage Sector

As suggested by Di Pietro et al. (2013), culture is at the basis of a symbolic world full of meanings, beliefs, values and traditions. Culture also plays a fundamental role in human development and in the creation of the identities and habits of individuals as well as communities (European Commission 2007). At the same time, culture fosters the development of other sectors in an economic environment, playing an essential role in the creation of national wealth with social, economic and political implications.

In this context, cultural heritage assumes a central role in the territory due to its ability to influence the definition of social and economic objectives to be pursued, to encourage the determination of social practices and shared norms, and to influence the equity of the system through the identification of moral principles and values (Di Pietro et al. 2013; Sacco and Ferilli 2006). As noted by various authors, cultural heritage tourism reintroduces people to their cultural roots (Donert and Light 1996; McCarthy 1994) and reinvigorates people's interest in history or culture (Squire 1996). Hence, to invest in culture means to improve the quality of life in a specific area by attracting new economic, financial and human resources that influence the growth of the society (Di Pietro et al. [forthcomining]; Sacco and Ferilli 2006).

UNESCO (1972) recognized the importance of conserving the World Heritage Sites for future generations. For this reason, as affirmed by various authors (Landorf 2009; Garrod and Fyall 2000; Perdersen 2002), in order to manage the cultural heritage it is necessary to take into account the sustainability of activities and processes carried out. Pizzarani et al. (2014) emphasize that there are few examples of cultural impact assessment tools; in particular, no application of LCA or SLCA was written up in the current literature. The main aim of this study is to contribute to filling this lack, and proposing a theoretical framework to guide the application of an SLCA approach in the field of cultural heritage. As confirmed by Aas et al. (2005),

the implementation of models designed to preserve cultural heritage is an important aspect because, besides favoring their transmission to future generations, it also allows the development of tourism as a local resource.

As posited by Di Pietro et al. (2014), cultural heritage sites are expected to conceive their economic sustainability as part of their social function. They are asked to create value for attracting new visitor flows (Gilmore and Rentschler 2002) and generate significant income (Caldwell 2005) in order to guarantee their self-sufficiency and autonomy. Thus, museums need to achieve competitiveness (Goulding 2000) by expanding their supply, and offering traditional and cultural services that meet the additional needs of visitors, so as to increase visitor flows and related incomes (DiMaggio 1986; Kotler and Kotler 1998; Goulding 2000; Bagdadli 1997; Shamsuddin and Sulaiman 1998; Chirieleison 2003; Bernardi 2006). Weerawardena and Sullivan Mort (2006) suggested that museums should focus on sustainability from the economic point of view as the possession of sufficient resources to maintain their existence, and achieve the objectives in the future. However, to ensure sustainability in the museum in the long run, it is necessary to have a radical change in the management of the sector, through careful planning of effective management strategies (Bernardi 2006). Moreover, cultural organizations have to redesign their identities by focusing on the principles of democracy and inclusion, becoming a cultural, ethical and social tool that is able to meet the stakeholders' needs and to generate value (Ivory 1999).

On the basis of these considerations, the concept of sustainability should be seriously taken into account in the management of cultural heritage, as well as assessment tools such as SLCA should be adopted in a systematic way. To develop a theoretical framework of SLCA application in the cultural heritage sector, first it is necessary to map the stakeholders who are directly and indirectly involved. Second, for each category of stakeholder, it will be useful to define the role and its interests in order to realize the evaluation of the social impact of companies that work in the cultural heritage sector. In particular, it is useful to determine whether all the subcategories identified for the assessment are relevant and consistent with the specific features of the cultural heritage context.

In order to identify the main stakeholders involved in this sector, it is useful to define the cultural heritage service, with the aim of detecting the main activities and processes that characterized it. The core activity of a cultural visit is represented by the exhibition itinerary set up inside a museum/monument/archaeological site. In general, the exhibition itinerary begins after purchasing a ticket at the ticket office of the cultural site and finishes at the end of the visit. This process is the main element at the base of a cultural experience, and its presence contributes to creating value for the customers, and, indirectly, for the local community and the society in general. Figure 2 shows the essential scheme of a generic cultural heritage service.

The ability to create this kind of value depends by the combination and integration of the various elements and peculiarities that characterize, in a unique way, each cultural site and its relative offerings.

The core activity can be enriched by the inclusion of other additional services, such as a tour guide, technological applications, bookshop, coffee bar, restaurant,

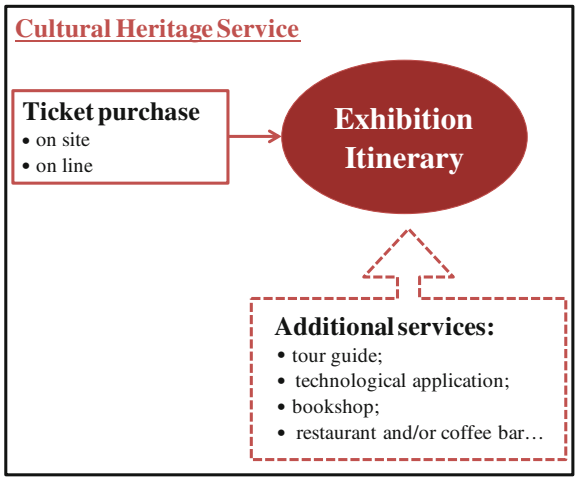

Fig. 2 Cultural heritage service tracking (authors' elaboration)

etc. These accessory services integrate the traditional cultural offering, adding more value for the customers, local community and society. The former can take advantage of additional services that increase the value of the visit's experience, while the latter can benefit, for instance, from the creation of new jobs or the higher level of cultural knowledge of the community. From this quick description of a general cultural visit process, it is possible to identify the most important stakeholders that are, directly or indirectly, involved and/or connected with the main developed activities.

As defined by Aas et al. (2005) a stakeholder is "a person who has the right and capacity to participate in the process," and, as recognized by Gray (1989), anyone who is impacted upon by the action of others has a right to be involved. In the cultural heritage context, thus, a stakeholder is an entity interested in the activities carried out by the cultural management and/or that is influenced by these activities. In order to map the stakeholders of the services provided by a cultural heritage site in a way consistent with the previous applications of the SLCA, it is appropriate to take into account the stakeholder classification presented by the UNEP/SETAC Guidelines (2009a, b). This classification identified five categories of stakeholder: employee, consumer, local community, society, and value chain actors, and for each of these categories are the linked subcategories as shown in Table 2.

As highlighted by some authors (e.g., Pizzirani et al. 2014; Arcese et al. 2013; Benoît et al. 2010), the above-mentioned five categories of stakeholders and subcategories have to be reviewed within an SLCA assessment. Hence, to allow the implementation of an SLCA approach to the cultural heritage services, it is necessary to identify and describe the meanings of the five stakeholder categories in this specific context and the relevance of the linked subcategories. Each category of stakeholders will be examined and contextualized, while each subcategory will be awarded a score of relevance in relation to the appropriateness of the category with the cultural heritage sector. The index represents the appropriateness of the

Table 2 Table of stakeholder and subcategories

Stakeholder categories	Subcategories
Employees	1. Freedom of association and collective bargaining
	2. Child labor
	3. Working hours
	4. Forced Labor
	5. Equal opportunities/discrimination
	6. Health and safety
	7. Fair salary
	8. Social benefit/social security
Local community	1. Access to material resources
	2. Access to immaterial resources
	3. Delocalization and migration
	4. Cultural heritage
	5. Safe and healthy living conditions
	6. Respect of indigenous right
	7. Communities engagement
	8. Local employment
	9. Secure living condition
Society	1. Public commitments to sustainability issues
	2. Contribution to economic development
	3. Prevention and mitigation of amending conflict
	4. Technology development
	5. Corruption
Consumer	1. Health and safety
	2. Feedback mechanism
	3. Consumer privacy
	4. Transparency
	5. End of life responsibility
Value chain actors not including consumers	1. Fair competition
	2. Promoting social responsibility
	3. Supplier relationship
	4. Respect of intellectual property rights

Source (UNEP and SETAC 2009a, b, Arcese et al. 2013)

assessment subcategory of social sustainability, in general, to evaluate a service, a product or a process that is part of the cultural heritage sector and where the value "1" represents a low level of relevance, while the value "3" expresses a great relevance.

4.1 Local Community

The local community is one of subjects belonging to a geographical area where the cultural heritage sites are located. The main interest of this community the ability of the cultural heritage service to produce a general improvement in the quality of life of the local area, allowing its members to achieve a higher social, economic and cultural status and level. The mission of every cultural site should be to favor the accessibility to material and immaterial heritage with the aim of increasing the level of awareness and knowledge of the local community. This way, it is possible to generate an increase in the attractiveness of the local territory, strengthening the sense of belonging to the community and triggering mechanisms for the wider diffusion of culture and knowledge.

As shown in Table 3, the subcategories listed for the stakeholder local community are:

- Cultural heritage
- Respect of indigenous rights
- Access to immaterial resources
- Access to material resources
- Safe and healthy living conditions
- Secure living conditions
- Local employment.

Evidently, some of the subcategories listed are less consistent and relevant in the management of cultural heritage. To measure the correlation of the subcategories in the application of an SLCA assessment in the cultural heritage sector, a qualitative approach was implemented. In particular, as shown in Table 3, each of the subcategories was assigned a score of consistency to the specific frame of reference, where "1" indicates a low level of relevance, while "3" expresses a strong coherence.

Table 3 Score of consistency for the local community subcategory

Subcategory of local community	Level of consistency with the cultural heritage management
Community engagement	3
Cultural heritage	3
Respect of indigenous rights	1
Access to immaterial resources	3
Access to material resources	2
Safe and healthy living conditions	2
Secure living conditions	1
Local employment	3

On the basis of the presented examination, it is appropriate to consider six out the eight subcategories in the implementation of an SLCA analysis to the cultural heritage service. The subcategory "cultural heritage" shows great relevance, due to the fact that a positive performance of the cultural services under review can produce a positive impact on the image and knowledge of the other cultural attraction available in the surrounding areas. At the same time, sustainable management of a specific cultural heritage can present a constructive influence on the rate of local employment, as well as on the local community's engagement. Similarly, another important aspect to take into account for the SLCA application in a cultural service, is the ability of the cultural site to facilitate access to the immaterial resources, such as knowledge, awareness, history, identity, etc.

4.2 Employees

In the cultural heritage site, the numbers of employees is not usually very high, but their contribution in the provision of services is crucial. Different types of worker are present within these kinds of organizations and they have heterogeneous competences among themselves (administrative, managerial, archeological, cultural, technological, etc.).

The general subcategories listed for the "employee" stakeholder in the SLCA are:

- Freedom of association and collective bargaining
- Child labor
- Fair salary
- Hours of work
- Forced labor
- Equal opportunities/discrimination
- Health and safety
- Social benefits/social security.

Analyzing these subcategories in the cultural heritage sector, it is evident that they are all applicable to this specific context (Table 4). Indeed, the relevance of these subcategories is strongly influenced by the national level of development. More is high the level of development of a country and, normally, more should be positive the evaluation of all these subcategories. Conversely, in developing countries, some of these elements could cause criticisms (e.g., child labor, fair salary, equal opportunities, etc.).

Table 4 Score of consistency for the workers subcategory

Subcategory of employee	Level of consistency with the cultural heritage management
Freedom of association and collective bargaining	3
Child labor	1
Fair salary	3
Hours of work	3
Forced labor	3
Equal opportunities/discrimination	3
Health and safety	3
Social benefits/social security	3

4.3 Customer

The customers are the final users of the services offered by a cultural site, and they represent a highly heterogeneous category of stakeholder, which includes not only resident users but also national and international tourist flows. Every consumer is the bearer of his own experience and, consequently, evolving needs. The monitoring of the consumer dynamic needs is an essential element in order to understand how to improve the quality of services and products for making it even closer to the desired end-user. Because of this, it is necessary to institute mechanisms within cultural heritage sites to listen and study the final customer, with the aim of understanding their behavior, studying their needs and analyzing the level of satisfaction.

In general, the subcategories concerning the stakeholder "customer" are:

- Health and safety
- Feedback mechanism
- Privacy
- Transparency
- End-of-life responsibility.

From the evaluation of the relevance of each of these subcategories in the implementation of an SLCA in a cultural heritage site, there emerges a strong importance of "health and safety" and "feedback mechanism," a medium relevance of "privacy" and "transparency" and a low significance of the "end-of-life" subcategory (Table 5).

The "health and safety" aspects of a cultural heritage site are strongly tied to the exhibition itinerary, which has to be projected with consideration for the security of the customer along the whole path. Likewise, a pivotal role is played by the "feedback mechanism" subcategory, since it assesses the ability of the management to create a dialogue with the customer in order to improve the quality and sustainability of the services provided.

Table 5 Score of consistency for the customer subcategory

Subcategory of customer	Level of consistency with the cultural heritage management
Health and safety	3
Feedback mechanism	3
Privacy	2
Transparency	2
End-of-life responsibility	1

Conversely, the "privacy" subcategory is less relevant in these kinds of services because they are not particularly risky for the customer. Only a few situations could be unsafe, and they are basically connected with the use of technological devices during the visit. In the same way, "transparency" is not very essential, considering the type of services; at any rate, it could represent an important element for the SLCA implementation of presence of specific certifications and commitments toward the main aspects of CSR. Finally, "end-of-life responsibility" is not applicable in the assessment of the cultural heritage services.

4.4 Society

A company that manages a cultural heritage site, with its strategy and behaviors, actively contributes to the social and economic development of the society. In general, for the stakeholder society, the implementation of SLCA considers the following subcategories:

- Public commitments to sustainability issues
- Contribution to economic development
- Prevention and mitigation of armed conflicts
- Technology development
- Corruption.

In the cultural heritage sector, the "contribution to economic development" subcategory can show a strong relevance, particularly in the territories characterized by a high concentration of cultural sites and where sustainable management may achieve important goals in terms of local and national development. Even the "public commitments to sustainability issues" presents significant consistence within the cultural heritage sector. Another interesting subcategory is "technology development," because in recent years the diffusion of technological application in the cultural heritage sectors is growing. This aspect represents an opportunity to manage—in a sustainable way—the technological factors in this sector, fostering and stimulating the development of new technology, its application, and its dissemination (Table 6).

Table 6 Score of consistency for the society subcategory

Subcategory of society	Level of consistency with the cultural heritage management
Public commitments to sustainability issues	3
Contribution to economic development	3
Prevention and mitigation of armed conflicts	1
Technology development	3
Corruption	2

4.5 Value Chain Actor

Various actors are involved within the value chain of a cultural heritage site. As shown in Fig. 1, several additional services can be added to the traditional and basic exhibition itinerary, and each of these extra services may involve supplementary actors (i.e., technology suppliers, contracting managers of bookshops, restaurants or coffee bars, security agencies, etc.). For the application of SLCA, it is also necessary to evaluate the relationship of a company with this category of stakeholder, which is directly involved in the process of value creation. The subcategories recognized for the stakeholder "value chain actors" are:

- Fair competition
- Promoting social responsibility
- Supplier relationships
- Respect of intellectual property rights.

All the above-mentioned subcategories show a high level of relevance in the cultural heritage management context (Table 7), but one subcategory takes on a particular relevance in this sector: "respect of intellectual property rights." A sustainable cultural heritage management has to base its activities on the respect for intellectual property rights in order to guarantee and preserve the works of art, the authors, and the availabilities of culture and history to future generations. Hence, the respect of this subcategory must be carefully considered throughout the supply chain management of a cultural heritage site.

Table 7 Score of consistency for the value chain actor subcategory

Subcategory of value chain actor	Level of consistency with the cultural heritage management
Fair competition	2
Promoting social responsibility	2
Supplier relationships	2
Respect of intellectual property rights	3
Fair competition	2

We could conclude with the ideal application of the SAM to the table revisited on the basis of our study of the general assessment of the subcategories in the field of cultural heritage. Mapping the services on the use of cultural heritage, we can categorize the following processes:

- Ticket purchase on-site
- Ticket purchase online
- Exhibition itinerary
- Additional services—tour guides
- Additional services—technological application
- Additional services—bookshops
- Additional services—restaurant and/or coffee bar.

Hypothesis of application in a museum

To better understand the operation of the model in the context of cultural heritage, it is possible to hypothesize the application in a general museum. Taking into account the mapping of processes for the provision of museum services, it is possible to detect the impact of the operations carried out on social variables.

We conclude the SAM application (Ramirez et al. 2014) and takes into account the categories represented in Table 8. In this model we have a scale of levels and scores from 4 to 1, when 4 is the best score and 1 represents a poor evaluation, based on interviews and on-site observations. We could be resume in the table the results for each stakeholder's subcategories. In the final evaluation, in order to consider the consistency score attributed to the subcategory, you can ponder based on consistency, the incidence of overall score in the category of stakeholders.

During the periods of observation of visits to the museum, usually the behaviors and interactions between users (customers) and exhibits permits the assessments of the variables that attract them. In this way, it is possible to consider, for example, for the "local communities" category, in a less accident categories under the "access to material resources," "safe and healthy living conditions" in relation to the "sub-local employment community engagement Cultural Heritage and Immaterial and Access to Resources.

Limitations and recommendations

SLCA is a methodology for comprehensive and effective assessment, and the whole concept of social sustainability has evolved in multiple aspects. The level of analysis has moved from the macro-societal level to the organizational level, through the application of the methodology to a specific sector, such as cultural heritage. As of now, any quantitative application could be used because this model is an experimental and theoretical technique.

Usually, the impact assessments of the indicators of social sustainability on "cultural heritage" yield negative results; this depends largely on the lack of participation of the accommodations sector in the tourism network and the lack of cultural organizations and artistic collaboration, which hinder the promotion and development of the area, and the lack of organizational networks and tourism

Table 8 SAM assessment for cultural heritage services (Rivera-Sánchez et al. 2014)

Subcategory	Score of consistency	Ticket purchase on-site	Ticket purchase online	Exhibition itinerary	Additional services tour guides	Additional services technological application	Additional services bookshops	Additional services restaurant and or/ coffee bar
Local community								
Community engagement	3							
Cultural heritage	3							
Respect of indigenous rights	1	–	–	–	–	–	–	–
Access to immaterial resources	3							
Access to material resources	2							
Safe and healthy living conditions	2							
Secure living conditions	1	–	–	–	–	–	–	–
Local employment	3							
Worker								
Freedom of association and collective bargaining	3							
Child labor	1	–	–	–	–	–	–	–
Fair salary	3							
Hours of work	3							
Forced labor	3							
	3							

(continued)

Table 8 (continued)

Subcategory	Score of consistency	Ticket purchase on-site	Ticket purchase online	Exhibition itinerary	Additional services tour guides	Additional services technological application	Additional services bookshops	Additional services restaurant and or/ coffee bar
Equal opportunities/ discrimination								
Health and safety	3							
Social benefit/social security	3							
Customer								
Health and safety	3							
Feedback mechanism	3							
Privacy	2							
Transparency	2							
End-of-life responsibility	1	–	–	–	–	–	–	–
Society								
Public commitments to sustainability issues	3							
Contribution to economic development	3							
Prevention and mitigation of armed conflicts	1	–	–	–	–	–	–	–
Technology development	3							
Corruption	2							

(continued)

Table 8 (continued)

Subcategory	Score of consistency	Ticket purchase on-site	Ticket purchase online	Exhibition itinerary	Additional services tour guides	Additional services technological application	Additional services bookshops	Additional services restaurant and or/ coffee bar
Value chain actor								
Fair competition	2							
Promoting social responsibility	2							
Supplier relationships	2							
Respect of intellectual property rights	3							
Fair competition	2							

systems capillaries. However, both the application in the field of SAM and the SLCA in general are moving in its infancy, and still have several shortcomings and problems to solve.

The main problem is related to the difficulty in linking social indicators with the functional unit of the system/product to make it manageable and meaningful, especially for the tourist sector and cultural heritage, but this does not mean that the model is not operational. The effectiveness of the model structure has been amply demonstrated in the literature and through empirical analysis conducted on specific products.

5 Conclusions

This study introduced a theoretical framework for the evaluation of social impacts in the cultural heritage sector, through the application of SLCA methods. The role of the sustainability concept must integrate, in a systematic way, the management of cultural heritage companies as well as other sectors. Until now, there has been a lack of studies on the application of the social impact assessment in the cultural context. For this reason, this research introduced a first theoretical frame adapted for the specific characteristics and peculiarities of this sector. After identifying the main stakeholder categories, an analysis of the evaluation of relevance and coherence of the various subcategories was carried out. In this way, each subcategory has been measured, in terms of appropriateness, with features of the companies working in the cultural heritage sectors.

Although this represents the first study conducted on the evaluation of social impacts in the cultural sphere, it is not without limitations. Firstly, the proposed framework should be tested in a real context to understand its validity and to detect possible actions to improve its potentialities. Moreover, each subcategory might be defined for leading indicators to refer to the application of the SLCA. These limitations, at the same time, point to future implications of the present study. Indeed, future research steps may provide the ability to apply the developed theoretical framework within the real context, carrying out an empirical application through an empirical case study on a cultural heritage site (e.g., museums, monuments, archaeological sites, nature reserves, etc.).

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Assessment of Social Impacts of Chemical and Food Products in the Czech Republic

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Abstract The journey towards sustainability for the chemical and food industries requires sustainable production and consumption and also requires the social responsibility of organizations. Companies' stakeholders ask themselves more and more about the social impacts of products and production processes. The chemical and food industries can be considered to be among the most important industries with strong impacts on society, and they bring about many social interactions. Both industries are interested in solving the questions of the impacts of their products on health, working conditions, production, and product safety, as well as the protection of human rights and cultural heritage. It is necessary to discuss conditions and limitations for effective assessment of social impacts along the whole product's life cycle. The assessment of chemical and food products' impacts requires identification of the industry specifics and the regional specifics; traditionally, the chemical industry is perceived as an indispensable and helpful, but on the other hand, a dangerous, hazardous and environmentally harmful industry branch. The food industry can be considered to be essential and beneficial, but with a strong influence on landscape utilization, human health, and social welfare. Both industries have strong social interactions and are under the strict supervision of EU legislation authorities and stakeholders; therefore, it is necessary to discuss the scope of social impact assessment studies, the choice of suitable indicators, and data availability. This chapter characterizes the perceived importance of the social impacts of chemical and food products on stakeholders. There are determined sector-specific and national-specific social impacts of chemical and food production processes in the EU area. Also, the possibilities of monitoring and evaluation of appropriate Social Life Cycle Assessment (SLCA) indicators at the corporate level are

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disscused. On the basis of the data collected from semi-structured interviews with top managers from more than 35 chemical and food companies, it was possible to conclude that there is a considerable effort on the part of the companies not to underestimate the assessment of social impacts of their products. Both industries are influenced by many specifics, but a lack of information support for the collection of data or selection of indicators is evident. The absence of branch data and absence of information about the social impacts of the origins of the basic raw materials complicate monitoring in the initial stages and in the final life cycle stages of chemical substances. The assessment of food products can be considered to be significantly simpler than the assessment of chemical products, but the absence of branch-specific data and availability of branch-oriented indicators complicate the assessment. Future effective assessment of social impacts requires closer understanding of the life cycles of chemical and food products—especially with chemicals. It is necessary to carry out further theoretical developments in the field of branch-specific indicators and the development of an information basis for the collection and processing of generic (hotspot) data. It is also necessary to encourage further improvement of an information basis on the corporate level.

Keywords Social life cycle assessment · Social impacts · Life cycle · Chemical industry · Food industry

1 Introduction

Sustainable production and consumption, based on the key outcomes of Rio +20: The Future We Want requires more effective decision-making processes on the company products in the context of financial as well as environmental and social issues. Chemical and food industries can be considered to be among the most important industries affecting changes in climatic conditions and other environmental issues, and they also have strong impacts on the society. These industries produce highly concentrated forms of pollutants, but at the same time their products are absolutely essential for man to be able to survive. While the environmental controversies regarding both industries are nowadays the subject of a number of studies, sustainable production and sustainable consumption concepts have been approved, Life Cycle Assessment (LCA) studies, Ecological Footprint and Carbon Footprint studies of a number of chemical and food products have been published (see Burgess and Brennan 2001; Mendivil et al. 2006; Wernet et al. 2010; Capello et al. 2009; Muthu 2014), and a number of standards and norms have been issued, research in the social area in both of these industries is still in its infancy. The growing interest of the society and the scientific community in the problems of social impacts of the produced items have raised quite a few important questions concerning the rate of influence of the produced items on the society and, in general, on all the important stakeholders. The existing concepts solving social

questions in entrepreneurial practice (e.g., the corporate social responsibility [CSR] concept) have not been able to express these impacts, even with the help of the generally applied current methods, such as the SIA method, or approaches focusing on sustainable development, such as SA or AA. The SLCA method offers a complex assessment of the social impacts of the produced items alongside the products' life cycles, and although it is a promising methodical approach, its practical application faces a number of differences among individual industries, as well as the geographical affiliation of the production plants. Therefore, it is necessary to discuss the relevant conditions for assessment of social impacts for individual industries and perform direct surveys in the conditions of chemical and food production to identify the specifics of individual industries and the regional specifics, as well as to identify the scope of studies, the choice of suitable indicators, and data availability.

In view of the product diversity in both industries, finding answers to these questions is a considerable challenge. A number of certain circumstances and limitations can only be supported after thorough research into the conditions and possibilities of the entrepreneurial practice. Furthermore, despite a number of uncertainties connected with the calculation of social indicators, it is obvious that different types of chemicals and food products will show very different social impacts, depending not only on the product type and its next usage, but also on the production technology used. However, the information assessing the social impacts of the produced items can be usable in communication with various stakeholders, support positive perceptions of food, and particularly chemical production, and also contribute to sustainable production and consumption. Food and chemical industries are basically very similar; in a number of cases there is chemical transformation of feedstock, the produced item has another chemical composition, and the production technologies are very similar. However, the perception of these industries by the society and various stakeholders is significantly different. The chemical industry is, unlike the food industry, perceived as a potential danger not only for the neighborhood closest to the production plants, but also for the wider surroundings. Significant environmental burdens in some areas definitely support these arguments. From the point of view of social impacts, chemicals are considered by some strata of society as something "artificial" and unhealthy, and their production is, apart from the potential risk of an accident, not only accompanied by emissions of pollutants into the environment, but also by a number of effects giving off odors or visually negative impressions. The food industry is perceived significantly more positively; on the one hand, it does not represent the strongly perceived environmental burden and, on the other, its products are essential, welcome, and often popular for the society. In view of the fact that these foodstuffs are, however, directly consumed by humans, their impacts on the society are direct and cardinal, and in the case of low-quality products, can even be critical.

These are the reasons that both industries are greatly interested in solving the questions of the impacts of their products on health, working conditions, production and product safety, as well as on the protection of human rights and cultural heritage. When the reserves of the basic raw materials for chemical, and often also

for food production, start to show critical limits (as a result of the growing population and increased consumption of these products), and their prices start, to increase unstoppably as a result of this, enterprises in both of these industries face the basic task of getting to know and express both the negative and positive impacts of their products on the society and on the environment.

Social life cycle assessment represents a new technique for evaluating social impacts throughout the life cycle of a product (Benoit-Norris and Mazijn 2009). However, SLCA methodology presents only a general framework, and for its full application requires some adaptations for each individual industry as well as the geographical affiliation of the production plants (Benoit-Norris 2014). The sectorial- and the process-based approaches are mentioned directly in the Guidelines for SLCA (Benoit-Norris and Mazijn 2009). In environmental LCA there is a collection of "generic" or industry Data averages to identify processes that make small, individual (but possibly a large total) contributions to total impacts over a life cycle, following the goal to identify the processes that make a major contribution to total impacts. A similar process of identifying branch specifics using average data can be very helpful in the early stages of an SLCA (Benoît-Norris 2009). For data collection related to relevant social themes or subcategories, a Social Hotspots Database (SHDB) as an overarching, global database that eases the data collection burden in SLCA studies was developed (Benoît-Norris et al. 2012), but neither can the SHDB cover all social stakeholders, subcategories for particular production sectors and regions. For these reasons, further development and research on branch-specific and geographically specific indicators and databases must be realized.

Over the years, the existing literature has proposed a very limited effort in solving branch-specific and geographically specific social indicators and databases for the chemical and food industries. Modified SLCA methodology, focused on the agri-food sector, was presented by Group Ageco and QUANTIS; however, it did not assess all the related subcategories (Couture et al. 2012). The BASF chemical company, in collaboration with the Öko-Institut Freiburg and the Universities of Jena and Karlsruhe, developed a method called SEEBALANCE (BASF 2013). This method is closely related to SLCA methodology, but uses slightly different categories, and a limited number of indicators is considered. The European Chemical Industry Council (CEFIC) put forward a framework for social life cycle impact assessment based on SLCA but without any supporting information. According to a published document, "Sustainability of Products: What It's All About," the conclusion can be, "Assessing the social aspects of product sustainability is not an easy task, … there are very practical obstacles, such as the availability of data and the consensus on the procedure by industry and the public." (CEFIC 2012) For the food industry, a few SLCA studies concerning particular products (among them "Cheese Production in New Zealand," "Cereals in Valonia," and "Tomatoes in France") have been presented, but research on methodology adjustment is still in its early stages. The unique proposal for the food industry was published by Smith and Barling (2014) who created proposals for methodological development for SMEs in the European food and drink sector (Smith and Barling 2014).

Presented methodologies and case studies for SLCA mostly do not include all the subcategories suggested in the guidelines, nor are they branch-specific oriented. Due to those limits, the objective of this chapter is to closely describe the conditions and backgrounds in the chemical and food sectors of the European Union (EU) and of the Czech Republic. In the chapter, the following topics will be discussed in depth:

- The perceived importance of stakeholder categories and subcategories
- The availability of information related to social issues
- The willingness of companies to evaluate the social impacts of their products
- The accessible scope of SLCA studies for chemical and food products
- The branch-specific and geographically specific indicators for social impact assessment

While recognizing the difficulties of covering the methodology specifics of social impact assessment for particular industries (chemical and food sectors), it is argued that the chapter makes a useful contribution to the methodology development for both sectors. Also as of late, sources of uncertainty and limitations related to both sectors and recommendations for future research activities are discussed.

The chapter first reviews academic and "gray" literature on the Czech Chemical and Food Industry against the background of EU conditions and challenges at the beginning of 2014. Key challenges are identified and discussed and then drawn upon to help formulate important and crucial social impacts related to chemical and food products. In the next section, social interactions with stakeholder categories and sector-specific social impacts, as well as information availability, are closely discussed and described. These theoretical findings and assumptions were further explored through the conducted survey. Semi-structured interviews with managers of chemical and food companies were structured in four sequential themes, according to individual steps of SLCA methodology.

Based on the review and semi-structured interview survey findings, issues concerning social impact assessment for the chemical and food industries are discussed, followed by the identification of uncertainty sources and limitations, and then by concluding remarks about future research needs.

2 The Czech Chemical and Food Industry in the Context of the EU Area

Both the chemical and food industries play a unique role among the sectors of the European Union. The EU has dedicated considerable attention to the chemical and food industry; this, includes the social impacts of these products.

The methods for collecting information that were used included interviews with representatives of the industry associations and previously conducted interviews

with managers; the article also reviews of both academic and "gray" literature on chemical and food industries in the Czech Republic and the EU and their relationship to social LCA (SLCA).

2.1 The Chemical Industry

The chemical industry represents one of the most important industries, whose products today's civilization could not do without. Along with production of the basic organic and inorganic chemicals, it provides the basic cleaning and washing detergents; makes it possible to achieve higher agricultural yields through fertilizing and chemical protection of crops; and produces artificial textile fibers, plastics, painting materials, etc. The chemical industry is connected to other industries, such as food production, textiles, paper, drugs, machinery and many others; it is an industry that has changed the world around us. Thanks to the chemical industry, the development of new materials such as plastics, fibers, polymers, dyes, additives, protective substances and many others, products are cheaper, lighter, and more durable.

According to the EU Commission (the EU executive body that representing the interests of Europe as a whole), the chemical industry can be considered an extraordinarily successful EU industry; chemical substances, plastics, and rubber comprise the basis of the entire EU industry. This also makes a positive impact on economic growth, innovations, employment, and exports. The EU is on a high level in the area of the chemical industry; it controls about one-fifth of the global market. The traditional technological advanced level of European businesses has been ensuring highly competitive and successful products for decades (Haurnick 2010; CEFIC 2012).

2.1.1 EU Space Challenges

In connection with the chemical industry, the EU has specified its own challenges relating, for example, to energy demands, qualified manpower, innovations, chemical notifications, or sustainable chemistry, among others (Haurnick 2010; CEFIC 2014; European Climate Foundation 2014).

Energy Demands

Chemical production, compared to other industrial productions, is more demanding from the point of view of energy consumption, mainly of crude oil and natural gas, and therefore chemical production businesses spend huge amounts of money on energies. Despite its growing production, the European chemical industry continuously decreases the energy demands and limits the emission of greenhouse gases.

On the other hand, as opposed to the general global trend of energy cost-cutting, these costs are rising in Europe—they are three times as high as costs in the USA and generally higher than in the other competing regions. For the chemical industry as an energy-intensive industry, these increases in energy prices are reflected in the increases in the energy costs of producing chemicals.

However, high energy costs might result in a situation where chemical businesses with high energy demands will be closed and their production will move to the regions where the price of energy is lower (the USA or other countries). High energy expenses represent risks for the EU economy, particularly for industries with high energy demands (European Climate Foundation 2014).

Qualified Manpower

The chemical industry, its performance and extent, is certainly an indicator of the economic level of each country, as it places high demands on qualified manpower, According to a survey of the EU Commission (European Commission 2013), the chemical industry sector shows more than 25 % of highly qualified and 50 % of semi-qualified manpower. Compared to the other industries, it takes the top places in the EU space. However, at the same time, the EU education structure diverges from technologically educated graduates, and it is the humanities that prevails. Qualified manpower is thus going to become another significant chemical production cost.

Innovations

At the beginning of the twenty-first century, statistical analyses, opinions of entrepreneurial practice experts, and regular reports resulted in the identification of the alarming finding concerning the innovation potential of the EU chemical businesses (Fleischer 2003). Comparison with the EU, the US, and Japan implied the following:

- EU businesses are less efficient than U.S. firms.
- EU businesses show lower R and D productivity than U.S. firms.
- EU businesses show lower patent productivity than U.S. firms and a lower number of patents than U.S. and Japanese firms.
- The EU system creates a lower number of notifications of new chemicals.
- The EU system creates cost disadvantages for the notifiers, and also obstacles for those who enter the European markets, which by contrast leads to advantages for businesses operating in the EU.
- At the same time, it has been noticed that small and medium-sized businesses basically never use innovations on the basis of new chemicals. This is caused by the high regulatory costs in Europe (Fleischer 2003).

Europe is aware of the necessity of supporting innovations. Compared to EU businesses, their American and Japanese competitors still invest in research and development far more than European chemical enterprises. In 2007, as a reaction to these and similar findings, the EU announced extensive programs to support the innovation potential, networks of excellence, and research centers in order to improve the competitiveness of the EU economy and the R&D potential. As a result of these efforts, it is possible to notice positive trends in the chemical industry, where the R&D outputs and the numbers of patented notifications are on a level comparable to those in the U.S. (unlike other industries).

Chemical Notifications

On the basis of surveys and monitoring, more than 100,000 commercially available chemicals have been identified in the EU sphere, and more than 30,000 chemical substances have been found in products for everyday life (European Chemical Agency 2014). Thus the general public and the other stakeholders have been placing more and more pressure on the producers of chemical substances to perform systematic monitoring of the impacts and influence of these substances on the health of the population, the society, and the environment.

On December 18, 2006, the EU Council approved the REACH Law for Registration, Evaluation and Authorization of Chemicals; it is probably the strongest tool for the regulation of chemical substances. Since the introduction of the REACH, it has been obligatory to verify the safety of chemical products, as well as to know how they are used, and also to specify that the supposed use of these substances is safe. This obligation to register chemical substances also applies to importers to the EU.

The REACH aims to assess and decide whether the social benefits of using dangerous chemical substances rationalize the production of these substances. Europe can thus be proud of the fact that it has introduced the most advanced and safest legal regulations in the area of chemical substances, thanks to which the citizens of the EU are protected at a better level. The REACH directive has become a model for standards introduced elsewhere in the world, yet, at the same time, it is necessary to be aware of the fact that the chemical industry is obligated to the REACH under a significant regulatory burden, which can have negative impacts on its competitiveness. The EU Commission is now working on ways to make the REACH directive procedures more effective in helping smaller businesses with submission of the required information and in general to decrease the bureaucratic burden of businesses connected with the registration of chemicals (European Union Legislation 2014).

Green and Sustainable Chemistry

The introduction of the REACH and the development of new technologies, but also consumer preferences and economic factors, led to the support of the Green and Sustainable Chemistry sector.

For green chemistry, the basic approach is waste minimization in chemical production processes, replacement of the current products with alternative, less toxic products, and a shift toward renewable sources independent of crude oil. Rapid progress in the area of biotechnology creates prerequisites for work with microorganisms aiming to produce industrially usable compounds with a high rate of effectiveness, but only minimum waste (Benjamin 2014).

The concurrently rising prices of crude oil—still representing both a necessary source of energy and a feedstock of a number of chemical processes—elicit a growing interest and investment efforts aiming to find alternative, renewable sources. Although the green chemistry sector is still at the beginning of its growth, it represents an important solution to a number of essential questions for the civilization with fundamental importance for a sustainable future. The changeover to a low-carbon economy, or the basic problems of recycling, should be perceived as an opportunity, but not as a burden.

2.1.2 The Chemical Industry in the Czech Republic

The Czech Republic has been, as for business, a part of the EU sphere for many decades, and it formally became a member of the European Union in 2003. Its geographical location—right in the heart of the EU—predestines the Czech Republic to a strong bond with the EU and, at the same time, it has to face all the challenges the EU space registers. The chemical industry is the third largest industry in the Czech Republic. Historically, it began to develop at the end of the eighteenth century, but it did not see its boom until the second half of the nineteenth. During the twentieth century, the chemical industry became one of the backbones of industrial production, but the chemical industry was then also a significant generator of environmental pollution (particularly water) and soil contamination. Even now, many of the premises used for chemical production are still polluted, and these old environmental burdens are undergoing remediation that costs billions of Czech crowns.

The chemical industry in the Czech Republic is concentrated in large production premises that are mainly situated close to the sources (in view of the huge consumption of water, they are especially close to water sources), so it can be divided into several areas: basic chemistry; oil processing (petrochemistry); pharmaceutics (production of drugs); the rubber and plastics industries; and paper production. The most important of them are the production of basic chemical substances (64 % of the total sales) and production of drugs (17 %). The shares of the other five branches are smaller: the production of fine chemicals and fibers (9 %); of cleaning

detergents and cosmetics (5 %); of painting materials (4 %); and the production of pesticides and agrochemicals (1 %) (Ministry of Industry and Trade of the Czech Republic 2011).

2.2 The Food Industry

The food industry is a branch of the manufacturing industry that processes agricultural products of crop and livestock farming into the form of foodstuffs for the consumers. Food production also uses some chemical industry products, e.g., preservatives or colors. The food industry includes mills, bakeries, dairies, sugar refineries, canning factories, meat processing plants, and other production plants; it also includes the production of beverages (alcoholic and non-alcoholic). This industry is subject to very important systems of product quality controls, from both the chemical and biological points of view, as any deviations from the standards may result in damage to the consumers' health.

2.2.1 EU Space Challenges

Within years, the EU approach has qualified itself for covering all the potential and current challenges relating to food. It aims to ensure a high level of food safety, animal health, conditions of animal welfare, and healthy plants in the entire area of the European Union through a comprehensive system of measurement and monitoring of crop and animal farming product processing within the process of effectively ensuring a functioning domestic market.

To maintain this approach, the EU ensures, through the European Food Safety Authority (EFSA), an effective system of management and evaluation of the EU standards' observance within imports of food products from countries outside the EU in cooperation with international organizations and non-EU countries (European Food Safety Authority 2012).

Animal Health and Welfare

The European program for the support of animal health and livestock farming conditions focuses on the support and efforts of the EU member states in the following areas (European Commission 2007):

- A more risk-based approach to animal health requirements
- More effective controls/enforcement along the agrofood chain
- Enhanced disease preparedness
- Increased disease prevention for listed diseases
- Reduced administrative burden and economic losses due to outbreaks of disease

- Defining the roles and responsibilities of operators, health professionals and veterinarians
- Putting the primary responsibility for animal health on operators (animal keepers)

The objective is to protect and improve health and living conditions of animals kept in the EU, specifically animals that provide food products and, at the same time, to prevent imports of animals and products of these animals that do not meet the given health standards and internationally recognized conditions.

Food Labeling

Food labeling in the EU should guarantee that the consumer obtains all necessary substantial information about the product's composition, how to store it, its production, etc. This directive applies to foodstuffs delivered directly to consumers, as well as to restaurants, hospitals, kitchens, and other catering facilities. Such labeling has to be visible and legible, and has to include a specific amount of information about the components designated as allergens, or quantities of individual ingredients as a percentage of the final product. The producer and the distributor can add other optional information on the condition that it is truthful and does not mislead the customer.

Food Quality

The European space is particular about the high quality of the final foodstuffs, and so it tries to approach quality as an issue involving each seller or farmer. Food producers in the EU thus build their competitiveness and long-term sustainability and profitability just on the basis of the standards that guarantee high quality of their products; in this regard, the EU issues strict requirements guaranteeing high standards of all European foodstuffs. Moreover, quality marking also makes it possible to identify foodstuffs grown and produced under specific conditions.

Genetically Modified Food and Feed

Food and feed have basically been derived from animals and plants kept or grown by humans for several thousand years. As time passed, these plants and animals went through substantial genetic changes until they arrived at the features that are most suitable for breeding and growing the most convenient kinds and breeds for the needs of food production. The required features have been caused by natural deviations in the genetic equipment of individuals, but nowadays it is possible to modify the genetic material of living cells and organisms using genetics techniques. Plants and animals whose genetic material (DNA) has been modified this way are

called genetically modified organisms (GMOs); food and feed containing or composed of such GMOs, or produced from GMOs, are called genetically modified (GM) food or feed.

The European Union tries to monitor the use of these GMOs closely, and so it regulates and monitors the way that these foodstuffs are handled. In general, it is possible to say that before it is allowed to use a GMO in the EU countries, the risks are assessed by the European Food Safety Agency (EFSA), and only after consultation with the wider professional public, the EU authorities evaluate the opinions of scientific testing together with the EFSA conclusions.

Chemical Safety of Foods

Chemical compounds play an important role in the production and distribution of foodstuffs. As food additives, they, for example, prolong the life cycle of foodstuffs; as colorings and flavorings they increase their attractiveness. Other chemicals are used as pharmaceutically active and serve in the fight against diseases of livestock and plants. To keep foodstuffs hygienically clean and attractive, it is necessary to store them in containers made of chemical compounds, e.g., plastics. However, this demonstrable connection between the chemistry and food industries has to balance sensitively the potential risks for the food consumers' health resulting from the potential undesirable side effects or residues of these chemical substances.

In addition, many chemical compounds are freely present in the surrounding environment in the form of pollution. These contaminants are inevitably found in raw materials used for food production and distribution, and it is often impossible to eliminate them effectively. Therefore, European food legislation tries to define an acceptable rate of the utilization of chemical compounds, as well as a permissible rate of contaminants, obviously to protect the consumers. To achieve a high rate of protection of the customers' health, the EU performs a legislatively and scientifically supported risk analysis that takes account of, for example, the feasibility of inspection.

The legislation relating to chemical compounds added to foodstuffs is based on the assumption that only strictly tested and approved food additives in strictly limited quantities can be used. As for artificial colors and flavorings, there are limits only for the presence of undesirable compounds, but even here there is a requirement that they must be tested and approved. The legislative framework for contaminants is based on scientific research and the principles of minimization of the occurrence of contaminants, together with observance of the correct manufacturing practice. Maximum limits have been set for chosen contaminants (e.g., mycotoxins, dioxins, heavy metals, nitrates, and chloropropanols) to protect the health of the society.

The specific EU legislation also regulates the quantity of residual veterinary medicine preparations used for feeding animals and growing plants (pesticides). Even for these preparations, there is a scientific approval process, and, if necessary, these substances are subject to maximum limits—otherwise they can be prohibited.

The legislation also covers transport and storage materials, which are supposed to ensure that no components of these materials get into foodstuffs in quantities that threaten human health, or change the composition, taste, or look of foodstuffs.

All the above-mentioned challenges bring about strict restrictions for doing business in the food industry having, on the one hand, impacts on the competitiveness of this industry and supporting, and on the other, the high-quality standard of food produced in the EU space, thus protecting domestic producers, especially EU citizens.

2.2.2 The Food Industry in the Czech Republic

The food industry in the Czech Republic is not only situated in the regions with developed agricultural production, it is relatively evenly distributed throughout the Czech Republic. It is caused by the fact that the transport of agricultural commodities is less demanding than that of industrial raw materials. Also, from the points of view of the seller and the consumer, it is necessary to keep foodstuffs fresh, while long-distance shipping of selected kinds of foodstuffs causes a number of complications.

The production of food and beverages belongs to the principal branches of the manufacturing industry in the Czech Republic, and its importance is particularly evidenced by the fact that it provides food for the population. The basic raw materials in the Czech food industry are domestic agricultural products, products of forest and water management, and imported raw materials. In the Czech Republic, food production, together with the production of beverages, has a 2.7 % share in the GDP. The position of the food production branch of the manufacturing industry still remains significant, but it is gradually weakening (Ministry of Agriculture 2011).

The most important branches of the production of foodstuffs are:

- The processing and preservation of meat and meat products
- The processing and preservation of fruit and vegetables
- The production of dairy products
- Milling and starch production
- Other branches that include, for example, the production of bakery, confectionery, and other flour products, and the production of other food products

The most important branches of the production of beverages are:

- The brewing industry
- The wine-growing industry
- The distilling industry
- The production of mineral water and soft drinks

The food industry is mainly concentrated in the fertile lowlands, and the food industry production in the Czech Republic is significantly diverse and includes a number of branches.

3 Understanding Product Social Impacts Along the Products' Life Cycle

According to the SLCA methodology, it is possible to define a number of social aspects of a product alongside its life cycle. However, their actual recognition encounters a lot of practical obstacles and limitations. Only direct research on companies will help discover to what extent specification and evaluation of the social impacts are feasible, but even on the theory level, it is possible to define the problems that can make implementation and systematic performance of the SLCA methodology more complicated.

The methodological approach for preliminary hypothesis formulation concerning chemical and food products throughout their life cycles was based on the article reviews of both academic and "gray" literature on the chemical and food industries in the Czech Republic and EU and on previously conducted interviews with managers and representatives of the industry associations.

Product life cycle

Surprisingly, it is possible to identify the problem by determining the product's life cycle. In LCA studies, already a number of research teams were faced with the choice of a suitable product for which it is possible to evaluate the life cycle. It is not only determination of the system limits, but also the availability of data and, in particular, a clear definition of individual life cycle stages. At the end of the life cycle, individual stages are harder to trace, and in a number of cases they make the definition of studies on the basis of the life cycle more complicated (Tritthart et al. 2010).

The phase of product utilization itself brings immeasurable troubles just at the moment that the product can be used for various purposes; it represents a semi-finished product and the final product at the same time, so the determination of its life cycle is difficult. The answer to the question of where the product's life cycle finishes is then unclear; the product finishes its life cycle with its physical disposal, but it is a problem to find the exact moment when this occurs.

Social Impacts

Another problematic question is the identification of social impacts. As Benoît mentions in *The Methodological Sheets for Subcategories in SLCA* (Benoît-Norris et al. 2013), the assessment of social impacts includes the presentation of very few cause-and-effect chain models. Midpoints and Endpoints are found spread widely along the entire so-called "social impact pathway," which starts with social intervention and leads to various levels of social impacts. Obviously, during its life cycle, each product goes through various stages with numerous interactions with the environment and the stakeholders. During resource mining, processing, manufacturing, assembly, sale, use, recycling, and disposal, it is possible to identify tens of interactions with the stakeholders, both positive and negative ones; already their complete definition represents a problem, and the identification of relevant midpoint and endpoint impacts is a complex and time-consuming process.

Branch and geographical specifics
Assessment of the products' impacts on the environment and the stakeholders has to be performed not only with respect to all the life cycle stages, but also with respect to the specifics of individual branches and the "location" of the product life cycle, where various phases of life cycle stages can be connected with various geographical areas. The SLCA methodology mentions that indicators for assessment of social impacts have to be modified to respect the branch and geographical specifics of individual products. However, there are no proposals of indicators or databases of inventory data on the level of an industry or on the national level.

The above arguments further deepen the already difficult problems of assessment of the social impacts of a product. Without a thorough preparatory phase, the practical assessment of the social impacts of any product is not only resource-demanding, but also in a number of cases insufficient, incomplete, or even completely wrong.

3.1 Social Impacts of Chemical Products

On the basis of the definition of the chemical industry and chemical productions within the EU space in the first and second chapters, it is possible to deduce the specific social aspects in the chemical product life cycle in the Czech Republic. The SLCA methodology created by Benoît and Mazijn in 2009 recommends assessing social impacts in five main categories (Benoit-Norris and Mazijn 2009):

- Local community
- Value chain actors
- Consumer
- Worker
- Society

In addition to this, the methodology specifies subcategories for each main category in relation to the social impacts connected with individual stakeholders. In the context of branch and geographical specifics, some of these categories can be considered to be very important, while others can be considered unimportant or even irrelevant. On the basis of the research in scientific literature, published studies, annual reports, and the experience of managers, it is possible to specify, for the chemical industry, the important and less important subcategories of social impacts.

In the preliminary research phase, we chose the approach specifying important social impacts from the point of view of manufacturing companies. This choice was made on the basis of the assumption that they are just manufacturing companies who have the most significant influence on the form of a product, its genesis, and features, and thus they also give rise to the largest share of the emerging social impacts. In individual life cycle stages, production lies in the relative "center" of the life cycle with a significant influence on both the previous and future stages, when

the company has to communicate both with its suppliers and with the consumers. It enters important interactions both with the local community and with its employees, and, last but not least, with the society. It thus covers the interactions of all by the methodology proposed to the stakeholders. Although the chemical industry is characterized by its very wide product structure, it is possible to discover highly important as well as less significant social impacts in each category.

3.1.1 Local Community

All the operational activities from the beginning until the end have significant impacts on the permanently sustainable development in the particular area. The stakeholders are interested in firmness of the concept on the basis of which businesses manage their influence on the local communities. Businesses should evaluate the impacts of their activities on the local community even before their arrival at the place of business, during the performance of their activities, and also when deciding about leaving the place of business. In the case of chemical companies in the Czech Republic, we have to work on the assumption that the great majority of businesses operate in plants that have existed for several decades or even centuries. Factories that were originally built on the outskirts of towns gradually became part of a wider agglomeration, and although in a number of cases they are parts of industrial zones, their interaction with the local community has been developing for many years. In the EU environment, there are not many cases of disrespecting the rights of the original population. Although there are places with nationally coherent groups with their own identities created by immigration from both the past and the present, in the conditions of the Czech Republic, ethnic differences are not very significant.

For these reasons, it is possible to consider *delocalization and migration, cultural heritage*, and *respect of indigenous rights* as insignificant subcategories of social impacts. Subcategories with lower importance include *access to material and immaterial resources* and *secure living conditions*, as the European environment is, with the exception of a few locations, considered to be safe regarding the risk of violent conflicts and crime. Important subcategories could probably include *local employment, community engagement*, and *safe and healthy living conditions*.

As for the development of *local employment*, businesses should engage in the preparation, management and implementation of the policy in the area of employment with the aim to create jobs, solve unemployment, increase adaptability, etc. Organizations that support relations with the local suppliers more intensely will continue to support the development of local employment. This development can also be supported through the training of local employees in technical and transferable skills. A strong influence on the development of the local community can be achieved by businesses by recruiting local employees for higher managerial positions, which will probably foster communication and confidence with the community; local employees have a unique knowledge of the important community issues, which can help create strong bonds with the community. In view of the above-mentioned need for highly skilled as well as medium skilled workers (in total

about 75 %), it is possible to expect that businesses will consider this impact as fundamental. As for the chemical industry, the question of bonding a qualified workforce with the company is absolutely essential.

As for the subcategory of *community engagement*, it is possible to expect that organizations will try to include the opinions of local communities in the relevant decision-making processes, and also to what extent the company is perceived positively and interconnected within the environment of local communities. In the conditions of the Czech Republic, local communities are still not very aware of their negotiating position, their involvement in the decision-making process of businesses is sporadic, and in general it is possible to say that these interactions have not yet developed to an adequate level on either side. Nevertheless, the situation in this area is gradually improving, even though the pace is not yet very rapid. As the businesses are more and more aware of the concept of sustainable production and consumption, they are also more and more interested in their involvement in and support of community initiatives, and harmonize them with the sustainable development principles. A clear impulse on the side of businesses for support of *community engagement* is the effort to improve their positive image. In many cases, chemical production is accompanied by negative effects, and it is the opinion of local communities and the society that "chemical smells" have to be compensated by the chemical companies with increased efforts to build a positive image.

In the subcategory of *safe and healthy living conditions*, businesses evaluate how they affect the safety and protection of community health. There are general conditions of the safety of operations and their impacts on public health; with respect to the general safety in the chemical industry, corporate processes and activities can influence the safety of the community through accidents at the facilities or breakdowns of the structures. Unfavorable impacts on health can also be caused by production and/or use of dangerous materials, and pollution caused by the emissions of pollutants. The very nature of chemical production implies that it is not possible to prevent air pollution, and this environmental burden on the company surroundings can dramatically worsen in the event of accidents. Chemical companies should thus introduce a risk management system in the area of the environment to prevent, mitigate, and control damage to health caused by their activities. They can also support the health of the local community with their approach to employee health services, or with discussion about potential impacts of the manufacturing process on the health and safety of local communities.

It is possible to expect that businesses will be obliged to consider safe and healthy living conditions of communities as highly significant.

3.1.2 Value Chain Actors

Relations between the company and the value chain actors are essential for all organizations, regardless of the kind of industry or location. Under the present conditions, it is difficult to stay on the market, and so businesses are looking for new cooperation opportunities that will guarantee the existence and success of the

business. Such cooperation refers, for example, to acquisitions or mergers, strategic alliances, corporate networks, or clusters. In the competitive environment of the chemical industry in the EU, relations with the value chain actors—and especially the suppliers—represent an important constituent of competitiveness. Higher forms of cooperation shift cooperation relations from simple information sharing to coordination and collaboration with advanced planning methods within supply chain management. A large volume of stored and transported basic raw materials, transport and use of dangerous, health and environment damaging substances, elicits the necessity of paying more attention to the subcategories of *supplier relationships* and *promoting social responsibility*.

The *supplier relationship* subcategory is significant for chemical companies, as the choice of a reliable partner usually has a direct impact on the quality of the supplied substances and raw materials. The transport of chemical substances is subject to strict checks, and each party involved in the value-creating chain is responsible not only for observing safety measures, but also for the timely delivery in the required quality and quantity. More intense forms of cooperation then have a direct positive influence on the improvement of social conditions within the supply chain. The handling of chemical substances, often in various states of matter, places demands on securing shipping and storage conditions, including temperature, pressure, handling, and transport containers. Just like the risk of an accident in a plant during production, there are also risks in transit, and the viewpoint of damage to the corporate image intensifies the importance of this subcategory.

Promoting social responsibility is then, within a deeper form of cooperation, also an important subcategory and is closely related to the *supplier relationships* subcategory. It should be in the interest of businesses to spread *social responsibility* out to their suppliers; however, in many cases businesses either relinquish these activities or ignore them altogether.

Under the EU conditions, the subcategory of *fair competition* can be considered as less important. The relatively stable market conditions, relations built on a long-term basis, and strong anti-monopoly regulations by the legislative authorities, prevent the occurrence of barriers preventing access to the industry, price agreements, and creation of trust. Although the competition is severe, the B2B market has not register any serious offenses against business ethics, even though they cannot always be completely excluded. In addition, the subcategory of *respect of intellectual property rights* does not solve any more important issues in the chemical industry.

3.1.3 The Consumer

As with the manufacturing of chemical products, there are certain risks with their use, even though a number of final products are chemically stable and safe; however, there are products whose use requires the observance of the specified safety and technological regulations. The safe storage of chemical products at the end of their life cycles is generally considered to be a fundamental problem for sustainable

development of the society. In this respect, businesses do not also want to be connected with irresponsible business practices. Closer bonding and relations with the consumers then also represent an important category of social impacts for the chemical industry.

Just as in the relation to the value creating chain actors, the safety and elimination of the risk of accidents are also fundamental for the consumers. Therefore, businesses consider the subcategory of *health and safety* as significant for the consumers. The subcategories that should not be ignored include *transparency,* because of the minimization of the risk of occurrence of a negative environmental or social impact resulting from product misuse, and *end-of-life responsibility,* because of its prevention of undesirable environmental burdens with which the company could be connected.

Monitoring and assessment of consumer *health and safety* should stress the fact that the customer will not be injured or exposed to the effects of dangerous substances while using the product. For producers of chemical substances, the manufacturing of environmentally and socially responsible products represents an obvious priority. A dangerous product whose use could result in any damage to the consumer or the environment has a significantly lower chance of being used commercially.

The safe use of chemical products is substantially dependent on the provision of all the relevant information by the producer to the consumer. The European Union regulates its system of classification of chemical substances and their mixtures in accordance with the Globally Harmonized System (GHS) of the United Nations. This international system requires the classification of chemical substances and their mixtures according to their dangerous properties, and stipulates the warning symbol and other information that have to be put on the label. Nevertheless, this obligatory information should be, and often is, completed with information extending the obligatory minimum information to ensure product *transparency*.

The issue of the handling of chemical products at the end of their life cycles (*end-of-life responsibility*) is considered to be significant. The decision about disposal, recycling, or reusing unused products is to a considerable extent derived from the chemical nature of the product. Most chemical products are not, in the view of their composition, suitable for dumping, so they are disposed of alternatively, e.g., by biodegradation or burning. The forms of recycling or reuse are still not economically interesting, but the constantly rising prices of raw materials will finally make businesses solve this issue through these forms of life cycle termination. Regardless of what method of termination is chosen, this decision should not be left up to the consumer; the responsibility for safe disposal should be taken over by the producer, who is best informed about the nature of the product and its environmental and social impacts.

As for the subcategories of *feedback mechanism* and *privacy*, there are no specifics expected for chemical products.

3.1.4 The Workers

Participatory measurement proved that checking social impacts and the observance of the conditions of safety and health protection at work provide important social benefits, including a higher probability of the detection of breaching rights and stronger support of subsequent efforts to make improvements. In this category, with a direct impact on an important stakeholder, it is possible to identify a number of subcategories, but some of them are not quite relevant in the EU space. The cultural and social traditions, the legislation governing the labor laws, and the habits of corporate practice practically eliminate the existence of *child labor* and *forced labor*; these subcategories, together with *freedom of association and collective bargaining,* are governed by law, and the position of trade unions is strong enough to put pressure on the enforceability of these rights. Therefore, the most important subcategory is probably employee *health and safety*, where chemical production threatens with various forms of damage to health resulting from acid burning, scalding, and poisoning, as well as injuries from machines. A high percentage of qualified workforces are particularly necessary due to the responsible observance of working procedures and the awareness of all the chemical production risks. The subcategory of *fair salary* is specific, as the statistics show that despite the requirements concerning a qualified workforce, the wages and salaries in the industry are not really above the average compared to industries with a higher percentage of unskilled workers (CEFIC 2012). The questions of *work hours*, *equal opportunities/discrimination* and *social benefits/social security* are also significant for the assessment, but they are not specific for the chemical industry in any way.

Traditionally, businesses solve the problems of the *health and safety* subcategory, which results from the above-mentioned necessity of the handling of dangerous chemical substances. Many technologically obsolete production plants are unable to meet the conditions stipulated by the International Labor Organization (ILO) and the World Health Organization (WHO), proclaiming the rights of each worker to a safe and healthy working environment. The introduction of new technological procedures contributes to gradual improvements in the employees' working conditions, and it is necessary to say that the level of safety at work mainly depends just on the technological level of the manufacturing process. Not only are new production technologies more economical and more effective, but they are also, above all, safer, due to a number of regulatory and controlling functions that aim to prevent variances or even accidents. It is necessary to realize that it is not possible to eliminate these risks completely, as the share of human work cannot be completely removed from chemical production. Unfortunately, many of the accidents in chemical production can have fatal consequences for the attending staff and other employees. The risk of fire, explosion, poisoning, or acid burns, as well as long-term exposure to increased concentrations of dangerous substances in the air cannot be completely excluded; this is why this subcategory rightly belongs to the most important social impacts of chemical productions.

In the subcategory of *fair salary*, we can find an apparent discrepancy between the requirements concerning a qualified workforce and the level of the wages and

salaries offered. The pressure on product competitiveness also affects the level of wage rates, so despite the higher required workers' qualification, this sector of the chemical industry does not show corresponding remuneration; therefore, this subcategory can also be considered to be important.

3.1.5 Society

Apart from the above-mentioned and for the company's quite easily identified stakeholders, businesses also show strong interactions with the *society*. The chemical industry provably creates conditions that are necessary for life on the planet, improves the quality of our lives, ensures food for billions of people, and contributes to the general welfare of the society. Despite that, it can be negatively perceived by the society, both for its risky operations and the environmental burdens it creates, and for the unpleasant odors (it smells) and visual effects (it emits smoke).

However, since the future of mankind is fully dependent on chemistry, it is not possible to ignore its clear *contribution to economic development* and *technology development*. After all, further survival on this planet will depend on the technological ability of mankind to switch to renewable energy sources and to ensure living conditions that are adequate for the growing population of the planet. In connection with this, we have already mentioned the basic challenges that the chemical industry faces, and it is in the interest of businesses to call the general public's attention to these positive impacts on their activities. It comes under the responsibility of each company to press for and assess, despite or rather because of, the high risks of chemical production, its own *public commitment to sustainability issues*. The concept of sustainable production and consumption is based on the effectiveness of chemical production; if the current plundering and depletion of the planet's resources continues, chemical companies are aware of the fact that it will not be possible to achieve economic and social balance, which is why the subcategories of *contribution to economic development*, *technology development* and *public commitment to sustainability issues* are indisputably significant for the chemical industry, while *prevention and mitigation of conflicts* and *corruption* can be perceived as minor problems.

When assessing *contribution to economic development*, we can say that the chemical industry participates in almost all the recognized ways—from profit generation, creation of jobs, and investments, to direct research. It unquestionably supports the fight against poverty and starvation and satisfies basic human material needs. However, it is possible to state that these facts are often insufficiently promoted, and so the image of chemical production, in the eyes of society, is not always unequivocally positive.

As for *technology development*, the potential of the chemical industry is enormous. Not only is the industry obliged to contribute to the process of ensuring sufficient quantities of food for mankind, but also one of the fundamental issues is the question of sufficiency not only of quality drinks, but also of non-potable water.

Technological progress in the area of photovoltaic materials can ensure sufficient amounts of energy, while progress in the area of nanotechnology should solve the serious problem of effective exploitation of resources (resource efficiency). Last but not least, the chemical and pharmaceutical industries will contribute to improvements in the health and quality of life of the society.

Businesses should try to support all these largely positive activities with their *public commitment to sustainability issues*, in which they should prove how responsibly they approach the issues of sustainable production and consumption. Although the chemical industry is by no means "clean," many production plants belong to the most prominent polluters; there are also negative impacts on the local communities and the society, so it is obvious that chemistry can fulfill its task to support the society without significant negative environmental and social impacts.

3.2 Social Impacts of Food Products

The food industry is in many respects similar to the chemical industry, e.g., the production process is often technologically demanding and often also includes the chemical conversion of substances. Despite that, it is possible to define the basic differences between food and chemical products that predetermine the specific social aspects in the life cycle of foodstuffs.

- Foodstuffs are intended for direct consumption by humans, so they have a direct impact on the society. This also particularly relates to the availability and quality of these products, as these parameters have a direct influence on the welfare and health of the society.
- Foodstuffs are made from renewable resources, and also the end of their life cycle is, from the point of view of the environment, without problems, while the social impacts resulting from their insufficiency cause significant problems.
- Feedstock is, by the nature of the purpose of foodstuffs, safe (non-toxic, non-explosive, non-caustic), so the production process is not excessively dangerous and the risk of accidents is lower.

In relation to individual stakeholders, it is possible to say that:

- Food production does not represent as significant a burden for local communities as chemical production.
- As a result of a direct influence on the health of the society, food production is more prone to the risk of contamination; it places higher hygienic demands on the production.
- The safe use of foodstuffs is significantly dependent upon proper communication with consumers.

It is also true for the food industry that not only for the reasons of the branch specifics, but also from the point of view of geographical specifics, that some of the social subcategories can be considered to be highly significant, while many others

can be considered insignificant or even irrelevant. Based on a survey of scientific literature, published studies, annual reports, and the experience of managers, we have specified both significant and less significant subcategories of social impacts for the food industry. Similarly to chemical products, foodstuffs are characterized by a wide range of products. Nevertheless, it is still possible to identify the social impacts on various levels of importance in each category.

3.2.1 Local Community

Food companies in the Czech Republic also have strong traditional positions; their interaction with the local community has been developing over many years. It is an industry without a huge burden, but the local community is affected by a gradual decrease in the cultivated land and the related disappearance of a number of businesses resulting in unemployment and outflow of inhabitants from rural areas to larger agglomerations. Other problems are connected with the restitution of land to the original owners, whose land was nationalized in the middle of the twentieth century. In some cases, this restitution causes problems for local entrepreneurs (for example, because the land has not yet been returned or because of "new" owners changing the use of the land). As we have already mentioned, the European Union does not face very frequent cases of disrespecting the rights of the original population, even though there are some places with nationally compact groups with their own strong identities. As for the conditions of the Czech Republic, the national diversity is not significant.

For these reasons, the insignificant subcategories of social impacts again include *cultural heritage* and the *respect of indigenous rights*, and also *safe and healthy living conditions* and *secure living conditions*. The subcategories with lower importance could include *access to immaterial resources*, and *community engagement*; the significant subcategories most probably include *local employment*, and, as the specific ones for the conditions of the Czech Republic, *access to material resources*, and also *delocalization and migration*.

As for the development of *local employment*, the support of local employment and relations to local inhabitants are not fundamental problems. Food production requires mostly short-distance transport, and food distribution to consumers has to be, from the geographical point of view, evenly spread. However, the question of bonding a qualified workforce to the company is also fundamental for food companies, as an outflow of inhabitants from rural areas that are important from the perspective of food production to urban agglomerations is a long-term and irreversible trend. A decreasing share of cultivate land and decreasing quantities of kept livestock, together with a growing share automation, have significant impacts on employment in the economically poorer regions causing the undesirable growth of *delocalization and migration* of the population.

Access to material resources is an entirely specific subcategory for the conditions in the Czech Republic. The last century saw frequent appropriations of agricultural land by the state; then, 25 years ago, these lands were, in relation to the

processes of democratization, returned to their original owners according to a special law. In many cases it was not possible to return the land in its original condition, but individual disputes concerning access to land are being successfully settled step by step.

3.2.2 Value Chain Actors

In the food industry, relations with the value chain actors represent an important factor of competitiveness. and the choice of and cooperation with reliable partners ensures the quality of the supplied foodstuffs. The product quality can be reduced and the product destroyed in transit; in either case, it has a strong impact on the economic performance of the company and on the corporate image. The necessity of the rapid transport of foodstuffs from the producer to the consumer implies the need for higher forms of cooperation; the subcategory of *supplier relationships* is significant for just these reasons. In the value creating chain, another key issue for foodstuffs is the issue of storing. The foods can be frozen, preserved, or otherwise treated to prolong their life cycles, and all of that in compliance with strict hygienic directives and standards. The resulting product's quality depends on the cooperation of the entire value creating chain.

The less important subcategories in the EU conditions include *promoting social responsibility*, as the food industry does not face such a fundamental problem with perception of the social responsibility as in the case of chemical production. Another less important subcategory is that of *fair competition*, where it is possible, in the production of certain foodstuffs, to identify efforts for market monopolization. Although the EU market conditions are relatively stable, even strong anti-monopoly regulation by the legislative authorities is sometimes not enough to prevent large food chains from affecting the markets, and we have already experienced price wars and cartel agreements. The subcategory of *respect of intellectual property rights* does not solve any significant problems in the food industry.

3.2.3 The Consumer

Food consumption has direct impacts human health as it ensures one of the basic physiological functions of our lives, which is why it is not surprising that it is, except for the subcategory of *privacy*, an important social issue.

As for the consumer, the significant factors are safety and elimination of the risk of health problems, so businesses consider the subcategory of *health and safety* to be significant. When using foodstuffs, the consumer's health must not be compromised, as poor health resulting from the foodstuffs has a direct negative impact on the corporate image. Another aspect that cannot be overlooked is the nutritional value and composition of the consumed food. Even foods that are considered to be harmless can cause any number of illnesses if they are consumed in unbalanced volumes. Mostly, these are the diseases of our civilization—with obesity in first

place—but also the risk of metabolism disorders, such as diabetes or heart disease, are on the rise. To eliminate the negative effects on the consumer, the EU authorities have issued several regulatory measures relating to the production of individual kinds of foodstuffs. A list of such foods and their descriptions goes beyond the scope of the presented topic, but the professional public and businesses agree that the regulations are, in many aspects, too strict, which is not really necessary.

In this respect, it is necessary that businesses also solve the problems of the subcategory of *transparency*, just to minimize the risk of harmful health consequences resulting from insufficient awareness of the possible consequences of excess and unbalanced consumption of some foodstuffs. Any negative effects have to be detected with the shortest possible delay, which is why it is necessary to build up and support communication in the direction from the consumer to the producer. The implementation of a well-functioning *feedback mechanism* will make it possible to minimize the potential distribution of low-quality foods and thus prevent extreme forms of damage to the health of the society, e.g., the spreading of a disease or even an epidemic.

The problem of starvation or famine is not very frequently mentioned in connection with Europe, as it is in the poorest countries in the world, where food insufficiency represents one of the most significant social impacts. It is more important to pay attention to the issues of overproduction and unused food. For this reason it is necessary to deal with the questions of *end-of-life responsibility* in relation to food overproduction and its often ineffective, but cheaper ways of disposal. Foodstuffs are usually biodegradable and do not have very serious environmental impacts. Paradoxically, food overproduction causes problems with growing amounts of municipal waste when food is disposed of as municipal waste and not as a biodegradable one.

3.2.4 The Workers

As mentioned in the case of the chemical industry, *child labor* and *forced labor, freedom of association and collective bargaining* do not represent problematic or significant areas in the food industry either. And similarly, the *health and safety* of employees is considered to be an important subcategory, as it is also not possible to exclude harming the health of workers in the food industry, but the rate of this risk is not as significant. The subcategories of *work hours*, *equal opportunities/discrimination* and *social benefits/social security* are not specific for the food industry.

The issue of *health and safety* of food production employees are not as significant as in chemical production. On the other hand, there is a higher risk of infection caused by low-quality raw materials and related health problems of the employees, as well as the risk of contamination of the foods produced. Businesses try to prevent these risks by strict observance of the conditions of the proper production and hygienic practice. Together with the introduction of new technological procedures, the industrial conditions are improving, and the share of human labor is decreasing.

The question that also gives rise to social unrest is remuneration in the food industry. Purchase prices of manufactured raw materials are often so low that the EU countries have to approach production subsidies. These measures cause imbalance in the food markets and contribute to general dissatisfaction with the EU policy in the areas of crop and livestock farming. Not surprisingly, wages and salaries in this industry are below the average of wages and salaries paid in the industrial sector of the EU. Working with crops is not, as for the required qualifications, very demanding, and so this sector is, on a long-term basis, undervalued as for wages and salaries, again causing an outflow of inhabitants from rural areas, and it is necessary to consider the subcategory of *fair salary* to be significant.

3.2.5 Society

Food represents an essential prerequisite for the welfare of each society, and sufficient quantities and qualities show the level of economic development of each country. By contrast, its insufficiency gives rise to social dissatisfaction that can threaten to develop into global problems. Although the EU does not face any acute problems of famine or food insufficiency, the lack of public awareness has resulted in the spread of our civilization's illnesses, related to the lack of physical activity and unbalanced food consumption. Therefore, the social circumstances of *public commitment to sustainability issues* appear to be significant for foodstuffs. At the same time, we cannot omit the responsibility of particularly large food producers and their roles in *prevention and mitigation of conflicts*, where the richer world countries should distribute their food oversupplies among the poorer regions suffering from chronic insufficiency and thus solve the issue of *resource efficiency* responsibly.

Food sufficiency for all the inhabitants of our planet is clearly an issue of *technology development* resulting, in the area of food, in its higher quality, chemical treatment, and also genetic modification. Within this role, businesses should not omit their unequivocal impact on sustainable development and thus demonstrate their *public commitment to sustainability issues*.

When assessing *contribution to economic development*, we can state that food production shares, as with chemistry, this issue through the generation of profits, the creation of jobs, investments, and direct research. It unequivocally contributes to the fight against poverty and famine, and satisfies basic human material needs. Therefore, the society perceives—unlike chemistry—food production as something positive, despite the fact that some of the products are not very environmentally friendly since they use excessive quantities of chemical preparations, additives, colors, and flavorings.

Many significant social interactions are involved in the food industry, and businesses should take a responsible approach to the assessment of individual impacts.

4 The Assessment of Products' Social Impacts: SLCA Methodology

A social life cycle assessment is a method based on traditional LCA that can be used to assess the social and sociological impacts of products, their actual and potential positive as well as negative impacts throughout their life cycles [LCI]. Individual categories and subcategories offered by SLCA methodology need not only be attributed with a level of significance, but also to be assessed effectively. It is necessary to think not only about which subcategories should be included in the assessment, but also about the next steps in the assessment of the social impacts of the product life cycle, particularly:

- How to select a consistent set of indicators on the corporate level, and
- How to obtain quality and relevant information for their specification

In 2013 it was possible to obtain access to the proposed indicators for the SLCA methodology in the document titled *The Methodological Sheets for Subcategories in SLCA* (Benoît-Norris et al. 2013). Although it is a pre-publication version, it presents proposals for a complex assessment of social impacts for each subcategory suggested by the methodology. Sheets regarding the methods include brief definitions of each subcategory, their relevance to sustainable development, and the sources in the form of the International Conventions and Agreements and the International Targets/ Recommended Standards. The most beneficial part is then the presentation of the sources for assessment, a brief summary of the data needed to compile the subcategory, and also the National and International Data Availability and Sources. Furthermore, there are Examples of Inventory Indicators, Units of Measurement, and attached Data Sources. Finally, the document specifies the Limitations. The draft methodology sheets are the first comprehensive proposal that can be widely grasped across various products in different areas of business; it at lays the foundations of possible answers to the above questions. The above-mentioned methodical instructions imply the basic data resources, which generally are:

- International and national reports
- Site visit or site-specific audits
- Interviews with stakeholders
- Organization and site-specific reports

An absolutely fundamental question for the possible future implementation of the SLCA methodology in corporate practice is whether it is possible to obtain quality and relevant information for the chemical and food industries in the EU and the Czech Republic. Data for the SLCA can be varied, depending on the purpose of specification; it can also be in the form of quantitative, semi-quantitative, or qualitative (descriptive) data. Basically, it can be divided into two resource categories: *generic (hotspot) data* and *site-specific data*. *Generic data* is usually gathered on the national or international levels; it is obtained from the efforts to identify geographical risk areas, where social impacts can be on a significant level.

In these areas, it is usually also necessary to gather *site-specific data*. However, in many cases some information about certain areas, branches of business, or businesses is missing, and to get data in individual impact categories, it is necessary to use site-specific data.

The *generic data* resource is mainly considered for reports of international organizations, while on the European level it is possible to obtain information resources through the Eurostat Database. Eurostat is a statistical office of the European Union, established in 1953, and since 1958 has been the Directorate-General (DG) of the European Commission. Eurostat's mission is to provide statistics on the European level, enabling comparisons of individual countries and regions. International statistics inform on the status and development of the society, not only in the EU member states, but also in other countries. The Eurostat Database provides businesses and important stakeholders with much important and interesting statistical data, free of charge (European Commission 2014). Among other things, Eurostat also offers predefined, completed charts covering information broken down by region, e.g., concerning:

- Socially sustainable development (GDP per person, rates of investment, rates of unemployment, price competitiveness, rates of savings, etc.);
- Sustainable consumption and production (resource efficiency, production and waste management, air pollution, energy consumption, eco-labeling, etc.);
- Social exclusion (threat of poverty, literacy, harmonious incomes, etc.);
- Public health (life expectancies, mortality rates, injury rates, human exposure to pollutants, etc.); and
- Other areas, e.g., climatic changes and power engineering, sustainable transport, natural resources, education, etc.

Other information can be obtained from the Intrastat Database—individual section of the Eurostat Database set up for intra-EU trade—which monitors the movement of goods between European Union countries on the basis of information gathered directly from businesses (European Commission 2014). However, its use for the needs of social impacts is rather limited, but it helps understand the life cycles of some products.

4.1 Local Community

For the category of *local community*, as generic data resources are considered to be reports of international organizations, such as:

- Amnesty International country reports on human rights;
- World Economic Forum annual country rankings;
- Global Reporting Initiative's reports;
- The World Bank Group's reports;
- World Health Organization's reports;

- The OECD's reports; and
- Other specific organizations' reports.

On the European level, the Eurostat Database provides quantitative data in the form of statistical charts, for the *local employment* subcategory (e.g., spread of regional rate of unemployment or rate of overpopulation); the *delocalization and migration* subcategory (e.g., population migration); *access to material resources* subcategory (e.g., rate of utilization of land for various purposes); and *safe and healthy living conditions* subcategory (exposure of population to various pollutants). However, statistical data is not monitored for a number of subcategories, e.g., *community engagement, cultural heritage, respect of indigenous rights, access to immaterial resources* and *secure living conditions*.

As for local community, there is no organization that arranges the support of data collection and publication for chemical and food industry businesses in the Czech Republic, so these businesses have to obtain much of their information through site-specific reports and interviews.

4.2 Value Chain Actors

There are not many organizations solving the problems in relations among the value chain actors, which is rather in the interest of entrepreneurial entities. A few sources of generic data can be found for example, in:

- OECD reports;
- World Trade Organization reports;
- World Intellectual Property Organization (WIPO) reports; and
- the Global Competition Forum.

Hardly any statistical quantitative data can be found in the Eurostat Database, but for the subcategory of *fair competition,* the EU policy is significantly under control. The European Commission and antimonopoly authorities in all the EU member states cooperate through the European Competition Network (ECN). This organization produces partial reports and news; the partial statistical reports in the subcategory of *respect of intellectual property rights* are presented by the European Patent Office. As for the *promoting social responsibility subcategory*, certain generic data is presented by the organization of the European Business Network for Corporate Social Responsibility. For the subcategory of *supplier relationships*, no usable data is collected in the area of the EU. In general, it is possible to state that generic data is, for the needs of SLCA studies, insufficient for this category of social interactions. Regarding the chemical and food industries, no data is collected through industry associations, and so businesses obtain most of their data from site-specific reports and interviews.

4.3 The Consumer

There are almost no generic data resources on the international level for the category of consumer, with the exception of the International Consumer Product Health and Safety Organization's reports. This function has been taken over by the national data resources, such as the Consumer Product Safety Commission's reports in the US, or Privacy International's country rankings. The European space tries to protect the EU citizens against the negative effects of using products, and so the EU authorities, directly through the established European Consumer Consultative Group, manage a number of undertakings, including reporting, to maximize the cooperation of consumers and to strengthen confidence in the European markets. Thanks to these efforts, it is possible to obtain generic data in this category in the EU.

In the *health and safety* subcategory, an extraordinarily important role is played by national organizations for consumer protection. The Czech Trade Inspection Authority, Czech Agriculture and Food Inspection Authority, and many other state-run institutions represent an important supervisory and information system intended primarily for consumers, but also applicable for businesses.

In the other subcategories, the industry associations do not provide any data in relation to consumers for the chemical industry in the Czech Republic. Partial information about food consumption is registered by the Agrarian Chamber of the Czech Republic. Despite this, site-specific reports and interviews remain the primary sources of information for SLCA.

4.4 The Workers

The category of worker enjoys many more generic data resources, including the reports of international organizations, such as:

- The International Trade Union Confederation reports;
- The International Labor Organization reports;
- UNICEF reports;
- Amnesty International reports;
- The World Bank reports; and
- Other specific organizations' reports.

A wide range of data provided by global organizations is supported by the European database of Eurostat, presenting statistics (quantitative data) in the form of statistical data charts. For the *fair salary, equal opportunities/discrimination, health and safety* subcategories, it presents wide-ranging statistics in various classifications of the rates of unemployment, by region, gender, age, salary, danger of poverty, rates of work injuries, etc. As for the *social benefits/social security* subcategory, information support is organized directly by the EU authorities led by

the European Commission. However, the EU authorities do not organize any information support for the subcategories of *freedom of association and collective bargaining*, *child labor*, *hours of work*, and *forced labor*, as they are not considered to be a significant problem in the EU environment.

The relationships with employees in the chemical industry are, in view of their importance, supported through the industry association—the Chemical Industry Association, specifically by the Council for Social Dialogue, which also provides businesses with information support. Similarly, the same mission is fulfilled for the food industry on the national level by the Agrarian Chamber of the Czech Republic. In view of the availability of generic data, the role of site-specific reports and interviews is less important for this category of social impacts, for the very reason that the employers' and employees' interests cannot be identical on many of the issues.

4.5 The Society

The *society* subcategory draws its generic data from the reports of such international organizations as:

- The OECD
- Amnesty International
- The United Nations
- The World Bank
- Transparency International.

The European database of Eurostat presents, in two-year cycles, an overview — a report on sustainable development, which indicates corporate *public commitment to sustainability issues* and, within performance of individual economies, also statistical data showing *contribution to economic development*. As a specific EU issue can be considered *corruption*. According to a statement issued by the EU authorities, corruption costs the European economy about 120 billion euros per year; therefore, this problem is from the organizational and informational standpoints, and managed directly by the EU authorities. Also, *technology development* has become a fundamental topic for the future development of the EU and its development programs are based on the development of new technologies. The EU provides vast information bases for generic data. It is only regarding the problems of *prevention and mitigation of conflicts* that the European organizations do not show any significant information activities.

Due to a strong focus by the European Union on the problems of *contribution to economic development*, *technology development*, and *corruption*, this issue is not substantially supported with information through industry associations of the chemical and food industries. As for the chemical industry, more information support is aimed at the *public commitment to sustainability issue*, specifically by their Responsible Care Program. In view of the production diversity of both

chemical substances and foodstuffs, and thus also their impact on the society, the role of site-specific reports and interviews is highly significant for this category of social impacts.

When choosing a consistent set of indicators, and regarding the obtaining of quality and relevant information for their specification in the chemical and food industries, it is possible to draw information from a number of international, European, and national databases, which can provide, after completion with site-specific reports and interviews, a comprehensive picture of social interactions of manufactured products along the entire life cycle. However, it is undoubtedly a costly, time-consuming, and often undervalued process that is not necessarily considered in entrepreneurial practice as significant enough for businesses to reserve appropriate resources for it.

5 Research on Czech Chemical and Food Products

Although the SLCA methodology is in the process of being developed (Jørgensen et al. 2008), the literature only includes sporadic references to its practical application in entrepreneurial practice. Although the available methodology of indicators that was published in 2013, *The Methodological Sheets for Subcategories in SLCA,* presents proposals and examples of indicators, including data resources (Benoît-Norris et al. 2013), any research findings on the specifics of individual industries are still missing. The chemical and food industries have specific conditions in the EU space, and therefore we can expect that it will also be necessary to identify specific indicators to assess social impacts.

5.1 Assumptions and Theoretical Backgrounds

It had been possible to specify the above-mentioned specific conditions on the basis of research in the scientific literature, expert opinions, and previously conducted interviews with managers of large chemical and food enterprises. The data obtained from the industry association—the Chemical Industry Association, and the Agrarian Chamber of the Czech Republic—proved that both industries have significant specifics. The research went on the basic assumption that it is possible to identify specific indicators for both industries, but the question is really whether businesses perceive these specifics and identify any indicators.

It is expected that indicators will probably not be supported by generic data, and businesses will thus rely mainly on site-specific data. In this context, the research will focus on whether or not the data for the assessment of social impacts is available in the sufficient amount regardless of the purpose of SLCA studies. Finally, businesses will be asked about their satisfaction with the level of monitoring of SLCA indicators.

Table 1 Number of surveyed companies

Industry	Size	Count
Chemical	Medium	1
	Large	8
	Enterprise	7
Food	Medium	2
	Large	10
	Enterprise	6

5.2 Research Methodology

Since the research on the industry-specific indicators for assessing social impacts is still at its beginnings and completely unexplored for many industries, we have decided to use, as the most suitable approach, the inductive approach, whereby the empiric data is used as the basis for the development of theory. The SLCA methodology can then be flexibly developed on the basis of the method of inquiry. The method of a semi-structured interview was approved as the most suitable method to support future development of the SLCA methodology.

In view of the number of large chemical and food companies, it was not a problem to implement the research in the sufficient number of businesses, as shown in Table 1.

To minimize the bias in the data analysis and data recording, the recorded data was subsequently verified by the interviewees.

5.2.1 Choice of Respondents

The research was primarily carried out to identify the monitoring and existence of indicators of assessment of social impacts, and so the assumptions listed below were also taken into account when choosing a purposeful sample of respondents.

The analysis of social interactions is a time-consuming, but also costly process, and so it is possible to presume that it will be solved by businesses with an advanced approach to CSR. It was decided to address primarily companies not only with a declared, but also with demonstrably functional approach to CSR (identified on the basis of CSR annual reports). In view of the previously proven relationship to the size of a business and a proactive approach to CSR, it is efficacious to address larger companies with a sufficient number of employees.

The chosen respondents were from the positions responsible for CSR and personnel management. In some cases the research team addressed the top managers or environmental management staff.

5.3 Research Topics According to SLCA Phases

The research methodology was adapted to follow four phases of SLCA, but with a broad and general scope of research covering products of the whole industry, and only selected issues were surveyed. On the basis of the assumptions and conditions defined for the chemical and food industries, the research team dealt with the fundamental issues concerning the specification of SLCA as drawn up in sequential themes.

- For the first phase, ***Definition of Goal and Scope***, there were questions regarding the goals of potential studies and potential system boundaries, especially the possibility of covering and assessing each individual life cycle phase. The *corporate approach to assessment of social interactions* was investigated—in particular, to what extent businesses consider the assessment of social interactions as beneficial and for what purposes they design it, or are going to design it. As companies do not perform a systematic assessment of social impacts very often, it is useful to find out what makes them perform such assessments, or what benefits they find in this method. Considering that the scope of a study depends on its purpose, it is essential to determine how a big part of the life cycle is monitorable from the point of view of information. With the current conditions, where higher levels of cooperation are only being implemented in the value-creating chain, information sharing on the required level is still not very frequent, and the question is whether it is possible to assess the entire product's life cycle effectively from the point of view of social interactions. The selection of the functional unit was not examined, due to the general character of research. In line with the objectives of the research, the questions in the questionnaire were formulated so that the conditions for any social impact assessment of the chemical and food processing industries could be verified. Since the respondents were from many companies with broad portfolios of chemical and food products, it was not the intention to formulate a functional unit. Similarly, no SLCA study was carried out, and thus the basis for the assessment was not specified.
- For the second phase, ***Life Cycle Inventory Analysis****, questions* were formulated that mainly targeted the availability of information, the presence of branch-specific or national-specific impacts, and related indicators. The issue of systematic data collection faced, in a number of cases, the problem of availability and existence of hotspot databases. Interviewees were asked for the availability of site-specific data, hotspot data, and overall information support related to the industry. The research probed *whether businesses are aware of the specific conditions of individual industries and what the rate of availability of hotspot data, branch-specific data, and national data is*.
- For the third phase, ***Life Cycle Impact Assessment***, the questions examined *whether businesses monitor indicators covering the problems of social impacts comprehensively and how effective is the collection of SLCA data that businesses are able to conduct.* The goals of the questions are not only in the focus

on the relevant stakeholders, but also in the choice of stakeholder categories, subcategories and indicators in relation to the study's objectives. Among others, the research team solved the question of which indicators businesses use nowadays and whether they are industry-specific. Effective social impact assessment processes must often solve the problem of the interest of corporate management to perform repeated site-specific surveys in the form of interviews and reports.

- The last phase, ***Life Cycle Interpretation***, was covered only marginally; just one question focused on *identification of the significant issues* and one question on *current levels of reporting* social issues and indicators. Due to the general nature of the study, there were no questions researching the *evaluation of the study*, the *level of engagement with stakeholders,* or potential *conclusions and recommendations*.

All questions were presented in the questionnaires and recorded data was subsequently verified by intense one-on-one interviews. On the basis of these research topics, it was possible to specify the sources of uncertainty and the potential limitations of application of this method in the corporate practice, in the conditions of the EU and the Czech Republic. The theoretically defined conditions showed that it is more effective to monitor the chemical and food industries separately despite all the similarities between them. The most important key findings are presented in the following subchapters.

6 Social Life Cycle Assessment of Chemical Products

On the basis of the data collected from 16 companies in the chemical industry, it was possible to formulate answers to the fundamental research themes. Most respondents represent businesses claiming allegiance to the Responsible Care Program, which is a global initiative of the chemical industry in the area of the environment, health, and safety, that aims to improve results in these areas continuously and to create more confidence in the industry.

Therefore, businesses aim not only to meet the legislative and regulatory rules, but also to **adopt voluntary initiatives based on cooperation with governmental and other involved parties**. All the companies have implemented ISO standards, i.e. at least ISO 9001 and ISO 14001, very often supplemented with ISO 18001 or another OHSAS standard.

Therefore, it was not surprising that the problems of social impacts are not unknown to the respondents, even though the evaluation of social impacts represents a new challenge for them. Businesses admit that the industry faces many specific social problems. Specifically, it is possible to name the following social subcategories marked by the respondents as branch-specific.

As for the workers category, a specific problem is the *protection of health and safety at work*; in the consumers category they are the subcategories of *health and*

Table 2 Branch-specific social impacts—expectations and research results (chemical products)

Category	Subcategory	Theoretical assumption	Research findings
Worker	Health and safety	Very important	Very important
Consumers	End-of-life responsibility	Important	Very important
	Health and safety	Very important	Important
Local communities	Local employment	Very important	Very important
	Community engagement	Important	Very important
	Safe & healthy living conditions	Unimportant	Important
	Secure living conditions	Unimportant	Important
Society	Public commitment to sustainability issues	Important	Very important
	Corruption	Less important	Important
	Contribution to economic development	Important	Less important
Value chain actors	Respect of intellectual property rights	Less important	Very important
	Fair competition	Important	Very important
	Promoting social responsibility	Very important	Less important

safety and *end-of-life responsibility*. In the *Local Communities* category, businesses consider the following subcategories as significant: *local employment, community engagement*, and, surprisingly, *safe and healthy living conditions* and *secure living conditions* as well. Probably the most significant specifics of the industry were identified in the category of society, specifically in the subcategories of *public commitment to sustainability issues*, *corruption*, and particularly in *contribution to economic development*. Concerning the category of value chain actors, surprisingly the most significant subcategories were *respect of intellectual property rights*, and after it, *fair competition* and *promoting social responsibility*. Compared to the theoretical assumptions, the research showed surprising contradictions in some categories (see Table 2).

6.1 The Scope of Social Life Cycle Assessment of Chemical Products

Businesses try to monitor social interactions, particularly for *compliance with the CSR concept*; all the respondents marked this reason as very significant. Similarly,

Table 3 Reasons of considering and assessment of social impacts (chemical products)

Reason	Marked as very important (%)
Compliance with the CSR concept	87.5
Improvements in employee relations	81
Improvements in consumer relations	81
Improvements in supplier relations	75
Improvements in effectiveness and responsibility of the entire supplier-customer chain/network	62.5
Improvements in relations to the local community	56
Enhancement in product properties	50
Support of corporate sustainability	50
Improvements in relations with the society	37.5
Requirements of customers	25
Requirements of suppliers	12.5
Business transparency	12.5

they agreed with the reasons for considering social impacts within *improvements of employee relations*, but also improvements of *consumer relations* and *improvements of supplier relations*. They also clearly supported the reasons for improvements in the corporate image, increasing corporate attractiveness as an employer, and increasing corporate credibility. Surprisingly, the following reasons were not assigned such high significance: *improvements in effectiveness and responsibility of the entire supplier-customer chain/network*, *improvements in relations to the local community*, *enhancement of product properties*, or *support of corporate sustainability*.

The least significant reasons, as marked by the businesses, included *improvements in relations to the society*, *evaluation of social impacts required by the customers*, and *evaluation of social impacts required by the suppliers*; in addition, the reasons do not include the *evaluation of an increase in business transparency*. In Table 3 we see how many companies marked *considering and assessment of the social impacts* as very important.

All businesses attribute a high rate of importance to the evaluation of social impacts, and it is on the same or slightly lower level compared to the evaluation of environmental impacts. In general, it is possible to say that businesses take account of and prefer, as presumed, suppliers, workers, and consumers over the interests of the other stakeholders (local communities, society). The assessment mostly takes account of the interests of employees and then the consumers, followed by the other value chain actors. As for the stakeholders outside the value chain, the most preferred interests are those of the society, while the interests of local communities are least preferred. None of the other stakeholders are considered, from the point of view of social impacts, by any of the companies.

6.2 Setting Boundaries

Regardless of the targets of potential SLCA studies, we researched a potential scope of such studies. The answers and conducted interviews involving managers of the businesses imply a number of limitations for the determination of the limits of potential SLCA studies. There is a general agreement that on the part of the suppliers, the information is more available than in the next life cycle stages. Cooperation with suppliers shows various forms of cooperation closeness and the sharing of information is for some companies absolutely commonplace and essential, while other companies do not build very close relationships with their suppliers. Despite this, it is possible to say that they are at least aware of the significant social impacts relating to their suppliers. It is given by the properties of the used raw materials and other materials, by the obligation to select suppliers observing ISO standards, as well as by the personal contacts and audits performed in the suppliers' companies.

Unfortunately, such awareness does not apply to all of the supplier chain actors. Businesses admit that they do not require the evaluation of social impacts from their suppliers, and when choosing a supplier they do not even assess their approach to social issues. All the information within the product's life cycle is thus available from a direct supplier only, and social impacts on the previous life cycle stages are just estimated.

On the part of the customers, the situation is similar. Businesses know their direct customers, from whom they also do not require a responsible approach to social issues. In many cases, no other segments of the distribution chain are known as far as the consumer. Although businesses comply with the legal, and in many cases also voluntary, directives relating to product labeling and informing customers, they often do not know their final consumer, nor even the way the product is used. What is rather specific for the chemical industry is its high variability of chemical products. A customer can use a chemical substance for various purposes, which is why many respondents consider the definition of a life cycle to be a significantly complex problem, even though for some chemical substances it would not be a problem to define a life cycle and implement SLCA studies. However, for many products, the implementation of such a study is difficult to carry out, and the monitoring of their life cycles is limited.

6.3 Selecting Indicators and Collection of SLCA Data

Significant limitations of the scope of studies and setting limits of the researched system are also reflected in monitoring individual social interactions with the stakeholders through indicators.

Naturally, the easiest and also most widespread is the monitoring of social interactions with the employees of the company itself. Businesses mostly monitor the subcategories of *social benefits/social security* (87.5 % of businesses) and

health and safety (94 %), which are assessed by quantitative indicators more often than by qualitative ones. Furthermore, subcategories such as *fair salary* and *hours of work* are also considered important and are monitored (81 %)—again, mostly through quantitative indicators. The other monitored subcategories are *equal opportunities/discrimination* (75 %), and *freedom of association and collective bargaining* (62.5 %), where qualitative indicators are used to a larger extent. The subcategories of *child labor and forced labor* are monitored in less than half of the addressed companies.

The second relatively well monitored category is interactions with the consumers. Businesses mostly monitor *consumer product health and safety* (94 %), mainly through qualitative indicators. They also monitor *feedback mechanisms* (69 %), and again, mostly through qualitative indicators. For these indicators, it is possible to monitor potential negative responses, and so it is relatively easy for the company to capture these responses. In view of the fact that businesses do not know the final consumer, it is, however, not possible to monitor the other subcategories sufficiently.

The third monitored category is *value chain actors*, where businesses mostly monitor and assess *supplier relationships* (81 %), evenly through quantitative and qualitative indicators. Businesses also monitor the subcategories of *fair competition* (62.5 %) and *respect of intellectual property rights* (62.5 %), again, evenly through a combination of quantitative and qualitative data.

Categories that are not monitored very much include *society,* where businesses particularly assess *technology development* (81 %) through qualitative indicators, and *contribution to economic development* (62.5 %), using a combination of qualitative and quantitative indicators. The *corruption subcategory* (50 %) is not monitored to a large extent, even though businesses consider this area to be specific.

The last category is *local communities*, where companies conduct systematic monitoring of the subcategory of *safe and healthy living conditions* (56 %) only, where qualitative indicators prevail. Surprisingly, the other subcategories are monitored only sporadically.

As for the possibility of using available generic data and specific data, businesses work with the database of Eurostat. However, the reasons are mostly just for marketing or environmental purposes. Unfortunately, industry associations do not have sufficient capacities to publish national data regularly; this function is fulfilled by the national statistical office. The Czech Statistical Office (CSO) is a central authority of the state administration of the Czech Republic; it provides services such as the collection and processing of data for statistical purposes and provides the state authorities, local government authorities, public, and foreign countries with statistical information. The CSO ensures the processing and publishing of data, compiles summarizing statistical characteristics of the national economy development, processes analyses, processes projections of the demographic development, and conducts conjectural surveys. Thanks to these functions, it is possible to use the output partly for the needs of individual industries, but to a limited rate of detail only. Businesses thus have to rely mostly on site-specific reports, audits and interviews.

To sum up the above, we can say that businesses, when monitoring and assessing individual social interactions, generally use semi-quantitative indicators to a small extent, even though they are just indicators whose application is not very difficult. A fundamental contradiction can also be found between the significance of individual subcategories and their assessment through indicators.

The interviews with the respondents identified significant deficiencies in the assessment. Many of the companies perform assessment unsystematically, often just on a one-time basis for individual decision-making processes. Information acquired this way is then not used again; there are no company databases on the basis of which the historical data could be compared with the current data. Some collected information is often not published by the companies, and thus they lose an important tool and opportunity to demonstrate their social policy and social responsibility. Therefore social impact reporting is to a large extent replaced with general proclamations of the corporate interest in sustainable development and CSR, even though such proclamations could be backed up by measurable outcomes. The publicly available information resources (e.g., the Eurostat database) are not used by businesses. A significant rate of ignorance of the final customer or the way the product is used, as well as of its disposal, is not only a problem of the evaluation of social impacts, but also in particular a marketing and commercial problem threatening the economic survival of companies themselves.

On the other hand, we have identified a concern for enhancing the assessment of social impacts; businesses are aware of the roles of individual stakeholders, especially specialist employees, who prevail in the chemical industry. The research showed a significant respondents' interest in obtaining information for the assessment of individual categories and subcategories. Unfortunately, we have to state that the chemical industry does not yet have any important tools of information support for the collection of data or selection of indicators. These activities would be, on the part of branch institutions, national or European organizations, an interesting tool for evaluation of companies and for benchmarking, which the chemical industry uses quite often commonly for economic indicators.

6.4 Sources of Uncertainty and Limitations

The above implies that the assessment of social impacts in the chemical industry can help identify a number of specific sources of uncertainty and limitations.

The basic source of uncertainty is the fact that businesses do not know the final user. Although they know the possible ways in which their products will be used, in a number of cases they are not able to find out how the product was indeed finally used. Basic acids or products made from crude oil can be used in such diverse ways that monitoring them during their life cycles is quite difficult. By contrast, some products can serve as final products (fertilizers, explosives, additives, fuels) and, at the same time, as semi-finished products for the production of other substances and their derivatives. Such multifunctional uses of chemical substances makes the

identification of the product life cycle and therefore also its environmental and social assessment significantly more difficult. This shortcoming can only be eliminated by sufficient information sharing and strengthening cooperation inside the value chain.

Another deficiency mentioned is the absence of branch data. Today's industry association—the Association of Chemical Industry of the Czech Republic—mainly aims to take an active role in representing and enforcing the interests of the chemical industry, particularly the members of the Association. Together, with the support of the development of the chemical industry, it puts emphasis on the environment, safety of operations, and friendly social climate, but particularly in the employer-employee relationship. This organization has no power to collect, sort out, analyze, or present data; nowadays, it does not even take part in the genesis of individual indicators for measuring social interactions in the industry. Therefore, businesses have to rely particularly on their own information resources, which represent for them a significant burden, and in many cases it is also an obstacle to assessing social impacts. The availability of information and the scope of assessment thus often end at the border of the company itself, and the other life cycle stages are not identified.

Another limitation mentioned that emerged from the interviews is a certain absence of information about the origins of the basic raw materials. Although chemical companies were built directly at the sources of the basic raw materials, these sources were depleted in a number of cases and the businesses had to import the basic raw materials. When purchasing the basic raw materials e.g., from Asian or African suppliers and resellers, businesses are not able to guarantee the social approach of these companies as applied during the mining of these raw materials. They admit that the basic criteria are the price and required qualitative properties of chemical substances. Despite the REACH administration, it is often not possible to guarantee a socially responsible "origin" of the basic raw materials.

In general, it is possible to summarize that as follows: It is very difficult to monitor the life cycle of chemical substances, both in the initial and in the final stages of their life cycles. These reasons imply that the scope of potential SLCA studies is significantly limited.

7 Social Life Cycle Assessment of Food Products

When comparing chemical and food companies, the basic assumption was the correspondence of their technologies, but, among others, the dissimilarity in the use of the product, attitudes toward customers, local communities, and generally perceived lower danger in production. The direct influence on consumers requires a significantly higher interest in the category of consumers.

On the basis of the data collected from 18 food industry businesses, it was possible to formulate answers to the fundamental research themes. All business entities in the food industry in the EU are obligated, by law, to introduce and

maintain technological procedures in compliance with the HACCP principles. Almost all the companies have implemented not only ISO standards ISO 9001 (87.5 %), ISO 14001 (81 %), and ISO 18001 (75 %), but also a number of other certificates, e.g., IFC, BRC, CEFF.

Social aspects are particularly considered by businesses in relation to consumers, but also to employees and suppliers, even though their assessment is still not carried out very often. It is possible to specify some branch-related social problems, especially in the area of food safety. A dangerous foodstuff can cause illness—in the best-case scenario just unpleasant, but in the worst case, fatal. Food safety is closely connected with physical, chemical and/or microbiological risks, which may occur anywhere along the food chain, from the grower or keeper to the consumer. Food area entrepreneurs have to play important roles in controlling such risks, which is why most respondents marked the following *branch specific social subcategories:*

In the category of *consumers*, they unanimously marked the subcategory of *health and safety*. Also such other subcategories as *transparency, feedback mechanism* and *end-of-life responsibility* enjoy a high rate of importance. The *workers* category includes the important subcategories of *protection of health and safety at work*, *fair salary*, and, surprisingly, *social benefits/social security* as well.

As for the *value chain actors category*, the respondents marked *supplier relationships*, then *fair competition* and *promoting social responsibility* as the most important subcategories.

In the *local communities* category, only the following subcategories were marked as significant: *local employment* and *safe and healthy living conditions*. In the category of *society*, businesses see significant subcategories in *contribution to economic development* and *public commitment to sustainability issues*. A brief comparison between theoretical expectations and research findings is shown in Table 4.

The research outcomes were again in partial contradiction to the theoretical assumptions.

7.1 Scope of SLCA of Food Products

Food industry businesses saw the most significant reasons for *improvements of consumer relations,* followed by *improvements in employee relations,* and *improvements in product properties.* Businesses consider the growing *requirements of the customers* concerning assessment of social impacts as a very important impulse for monitoring and assessing social interactions. The interviews showed that the industry is not as negatively perceived by the public as it is in the case of the chemical industry, and so businesses consider the following reasons to be significant: *improvements in supplier relations* and *enhancement of the effectiveness and responsibility of the entire supplier-customer chain/network* and *an increase in the company attractiveness as an employer*; they also try to monitor social interactions for the of *compliance with the CSR concept*. Lower importance was seen in

Table 4 Branch specific social impacts—expectations and research results (food products)

Category	Subcategory	Theoretical assumption	Research findings
Consumers	Health and safety	Very important	Very important
	Transparency	Very important	Very important
	Feedback mechanism	Very important	Important
	End-of-life responsibility	Less important	Important
Worker	Health and safety	Important	Very important
	Fair salary	Very important	Important
	Social benefits/social security	Less important	Important
Value chain actors	Supplier relationships	Important	Very important
	Fair competition	Less important	Very important
	Promoting social responsibility	Less important	Important
Local communities	Local employment	Very important	Important
	Safe & healthy living conditions	Less important	Important
	Corruption	Less important	Important
Society	Contribution to economic development	Less important	Important
	Public commitment to sustainability issues	Less important	Important

improvements of relations to the local community, *an increase in corporate credibility,* or *an increase in the business transparency*.

As the least significant reasons, businesses marked, as for the chemical industry, the following: *improvements in relations to the society, assessment of social impacts required by the customers, assessment of social impacts required by the suppliers,* and *support of corporate sustainability*.

A summary of significant reasons of social impact assessment of food products is seen in Table 5.

As with chemical companies, food businesses also assign great importance to the assessment of the social impacts that are comparable to the assessment of the environmental impacts. According to the assumptions, they mostly prefer and consider the interests of the consumers, and are followed by the interests of the stakeholders having direct impacts on the quality of the generated product (suppliers, workers). The interests of local communities and society are, compared to the above stakeholders, less significant, or even marginal. When assessing social impacts, businesses do not take any other stakeholders into account.

Table 5 Reasons for considering and assessing social impacts (food products)

Reason	Marked as very important (%)
Improvements in consumer relations	83
Improvements in employee relations	78
Improvements in product properties	72
Requirements of customers	67
Improvements of supplier relations/requirements of suppliers	55.5
Improvements of effectiveness and responsibility of the entire supplier-customer chain/network	55.5
Increase in the company's attractiveness as an employer	44
Compliance with the CSR concept	33
Improvements in relations with the local community	33
Increase in the corporate credibility	28
Business transparency	22
Other reasons	Less than 20

7.2 Setting Boundaries

The potential possible scope of SLCA studies is not as limited as it is in the chemical industry. A number of raw materials have clearly identified initial stages of the product genesis, as it is identified in the final stages, so the identification of the life cycle does not represent a fundamental problem. A somewhat worse situation is in the area of data availability; the production of some foods does not have information processes and systems sophisticated enough to be able to engage in its collection and analysis to a sufficient extent.

They do monitor social impacts alongside the life cycle, partly in order to comply with the HACCP principles and ISO standards, as well as any other food legislative directives and norms. However, the respondents admit that they do not require the assessment of social impacts from their suppliers, and when selecting suppliers, they do not assess their approaches to the social impacts. One of the advantages of food products is their relatively short life cycle. Therefore, the information is relatively accessible, with the exception of exports of foodstuffs out of the area of the European Union. Nevertheless, even in these cases, at least the final customer is known, so it is possible to specify social impacts in individual life cycle stages much more accurately than it is possible for chemical products.

7.3 Selecting Indicators and the Collection of SLCA Data

The selection of indicators is not limited to food products by ignorance of the life cycle as much as by the requirement concerning the genesis of a safe foodstuff. It

results in monitoring three categories: *product users, employees, and raw material suppliers.*

For *food safety*, the most significant issues are connected with social interactions with consumers. Apart from monitoring marketing objectives such as the enhancement of the image, loyalty, and generally bonding the customer to the product, it is essential for the company to monitor *consumer product health and safety* (100 % of businesses), via both quantitative and qualitative indicators. They also monitor *feedback mechanisms* (61 %), again with a balanced quantitative-qualitative indicator ratio, and *transparency* (55.5 %) in order to mitigate the risk of negative health impacts resulting from the misuse of foodstuffs—assessed through semi-quantitative and qualitative indicators. After this, respondents marked *end-of-life responsibility* (61 %) as a slightly less significant subcategory, but hardly any foods represent an excessive burden for the environment and the society, and so businesses do not monitor this problem very often.

What is very common is the monitoring of social interactions with *employees*. Traditionally, businesses monitor the subcategory of *health and safety* (94 %) through quantitative indicators. Due to insufficient valuation of the workforce and lower requirements concerning a qualified workforce, they monitor the subcategory *fair salary* (78 %) and, in addition, they monitor the subcategory *hours of work* (72 %) through quantitative indicators, and *social benefits/social security* (72 %), mostly through semi-quantitative and qualitative indicators. Another monitored subcategory is also the issue of *equal opportunities/discrimination* (61 %), using both quantitative and qualitative indicators. The addressed companies assess the other subcategories only in exceptional cases.

The third monitored category is *value chain actors*, where, like in the chemical industry, the most often monitored and assessed subcategory is *supplier relationship* (72 %), but due to the quality requirements, qualitative indicators prevail, and they are just supplemented with quantitative and semi-quantitative indicators. Businesses also monitor the subcategory of *fair competition* (50 %), because of serious competition in the industry through the combination of quantitative and qualitative data.

In the *society* category, businesses assess individual subcategories only marginally. They monitor the *contribution to economic development* and *corruption* (both 50 %) through a combination of qualitative and quantitative indicators. The last category is *local communities*, where only the subcategory of *safe and healthy living conditions* (39 %) is monitored, with a prevalence of qualitative indicators.

As for the possibility of using available generic data, businesses use the Eurostat database and the national databases published by the Czech Statistical Office (CSU). Unfortunately, the industry association—the Czech Agrarian Chamber—also lacks the ability to publish national data on a regular basis. Businesses thus complete the European and national information with their own site-specific reports, audits, and interviews.

The food industry also experiences an apparent contradiction between the perceived significance of individual subcategories and their assessment through indicators. However, this contradiction is not as distinct as it is in the chemical industry.

The interviews also helped identify significant insufficiencies in the assessment of social impacts in the food industry, and it corresponds to the assessment in the chemical industry to a considerable extent.

- Assessment is not performed on a systematic or regular basis; it is often just in the form of an ad hoc analysis.
- Obtained information is not further used; businesses do not create databases of historical data.
- Obtained information is published very seldom and irregularly; businesses thus omit the opportunity to demonstrate their social policies and social responsibilities.
- Publicly available information sources (e.g., the Eurostat database) are insufficiently used by businesses.
- Despite good knowledge of the products' use and the origin of foodstuffs, the rate of assessment of the food life cycle is relatively low (less than half of the addressed businesses conduct life cycle analyses).

One positive thing that can be seen in the efforts of the companies not to underestimate the assessment of social impacts in relation to the safety of the produced foodstuffs, which can be confirmed by the minimal problems with the quality of food in the Czech Republic and the EU is that most poor-quality products have been imported. The research identified the respondents' interest in obtaining information for the assessment of individual categories and subcategories. Unfortunately, as with the chemical industry, there are still no significant information support tools for collecting data or selecting indicators.

7.4 Sources of Uncertainty and Limitations

The assessment of social impacts in the food industry is significantly simpler compared to that in the chemical industry. However, it is possible to identify specific sources of uncertainty and limitations.

The absence of branch-specific data and low availability of branch-oriented indicators affect the food industry, too. The industry association—the Czech Agrarian Chamber—is an organization determined by law, aiming to support entrepreneurial activities in agriculture, in the food industry, and in forestry, to enforce and protect the interests of its members and tend to their needs. It provides its members with counseling and consulting services, it issues expert opinions and statements and, in relation to the social issues, it also organizes educational activities and cooperates with the state administration authorities on provision of information services, professional education and retraining, and on solving employment problems by informing the chamber members. However, the organization lacks the ability to collect, sort out, analyze and present data to a sufficient extent for all produced foodstuffs, or to share the creation of branch-oriented indicators. Therefore, businesses have to draw their information from the Eurostat

and the Czech Statistical Office databases, but, unfortunately, they do not always do it; when collecting information, they rely on their own information resources.

Another fundamental source of limitations is in human capacity. The pay packet in agriculture and the food industry is considerably below average as a result of the serious competition in the European markets. Businesses thus face a lack of employees to solve non-production problems; some managers involved in the research admitted to being unable to solve the assessment of social impacts.

A specific problem and limitation occurring in the food industry is insufficient awareness of food imports. Although the movement of goods within the EU is monitored through the database of Intrastat (a system of statistics of trade between the European Union member states) there is a problem with frequent distortion of the origins of some raw materials. Although the EU authorities are doing their best to prevent these discrepancies through legal requirements concerning marking and checking foodstuffs, they have not yet succeeded in eliminating these dishonest practices.

The last problem is the end of the food life cycle. In this matter, European Union companies still often face overproduction and overconsumption. However, there is no accurate information on how high this overproduction is, how much food is stored, how much is returned to be processed to the form of fodder, or fertilizers and biomass, or how much food is uselessly disposed.

In general, it is possible to conclude that monitoring the food life cycle is not very complicated from the point of view of methodology. More likely, the efficiency of this assessment is low for the capacity reasons and for the reason of insufficiently perceived and insufficiently explained benefits for the company.

8 Conclusions and Discussion

The Social Life Cycle Assessment method offers a complex assessment of the social impacts of the products alongside the products' life cycle, but its practical application faces a problem of branch specifics as well as the geographical affiliation of the production plants. The SLCA methodology is still under further development and the literature includes sporadic references to practical application and to the branch specifics. Chemical and food industries represent the most important industries, whose products today's civilization could not do without. It is not surprising that the problems of social impacts are not unknown to the managers, even though the evaluation of social impacts represents a new challenge for them.

Theoretically, it is possible to define the problems that can make implementation and systematic performance of SLCA methodology complicated. Direct research by companies helps discover to what extent the assessment of the social impacts is done and whether the branch specifics and national specifics can be identified, as well as indicators for their measurement. On the basis of the data collected from 16 chemical industry and 18 food companies, it was possible to conclude the following

results. The interviews helped identify significant insufficiencies in the assessment of social impacts in both industries.

The social impact assessment of chemical and food products is influenced by many similar specifics for each impact category, but take into account the interests of stakeholders on a different level of importance: the chemical industry managers mostly take into account the interests of employees, followed by consumers, local communities and the other value chain actors, while the food industry managers respect the interests of consumers, followed by employees and the other value chain actors.

In early life cycle stages—**resource mining** and **processing**—the research confirmed a limited scope of potential SLCA studies due to the lack of information; chemical companies just estimate social impacts in the initial life cycle stages and all the information within the product life cycle is thus available from a direct supplier only. Food products have considerably shorter life cycles, but, like chemical products, often do not have enough information to be able to analyze the interest of stakeholders on a sufficient level in the initial life cycle stages.

Because of very similar technology processes used for manufacturing both chemicals and food products, analogical important social subcategories for "productive" life cycle stages can be identified. Regarding **manufacturing**, both industries evaluate the *health and safety of workers* to be highly important. Close cooperation with supply chain actors can be proved by great interest in these subcategories: *fair competition*, followed by *supplier relationships* for the food industry and *respect of intellectual property rights* for the chemical industry; in addition, interests of local communities are important, mostly for chemical companies, and especially for *community engagement* and *local employment* subcategories.

At the end-of-life cycle (**sale**, **use**, **recycling**, and **disposal**), high-level interest concerning social interactions with consumers can be traced. Both industries take *health and safety of consumers* and *end-of-life responsibility seriously;* in addition, the food industry managers strive for *transparency*. For chemical substances, the assessment at the end-of-life cycle can be complicated by the fact that some of them could be used for various other purposes.

The assessment of chemical products is influenced by the fact that businesses know their direct customers and suppliers and all the information within the product's life cycle is thus available from direct value chain participants. Chemical substances can be used for various purposes, and the definition of a life cycle can be perceived as a significantly complex problem. Companies perform assessment unsystematically, often just as an ad hoc assessment. There are no company databases, and information acquired in this way is not systematically used again. Collected information remains unpublished and companies lose an important opportunity to demonstrate their social responsibility. The basic source of uncertainty is the fact that businesses do not know the final user due to the multifunctional use of chemical substances. The absence of branch data, and absence of information about the social impacts of origins of the basic raw materials,

complicate monitoring in the initial stages and in the final life cycle stages of chemical substances.

The food industry is not as negatively perceived by the public as the chemical industry is, and branch-related social problems are related mostly to food safety. The scope of potential SLCA studies is not as limited as it is in the chemical industry, and the initial, up until the final stages can be clearly identified, so that identification of the life cycle does not represent a fundamental problem; significant insufficiencies in the assessment of social impacts in the food industry can be identified. Assessment is not performed on a systematic or regular basis, obtained information is not further used, obtained information is irregularly published, and publicly available information sources are not sufficiently used by businesses. Although an assessment of social impacts in the food industry is significantly simpler than in the chemical industry, the absence of branch-specific data and the availability of branch-oriented indicators complicate systematic assessment activities. Other limitations are the lack of working capacity for solving the problems related to the assessment of social impacts and insufficient awareness of food imports, but in general, the monitoring of the food life cycle is not very complicated from the point of view of SLCA methodology.

An effort on the part of the the companies not to underestimate the assessment of the social impacts of their products can be see for both industries. Businesses are aware of the roles of individual stakeholders, and the research showed a significant respondents' interest in obtaining information for the assessment of individual categories and subcategories. It can be concluded that the chemical and food industries still do not have any complex tools of information support for the collection of data or selection of indicators. Businesses admit that the industries face numerous specific social problems, and the assessment of social impacts represents the difficult, but necessary improvement of social interactions between companies and stakeholders.

The future effective assessment of social impacts requires further theoretical development on the field of generic (hotspot) data, branch-specific indicators, systematically oriented collection, presentation of data by companies, and closer understanding of the life cycles of chemical and food products.

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Partial Organization and Social LCA Development: The Creation and Expansion of an Epistemic Community

Catherine Benoît Norris and Jean-Pierre Revéret

Abstract Life Cycle Assessment (LCA) is a technique to study the environmental impacts of products from cradle-to-grave that was developed at the end of the 1960s and standardized by the International Standards Organization (ISO) at the end of the millennium. The discussion and research efforts to broaden the scope of the technique to include social impacts (e.g., O'Brien et al. Int J Life Cycle Assess 1 (4):231–237, 1996, and Gauthier J Bus Ethics 59:199–206, 2005) accelerated with the creation of a project group in 2004 under the umbrella of the Life Cycle Initiative, a joint enterprise of the United Nations Environment Programme and the Society for Ecotoxicology and Environmental Chemistry. Numerous authors have highlighted the institutionalization process of LCA and the social shaping of the technique (e.g., Heiskanen Sci Stud 11(1):27–51, 1997, Heiskanen J Clean Prod 10 (5):427–437, 2002; Frankl INSEAD Working Paper, Fontainebleau, France, 2001; Baumann et al. Towards Life Cycle Sustainability Management, 73–83, 2011). However, none of this research applies stakeholder theory, considers these forums as epistemic communities, nor strives to explain the organizational processes and dynamics of the field's development. A new theoretical framework (Rasche et al. J Bus Ethics 115:651–663, 2013) based on advancements in the sphere of organization studies (Arhne et al. Organization 18(1):83–104, 2011) offers a new perspective regarding the elements that enable and constrain organized orders. Rasche et al. (J Bus Ethics 115:651–663, 2013) argue that it is useful to analytically distinguish different modes of organizing for Corporate Social Responsibility (CSR) along the dimensions of complete-partial organization. They call for research to further examine the role of actors in the processes of organizing for CSR that would also highlight the dynamics of CSR multi-stakeholder initiatives. The phenomenon of Social Life Cycle Assessment development offers the context for a rich

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case study that can draw upon and contribute to these new research avenues. Researching the organization of the development of this new phenomena contributing to CSR will also help to further reveal the process of social construction of scientifically based methods. An analytical framework proposed by Glasbergen (Environ Policy Governance 21(1):1–13, 2011) serves as a starting point to map the process of the partnership and method development. This framework is then refined with reflections regarding epistemic communities.

Keywords Stakeholder theory · Corporate social responsibility · Multi-stakeholder initiative · Social shaping · SLCA institutionalization · Epistemic communities · Social Hotspot Database (SHDB)

1 Introduction

1.1 Social Life Cycle Assessment as a Tool for CSR

Social Life Cycle Assessment (SLCA) is a phenomenon that appeared in the late 1990s and is now at its rising crest as attested to by the growing number of published journal articles (Jorgensen 2013). Building on the technique of environmental Life Cycle Assessment (LCA), it aims to identify the positive and negative social impacts attributable to a product life cycle from the extraction of raw materials to the elimination of its waste, including the product use phase. It makes use primarily of industrial ecology modelling and accounting frameworks, and Corporate Social Responsibility (CSR) issues mapping, framework, and indicators. There is an ample and diverse literature that discusses the development, application and challenges of environmental LCA in several well-established journals such as the *Journal of Cleaner Production*, the *Journal of Industrial Ecology*, the *International Journal of Life Cycle Assessment, Environmental Science and Technology*, and others.

Being essentially a new impact dimension added to *environmental* life cycle assessment, SLCA development has been occurring mostly within the vicinity of the LCA organizations and initiatives, and those developments are mostly published in the same journals as environmental LCA issues.

Both Social and Environmental LCA can be considered as tools for CSR because they apply a framework to assess sustainable development dimensions within the sphere of a company's product's life cycles. CSR has been defined as the appropriation and implementation of the logics and principles of sustainable development to the business domain (Capron and Quairel-Lanoizelée 2004; Yedder and Farhoud 2009).

The first section of this chapter contextualizes the development of SLCA within CSR multi-stakeholder initiatives, and presents its history, highlighting the role played by the Life Cycle Initiative Project Group. In this chapter, we study the organization and the dynamics of SLCA initiatives using the SLCA project group and the SHDB as examples. In order to explore the organization of these activities, we first need to

understand what differentiates LCA from other sustainability decision-making tools. Thus, the second section explores the relevant literature regarding LCA's social construction and institutionalization. The third section analyzes how the Life Cycle Initiative SLCA project group was organized, applying the partial organization theory, and who was involved, using the stakeholder theory. The third section also introduces the concept of epistemic communities to understand better how the SLCA methodology was created, is evolving, and how the community it reaches is expanding. The fourth section highlights the dynamics of multi-stakeholder initiatives and demonstrates how SLCA activities evolved over time. The fifth section testifies to the growth of the SLCA epistemic community, using the development of the SHDB as an example. The sixth section discusses the importance of considering how initiatives are organized and evolve over time, so that they can better reach their objectives.

1.2 Methodology

The authors of this chapter have had hands-on experience regarding the development of SLCA. In particular, Catherine Benoît Norris coordinated the development and is lead editor of the SLCA Guidelines publication (Benoît and Mazjin 2009). She is also the executive director of the SHDB project that she co-created, piloted and launched at New Earth (Benoît Norris et al. 2012). Therefore, Catherine has a privileged (and of course subjective) viewpoint of SLCA development, having played a pivotal role at a special moment in its history. Participant observation was used during the process of development of SLCA (within the Life Cycle Initiative Project Group), and action research was conducted during the creation of the SHDB. Participant observation is a widely used method aiming to gain a close and intimate familiarity with a given group of individuals and their practices through an intensive involvement with people in their cultural environment, usually over an extended period of time (Kawulich 2005). Action research is research initiated to solve an immediate problem or a reflective process of progressive problem solving led by individuals working with others as part of a "community of practice" to improve the way they address issues and solve problems (Winter and Munn-Giddings 2001).

This article utilizes organizational theories and analytical tools to shed new light on the recent developments in the field of SLCA, their effect, and how they came into being.

1.3 The Life Cycle Initiative as a CSR Multi-stakeholder Initiative

The term CSR multi-stakeholder initiatives, also referred to as "partnerships", bears multiple designations in the literature, having more or less the same meaning. For instance, a multi-sectoral initiative will refer to an initiative including all four spheres

of society (state, market, NGO, and civil society), while the term "cross-sectoral initiative" will refer to an initiative including at least two spheres, and the term "intersectoral initiative" will also refer to an initiative that includes at least two societal spheres. "Intersectoral" partnerships can be defined as "collaborative arrangements in which actors from two or more spheres of society (state, market, NGO, and civil society) are involved in a non-hierarchical process, and through which these actors strive for a sustainability goal" (Van Huijstee et al. 2007).

CSR multi-stakeholder initiatives represent a contemporary way to organize in order to achieve a common practical purpose, pool core competencies, and share risks, responsibilities, resources, costs and benefits (Utting and Zammit 2009). Traditionally, the responsibility for dealing with sustainability issues was attributed to governmental organizations (Van Huijstee et al. 2007). However, since the beginning of the new millennium, public–private partnerships have become widely adopted and are generally understood with "reference to changing modes of governance, adaptations in management practices within both public and private institutions, as well as in perceptions regarding the roles and responsibilities of different development actors in the context of globalization and liberalization" (Utting and Zammit 2009). They are often portrayed in the literature as part and parcel of a "pragmatic turn" regarding governance and policy making. Intersectoral partnerships open up the policy arena to actors from spheres of society other than government (Dubbink 2003; Arts and Leroy 2006). The relationship between intersectoral partnerships and sustainable development was formalized when it was declared that partnerships are an important instrument for implementing sustainable development at the 2002 World Summit on Sustainable Development in Johannesburg (Hens and Nath 2003; Norris 2005; Eweje 2007; Van Huijstee et al. 2007).

CSR multi-stakeholder initiatives can be grouped using different typologies. Variables used to construct the typology often differ in the literature; they may be categorized by the degree of engagement between the partners (Austin 2000), by their goal (Glasbergen and Groenenberg 2001), by the functions they claim to fulfill (Hartman and Stafford 1997), or according to the participating actors (Davis 1999). Typologies may use one variable, as in the examples above, or they may employ several at once (e.g., Caplan 2003; Murphy and Bendell 1997; or Gray and Stites 2013).

The latter (Gray and Stites) uses two variables, level of shared responsibility and scope of the initiative, to categorize intersectoral partnerships. We adopt this approach to contextualize the Life Cycle Initiative.

The Life Cycle Initiative, an International Life Cycle Partnership, was launched in 2002 under the umbrella of the United Nations Environment Programme and Society for Ecotoxicology and Environmental Chemistry (SETAC), in order "to enable users around the world to put life cycle thinking into effective practice".[1] In particular, the Initiative aims at strengthening the methodology of LCA by facilitating the exchange of knowledge among more than 2,000 experts worldwide, and building its acceptability and legitimacy as well as promoting life cycle thinking globally.

[1] www.lifecycleinitiative.org.

The Initiative responds to the call by governments around the world for a Life Cycle economy in the Malmö Declaration (2000). It contributes to the 10 year Framework of Programmes to promote sustainable consumption and production patterns, as requested at the World Summit on Sustainable Development (WSSD) in Johannesburg (2002).

The Life Cycle Initiative plays a major role in facilitating a methodological consensus among members and defining optimal application scenarios of the method (life cycle management) with users and practitioners, many of whom work for, in collaboration with, or in businesses. These users and practitioners include sustainability managers, designers, engineers, consultants, interns, professors, and research associates working for industrial research groups, graduate students, etc.

Figure 1 presents the different types of CSR multi-stakeholder initiatives and sustainable development partnerships. The original figure found in Gray and Stites (2013) was designed to characterize business and NGO partnerships. It was adapted to study CSR multi-stakeholder initiatives, thus eliminating the need to include the categories of partnership reflecting only dyadic relationships, while also making the necessity to add new categories relevant to this specific type of intersectoral partnership: Scientific/Methodology Development, and Capacity Development and Dissemination.

The Life Cycle Initiative, like most CSR multi-stakeholder initiatives, has a broad mission to make its activities fit into the three main categories of the Gray and Stites framework: scientific and methodology development, capacity development

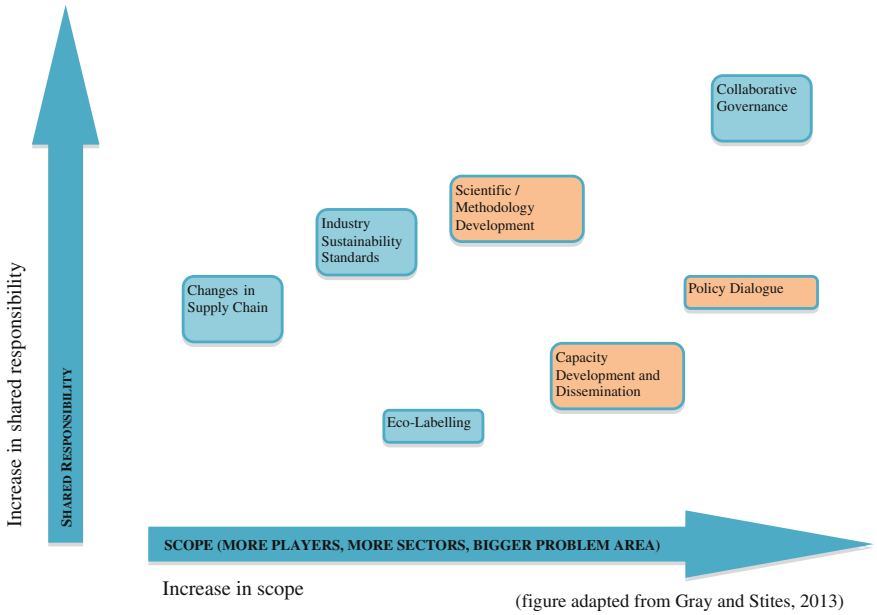

Fig. 1 Types of CSR multi-stakeholder initiatives or SD partnerships

and dissemination, and policy dialogue. All three categories rank at the higher range of shared responsibility and scope. However, the Life Cycle Initiative does not go as far as being collaborative governance. The table below presents some of the main existing Social Responsibility multi-stakeholder initiatives and identifies the leading sector as well as the partnership categories to which their activities mainly belong. This serves to put the activities of the UNEP/SETAC Life Cycle Initiative in context. In order to identify the categories of partnership for each initiative, the "about" section of each initiative Web site was scrutinized. From Table 1, we can observe, for instance, that UN-led partnerships tend to include policy dialogue in their activities, and industry-lead partnerships have a focus on developing sustainability standards.

Table 1 Multi-stakeholder initiatives leading sector and partnership categories

Name of Initiative	Launch year	Leading sector	Categories
UNEP SETAC Life Cycle Initiative	2002	UN/ Scientific lead	Scientific/methodology development, capacity building and dissemination, policy dialogue
UN Finance Initiative	1992	UN lead	Industry sustainability standards, scientific/ methodology development, capacity building and dissemination, policy dialogue
WBCSD	1995	Industry lead	Industry sustainability standards, scientific/ methodology development
Global Reporting Initiative	1998	UN lead, NGO lead	Industry sustainability standards, scientific/ methodology development
Global e-Sustainability Initiative	2001	UN lead	Industry sustainability standards, scientific/ methodology development, capacity building and dissemination
Global Compact	2004	UN lead	Industry sustainability standards, capacity building and dissemination, policy dialogue
Electronic Industry Code of Conduct	2004	Industry lead	Industry sustainability standards, capacity building and dissemination
ISO 26000	2005	Standard lead	Industry sustainability standards, scientific/ methodology development
Global Social Compliance Programme (GSCP)	2006	Industry lead	Industry sustainability standards, scientific/ methodology development, capacity building and dissemination
ILO IFC Better work global program	2007	UN – IFC lead	Changes in supply chain, capacity building and dissemination, policy dialogue
The Sustainability Consortium (TSC)	2009	Scientific/ industry lead	Industry sustainability standards, scientific/ methodology development
Global Initiative for Sustainability Rating	2011	NGO lead	Industry sustainability standards, scientific/ methodology development
Sustainability Purchasing Leadership Council	2013	NGO lead	Industry sustainability standards, scientific/ methodology development, capacity building and dissemination

The Life Cycle Initiative, as an actor, can be identified as a convener. The convener role (as described in Arenas et al. 2013) is to identify and bring the legitimate stakeholders to the table and adopt an "unbiased, even-handed approach to the problem domain" (Gray 1989). Among the main attributes of conveners, Wood and Gray (1991) identify being trusted and perceived as fair, credible, and powerful, being a "bridging organization" or an "enabling structure" (Selsky and Parker 2005), and playing a key role in facilitating collective action (Hardy 1994; Westely and Vredenburg 1991). To be a successful enabler, an organization must be able to link diverse constituencies (Westely and Vredenburg 1991), establish "common meanings and understanding across cultural boundaries" (Crane 2000), and display persistence and entrepreneurial capacity to cope with threats and maintain its support (Stafford et al. 2000; Arenas et al. 2013).

1.4 The Life Cycle Initiative Social LCA Project Group

In 2004, the UNEP/SETAC Life Cycle Initiative recognized the need for a task force to integrate social criteria into LCA. As a convener, the Initiative sought participation among interested members and other organizations. The task force was created with the objectives of (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 socioeconomic 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 (Benoît et al. 2010). Thus the planned activities of this task force (or project group) were to contribute to scientific/methodology development as well as capacity building and dissemination.

The first meeting of the SLCA Project Group was held in Prague, back to back with the annual SETAC Europe conference in April 2004. At this meeting, and at each meeting thereafter, methodological issues (including indicators) and case studies were discussed. The first deliverable was the publication of a 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 SLCA into question". After that, 12 meetings, workshops and seminars were organized between April 2004 and April 2009. Over 70 professionals became members of the project group during its lifespan, of whom 22 actively participated in the development of the Guidelines. Twelve organizations[2] representing key

[2] Accountability International (AI), Consumers International (CI), Fair Labor Association (FLA), Fair Trade Advocacy Office (FTAO), International Consumer Research & Testing Ltd (ICRT), International Labor Office (ILO), International Organization of Employers (IOE), International Social and Environmental Accreditation and Labelling Alliance (ISEAL), International Trade Union Confederation (ITUC), Society of Environmental Toxicology and Chemistry (SETAC),

stakeholders in the field of social responsibility provided continuous feedback on the SLCA guidelines and the project group work, and an international peer review was organized by UNEP and SETAC. Following the peer review, the publication of the Guidelines for SLCA of products (Benoît and Mazijn 2009) was officially launched on May 18, 2009 in Quebec, Canada, in conjunction with the ISO 26000 meeting (Benoît et al. 2010).

One element that differentiates the Life Cycle Initiative relative to other CSR multi-stakeholder initiatives, is that in fact, the stakeholders are gathered around a tool. Even though tool development is an important element of other intersectoral partnerships, what distinguishes the Life Cycle Initiative is that the tool (LCA) is the central motivation and rallying point for the efforts and activities.

With the publication of the SLCA Guidelines, a new era had begun, marked by expansion and acceleration. This post-Guidelines period sees the field opening up to new stakeholders and myriad new developments published in dedicated journal sections and books. The activities taking place within the field of SLCA post-guidelines are of a different nature and include case studies, further methodological development, the application of different theories to the SLCA framework and case studies, professional studies, and also the development of a database for SLCA, the SHDB.

The UNEP Life Cycle Initiative board, after the publication of the SLCA Guidelines, offered support to the SLCA methodological sheets completion project but did not extend this support to convene groups around new developments in the field of SLCA. However, a publication on Life Cycle Sustainability Assessment was written and published under the umbrella of the Initiative in 2011. Reasons for not including SLCA project group(s) in the formal program of the Initiative in its Phase 3 have not formally been given; perhaps a lack of funding, a lack of support from the Society of Environmental Toxicology and Chemistry regarding development involving "soft science", and/or perhaps a choice in the establishment of strategic priorities by the board for the Initiative contributed to the non-renewal of the project group.

New Earth, a not-for-profit organization based in the U.S., developed the SHDB in 2009, and Wal-Mart Private Brands funded the initial development of the SHDB. The Sustainability Consortium and additional private companies subsequently funded the piloting of further developments and projects and applying the SHDB. New Earth launched an advisory board for the SHDB project in 2009 that was composed of distinguished individuals from the industry, government, NGOs and academia. In 2013 the SHDB became the first comprehensive social impact database to be made available in LCA software tools.

(Footnote 2 continued)
United Nations Environment Programme (UNEP), US International Bureau of Labor Affairs (ILAB), World Business Council for Sustainable Development (WBCSD).

2 Social Shaping and Institutionalization of LCA

An interest in the social construction of the LCA technique and its institutionalization process resulted in the publication of several papers beginning in the mid-1990s (e.g., Heiskanen 1997, 1999, 2002; Ehrenfeld 1997; Frankl 2001; Baumann et al. 2011).

Although it is undisputed that the LCA methodology was socially shaped in addition to being scientifically constructed, Heiskanen (1997) was the first to establish this point in the literature, making use of the Latour Actor-Network Theory. Heiskanen's findings (1997) depict the existing tensions between proving the scientific validity and internal coherence of the method on the one hand, and on the other making it relevant to a variety of stakeholders intending to apply it in different settings with different objectives in mind by studying the phenomenon of LCA as a scientific method and as a management tool. This categorization is useful in the context of this article and will be utilized to refer to ideas and theory from the literature.

2.1 LCA as a Scientific Method and a Management Tool

Common definitions of LCA emphasize its scientific aspect, and LCA is usually referred to as a scientific tool. However, the origin of LCA lies in chemical engineering and materials accounting. As a technique, LCA makes use of science without being a scientific domain in itself.

In the 1990s, mounting criticism towards the young and unstandardized LCA method motivated the SETAC to get involved and hold several workshops in order to resolve problems associated with the methodology (Heiskanen 1997; Guinée et al. 2011). SETAC, one of the organizations that later founded the Life Cycle Initiative, as we mentioned earlier, sought to bring more credibility to the method and to develop a systematic, transparent and reproducible methodology, mainly through the series of workshops that it organized. This laid the groundwork for stakeholder involvement in methodology development and created the first sparks leading to the creation of the Life Cycle Initiative.

Guinée et al. (2011) describes the historical process of LCA development at length, but without analyzing it with a specific framework. Heiskanen (1997) shows that there is an inherent "politics dimension" within LCA, that politics is embedded in the method itself (Heiskanen 1997). Although she argues that additional stakeholders should have been and should be part of method development, she does not analyze the process of development per se and provides a limited account of how and which stakeholders contributed to method development (Heiskanen 1997).

Heiskanen also notes that over time, LCA results are becoming increasingly complex, which explains the specialization and "scientification" of the method. She also stresses that scientifying LCA, while legitimizing its practice, does so by emptying the technique of local meaning and context, thus making it less useful for decision-making. She believes that local stakeholders have largely been ignored in

the development, one example being the creation and application of universal valuation methods.

Applying concepts from the perspective of the social studies of science and technology (SST), Heiskanen defines LCA as a "boundary object" (Heiskanen 1999); this is a concept referring to knowledge constructs that interface between scientific and other social worlds (Star and Griesemer 1989), and which provide these diverse worlds with a unifying concept while allowing the different constituencies to maintain their local interpretations.

She concludes that the ambiguity and the multidimensionality of LCA need not always be seen as a weakness of the method, but also sometimes as a strength. Beyond its ambiguities, which can accommodate a number of diverse interpretations, considering LCA as a "boundary object" sheds light on its ability to bring together the viewpoints of industry, authorities, scientists and environmentalists.

The conceptual application of LCA involves policy stakeholders at different stages of the knowledge creation and utilization process, thus possibly leading to converging problem definition. In Heiskanen's view—and those of other authors—this convergent problem definition is not a starting point of the LCA, but its end result.

Heiskanen also argues that the original problem for which LCA was developed, and eventually the scientific community involved, of finding robust and incontestable solutions to environmental problems, remains unsolved (1997). She gives several explanations for this, primarily related to the situation that constructs do not exist as such in the real world. Since LCA's models are *constructs,*[3] they can't serve to find incontestable solutions. Although the fact that LCAs are constructs is often referred to in the literature (including in the SLCA Guidelines), it largely remains a blind spot for LCA. Another explanation provided by Heiskanen concerns how we view and attribute responsibility for social problems. She links the issue of context, and conceptual conflict in LCA utilization, to the broader debate on science and environmental policy, using concepts developed by Latour (1987, 1988, 1993) and exploring the idea that science cannot solve environmental problems precisely because it is different from decision-makers everyday knowledge. As such, she is one early voice calling for more stakeholder involvement in LCAs. Hers is a voice still finding echoes 15 years later (Baumann et al. 2011; Macombe 2013).

According to Heiskanen (1997), standardization moved LCA out of the domain of scientific methods and into the world of sustainability management tools.

2.1.1 LCA as a Management Tool

LCA is a management tool because it aims to provide insights to decision-makers concerning the sustainability impacts of product life cycles. It is thus offered and often expected to be used by firms and governments in developing strategies and

[3] Constructs are ideas or theories containing various conceptual elements, typically ones considered to be subjective and not based on empirical evidence.

policies aiming at improving, over time, the environmental burden associated with the production of goods and services. LCA is considered by many to be a complementary and more comprehensive tool with respect to other environmental management systems (EMS) for supporting an effective integration of environmental (and now social) aspects in business and economy (Frankl 2001). LCA can be used in many different ways by companies: for internal purposes, such as hotspotting; comparing existing products with planned alternatives; research; design and development; long-term strategic decisions; and for external uses, such as in marketing claims, communicating LCA results to clients, suppliers, consumers and other stakeholders.

From all these possible applications, research shows that LCA is used more often as an educational exercise than for comparing products (Heiskanen 2001; Frankl 2001 and many others). LCA provides managers with a new perspective on their products. This tends to support Ehrenfeld's (1997) idea that LCA's value stems primarily from its worldview, despite all its attention to detail.

One of Heiskanen's main points (1997, 1999), alluded to in the previous section, is that LCA takes local information to produce global knowledge. She points out that this is a very relevant and useful exercise because in our global economy, responsibility for sustainability issues can be so diffused that environmental and social systems may be destroyed without anyone being responsible for it. Therefore, LCA can be seen as an antidote for this, showing the unintended consequences of actions taken by life cycle actors. However, as she puts it, "the translation back from the universal to the local is as large of a problem as the translation from the local to the universal" (1999), and that is a problem largely unaddressed in LCA as yet (Baumann et al. 2011).

Beginning in the 1990s, researchers have been calling for the incorporation of additional stakeholder perspectives in the development and roll-out of the technique (e.g., consumers and value chain actors) (Heiskanen 1997, 2001; Baumann 2004; Baumann et al. 2011).

It is well known that conducting an LCA may require the involvement of a large number of different constituencies. For instance, it may require the input of scientists from many fields (engineering, environmental chemistry, toxicology, biology, social sciences), and involvement of many business units (communications/marketing, sustainability, ethical compliance) and different kinds of policy stakeholders. It concerns myriad economic activities (from raw materials extraction to waste management) and it encroaches on a large number of different stakeholders and interests. Heiskanen stresses that in order to gain a solid foothold for the LCA conceptualization, this heterogeneous network of actors and activities must be held together. "It is not enough to create a research model spanning this extensive network of activities; the model must also be believed in and enacted by the actors that it concerns" (Latour 1988).

How concepts and ideas are becoming integrated into the ordinary lives of people and organizations is often approached in the literature through institutionalization theory. The institutionalization of LCA and the institutionalization process are topics studied in the literature. Institutionalization refers not only to formal

regulations and institutions, but also the establishment of ideas, in terms of what the world is like, and which behaviors appear appropriate for different actors in society (see Berger and Luckmann 1967; DiMaggio and Powell 1983; Scott 1995). Institutionalization also occurs through action patterns in which people reproduce the rules and routines that bring structure to everyday life (Scott 1995; Barley and Tolbert 1997).

The institutionalization of LCA occurs at the level of the company (Frankl 2000), but also at a more diffuse level—societal (Heiskanen 2001)—to a point where everyday social actors are aware of product supply chains and life cycles to some extent. One example of this is the book *Ecological Intelligence* (2009), written by Dan Goleman, a New York Times best-selling author, which presents and discusses LCA for the general public. LCA was also presented to the Dalai Lama himself in Dharamsala, India, in 2011, at a workshop organized for him by the Mind and Life Institute and broadcasted on the Web.[4]

We can safely argue that LCA has achieved a high level of global institutionalization. Most fortune 500 companies have implemented LCA in some form over the past 20 years, and companies in developing economies are following the trend (Finnish Environment Institute 2010). Governments have enacted laws or implemented strategies citing life cycle thinking. CSR multi-stakeholder initiatives have been using LCA as a core component of their program.

Frankl and Rubik (2000) have studied LCA institutionalization processes, which they divide into three steps: pre-institutionalization, semi-institutionalization, and full institutionalization in 20 European companies. These three steps describe how integrated LCA is in the activities and strategic planning of companies. It shows that there is a dynamic in the way that companies take ownership of the tool.

3 Organizing for Social LCA Development

Although the literature acknowledges the social shaping of LCA, it does not offer any insights on how stakeholders organize in order to develop a sustainability methodology and how this organization evolves over time.

From the LCA literature, we've learned that LCA is a method that uses a large variety of science findings and tools, and that it aims to provide information to policy makers as well as to everyday economic actors, primarily managers. We also know that LCA is highly institutionalized, that it engages many constituencies, and despite the existence of the Life Cycle Initiative, should involve more stakeholders in methodology development and when conducting studies. The complexity of LCA is also an aspect discussed in journal articles as well as the intrinsic internal policy of development.

[4] http://www.mindandlife.org/dialogues/past-conferences/ml23/.

According to Heiskanen (1997, 2001), ordinary market actors all along have been conceptually incorporating more qualitative factors in a Life Cycle Thinking framework, including worker's conditions, health and safety, or biodiversity.

As we have seen, SLCA is a technique closely related—but also distinct from LCA and its development—that occurred mostly in the past decade, and has a specific history. In the remainder of this chapter we will explore how the process of development of SLCA took place, as well as what the dynamic has been. In order to study this process, we need to discuss how groups may organize and how they are formed.

3.1 Who Has Been Involved in Social LCA Development?

One theory is clearly associated with CSR, and and that is the Stakeholder Theory (Freeman 1984; Freeman 2004). What this theory tells us is that stakeholders have legitimate interests in corporate, and more broadly, organization's activities. Stakeholder theory can be normative or descriptive. The former is usually considered to represent the core of stakeholder theory, and it can refer to the ideal social context, to social norms as they currently exist, or to what needs to be done to create a desirable society (Friedman and Miles 2006). It can go as far as stating that "a corporation ought to be managed for the benefit of its stakeholders: its customers, suppliers, owners, employees, and local communities, and to maintain the survival of the firm (Evan and Freeman 1988; Melé 2008)".

In our case, descriptive stakeholder theory offers the most relevant insights because we are interested in applying its analytical framework in order to identify and characterize the stakeholders involved in SLCA development.

In line with Donaldson and Preston (1995) and Cronin et al. (2011), categories of stakeholders include governments, international organizations, NGOs, business entities (competitors, investors, supply chain partners, and industry groups), consumers, and community representatives. In addition, knowledge institutions (such as universities, research centers and think tanks) are added as a stakeholder group, given their active roles in many multi-stakeholder initiatives (Dentoni and Peterson 2011). Consultants may also play a significant role and be quite active in CSR multi-stakeholder initiatives and are also added as a separate category.

While the six groups of stakeholders portrayed in Fig. 2 participated at some level in the Life Cycle Initiative SLCA project group within the seven main years of its existence (2004–2010), if we consider the affiliation of the authors of the SLCA guidelines, we find the vast majority of contributors to be in the "researchers" category, and the rest to be from the "consultants," "businesses", and "inter-governmental organizations" (IOG) representative categories. The reviewers and the organizations consulted regarding the Guidelines were covering the other groups, with NGOs and research organizations being the most represented.

The objectives of the Project Group were to contribute to scientific/methodology development as well as capacity building and dissemination via the development of

Fig. 2 Stakeholders involved in the LCI SLCA project group

a framework to include socioeconomic impact on LCA and the sharing of experiences. Hence, it is not surprising to have many researchers and research organizations involved.

In that regard, the SLCA project group resembles what has been identified in the literature as an epistemic community; these are collective groups of people that share expertise in a given domain and are concerned with the production and dissemination of knowledge, and the relation of these activities with policy (Meyer and Molyneux-Hodgson 2011). These communities are said to be a crucial force for the production, discussion and diffusion of scientific knowledge.

Emmanuel Adler and Peter Haas introduced the term "epistemic community" in the literature on policy and international relations (Adler 1992; Adler and Haas 1992; Haas 1989, 1992). Several of their articles that were published in *International Organization* are now considered founding texts in this field. Since then, and particularly since the end of the 1990s, the notion of epistemic community has been applied to numerous academic domains, including political science, international relations, economics, law, business studies, administration, sociology, etc.

According to Meyer and Molyneux-Hodgson, one of the useful characteristics of the notion of epistemic community is that it accentuates the collective nature of knowledge production. This notion is also useful to point out the positioning of these collectives in relation to policy making. According to Haas and Adler (1992), epistemic communities are as preoccupied with knowledge production as they are with influencing policy. Indeed, epistemic communities are born from a policy demand, and policy receptivity is crucial for these communities. The knowledge

that they produce is supposed to provide solutions to specific problems. They thus have to produce "applicable knowledge".

Epistemic communities are usually comprised of scientists or of people sharing a similar scientific background. The SLCA project group, as we have seen, is very much a multi-stakeholder environment. Sometimes the concept of trans-epistemic communities (Knorr-Cetina 1982) has been used in the literature to describe this situation, but for our discussion and in line with a more holistic understanding of the concept, we will consider epistemic communities as communities of experts without regard to the various affiliations of these experts (consulting, businesses or others).

Haas refers to John Ruggie's conceptualization regarding the power of broader visions of reality, or epistemes, that provide the assumptions from which policies follow and shape the pattern of politics (and policies, too) over the long run (Haas 1992). Haas argues that institutionalization involves not only the institutional grid of the state and the international political order, through which behavior is acted out, but also the epistemes through which political relationships are visualized.

The SLCA project group was launched with its Terms of Reference described above and included experts from around the world with an interest and growing experience in the matter of studying social impacts with a LCA perspective. It was mandated to develop consensually a "practical" framework, emerging from these experiences, for the incorporation of social impacts into LCA. This was needed in order to broaden the then environmentally-focused technique to other areas of sustainable development so that it could become a tool for sustainable development.

In epistemic communities, the knowledge creation mode is much like a form of externalization (conversion of tacit knowledge into explicit knowledge), in the sense of Nonaka and Takeuchi (1995). The first task of epistemic communities is thus to create a "codebook" so that the knowledge circulating within epistemic communities is made explicit.

By forming the SLCA project group, the Life Cycle Initiative planted the seed for the emergence of the new epistemic community that came to life with the writing of the Feasibility Study (2006), an internal codebook for the experts, and the development and publication of the SLCA Guidelines, which communicated this framework to the external world (2009).

In turn, the presence of this epistemic community, which created the SLCA guidelines and the methodological sheets and interacted with the Life Cycle Initiative board to achieve the acceptance of the framework and officially launch this new domain, has also bolstered the practice. The goal of epistemic communities is thus simultaneously outside and above the community's members. Figure 3 reveals the process of creation and expansion of the SLCA epistemic community.

Since the SLCA project group was more or less dismantled after the publication of the SLCA guidelines and the methodological sheets, the epistemic community became more diffuse, although we argue that this epistemic community is nevertheless growing and playing a strong role in laying the groundwork for a broader acceptance of SLCA and actively participating in the construction of the social reality, which includes SLCA (institutionalization).

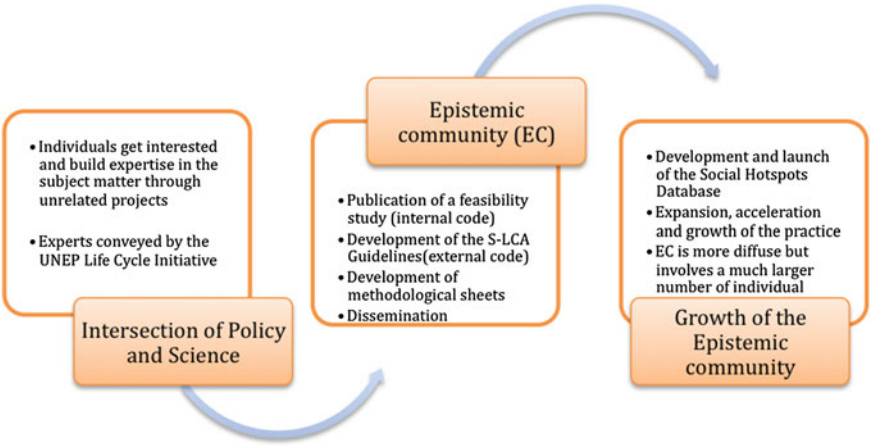

Fig. 3 The expansion of an epistemic community

3.2 Social LCA Project Group Organization

According to Ahrne and Brunsson (2011), it has been a mistake to analyze, almost solely through the lenses of institutionalization or networks, the activities that take place outside formal organizations (businesses), and they argue that organization theory can shed an informative light on how initiatives function. They define an organization as a decided order in which people use elements that are constitutive of formal organizations, which in turn open the door to studying how people organize outside of formal organizations (Ahrne and Brunsson 2011).

They present a set of criteria describing formal organizations and argue that informal organizations and initiatives can also be partially organized and studied as such through the use of one or more of these elements.

Membership, hierarchy, rules, monitoring and sanctions are all elements that are constitutive for the institution of organization as defined in laws or textbooks or otherwise widespread conceptions of formal organizations (Ahrne and Brunsson 2011). While all these elements are objects for decisions, the management of a formal organization cannot decide to abstain from an element altogether (Brunsson 2006).

However, these elements can also be used separately. As presented by Ahrne and Brunsson (2011), those who wish to organize do not always have the opportunity to or interest in building a complete, formal organization. Instead, they may use "merely one or a few of the organizational elements, thereby creating a partial organization among individuals or organizations. The organizers may be individuals or formal organizations, but they organize outside of any formal organization."

De Bakker et al. argue that the model of partial organizations presented by Ahrne and Brunsson (2011) reflects not only a desire to build more complete theories of organizations, but also a realization that the boundaries between different societal

domains and their corresponding organizational forms have become increasingly blurred (de Bakker et al. 2013).

In agreement with de Bakker, Rasche et al. (2013) argue that there is value in examining the organizational features of CSR developments more closely. After all, they say, "businesses address social and environmental issues through different types of organizing". As we have seen, one type of CSR organizing is multi-stakeholder partnerships such as the Life Cycle Initiative, whose SLCA project group has enacted some elements of formal organization. Each element will be discussed to highlight how they were managed during the active period of the project group.

Membership in the project group was open but the project group chair, upon reviewing interested candidate's qualifications, approved members. The project group also became closed to new members when the process of Guidelines development was reaching its end.

Although multi-stakeholder partnerships are usually considered to be nonhierarchical (van Huijstee et al. 2007), and the decisions made within the project group usually were made consensually, elements of hierarchy were present. Hierarchy implies "a right to oblige others to comply with central decisions" (Ahrne and Brunsson 2011). The group had a chair and two co-chairs who were initially the leaders and decision-makers for the group. As the work of the project group progressed, the decision-making process became increasingly open and leadership emerged from active group participants. While the hierarchy remained in place, in practice, additional individuals were granted leadership roles mainly based on their work contributions to the group.

There was no set of specific rules to follow, but the project group had terms of reference orienting their work. Although Rasche et al. (2013) find that rules are relevant in partnerships in several ways, such as internal rules, governing the partnership, and defining, for instance, membership, often there are also no clear guidelines available on how to operate within a partnership (Rasche et al. 2013).

Even if there is no formal monitoring process, they find that partners will often closely monitor the results of their fellow partners to see whether each participant is living up to the expectations. The Life Cycle Initiative Board was the organ responsible for monitoring the project group's advancements in regard to the set terms of reference, but there was no formal monitoring of individual's work. Rasche et al. (2013) highlight accountability when discussing monitoring, citing work from Bäckstrand (2006); they also list accountability, measurable targets, and timetables, reporting and monitoring mechanisms as important elements for successfully organizing partnerships. Even though the project group had no formal process for monitoring an individual's work, it was implementing all the above-mentioned mechanisms. In the project group, individuals were taking charge of tasks (accountability), and pledging to provide results by the agreed-upon deadline where they reported on progress.

Regarding the last element—sanctioning—there was no defined process in the Life Cycle Initiative SLCA project group. Rasche et al. (2013) also found that the "flexible character of monitoring complicates the final element of organization—sanctioning—as the outcomes of monitoring usually form the reason to sanction".

They add that, "the way partnerships are constructed often includes only limited sanctioning power for its participants". This was the case for the Life Cycle Initiative SLCA Project Group.

Of the five elements of organizing presented by Ahrne and Brunsson (2011), two were fully implemented by the SLCA Project Group (membership and hierarchy), two partially implemented (monitoring and rules) and one was not (sanctioning).

This shows how multi-stakeholder initiatives might implement elements of organizing while remaining flexible. It also can shed light on what could have been done differently to obtain desirable results within such an initiative or project group. Should the monitoring be more defined? The hierarchy strengthened or loosened? Should rules be drafted and a process of sanctioning be explicit, or did the Life Cycle Initiative Project Group reach its optimal equilibrium with the way things were organized?

Finally, we can also see that without a form of *organizing* that is supported institutional, it is much more difficult for stakeholders to act jointly. The Life Cycle Initiative Project Group provided that supportive space leading to tangible results that still have ripple effects. However, without continuous organizational support (e.g., by the Life Cycle Initiative or some new source), how can the SLCA epistemic community continue to flourish and expand? What additional or alternative means could nurture the epistemic community?

4 Epistemic Communities as Interactive Processes

Ahrne and Brunsson (2011), followed by Rasche et al. (2013), provided useful insights on organizing. However, they did not look at how organizing can evolve over time. Glasbergen (2011) made a very relevant contribution in the form of an analytical tool that he called the "Ladder of Partnership" activity.

Indeed, partnerships are not frozen in time. They evolve as a result of their work plan, people in place, events, and the work of other initiatives. The Ladder developed by Glasbergen (2011) is based on the assumption that partnering is "a process in which actors restructure and build up new social relationships to create a new management practice". Partnering is thus considered to be an interactive process.

The model developed by Glasbergen was intended to study intersectoral partnerships that have a different focus compared to the Life Cycle Initiative—for example, commodities fair trade certifications. Science-based methodology development and dissemination are at the heart of the Life Cycle Initiative SLCA project group's raison d'être. We have already seen that by creating the project group, the Life Cycle Initiative provided an impulse to the development of an epistemic community that has become a community of practice. We have adapted the ladder

of partnership activities to reflect the reality of the Life Cycle Initiative SLCA Project Group.

Figure 4 presents an adaptation of The Ladder created by Glasbergen (2011) and consisting of five core levels in a partnering process, set in a time frame. Each step is represented by a core activity. The first level involves the building of trust and the exploration of collaborative advantage (we merged these two dimensions, which are separate in the Glasbergen model). In order to partner effectively, actors need to trust each other and also to perceive that the partnering will result in shared benefits.

The second level, constituting a rule system, looks at the interim effects in terms of outputs. In Fig. 3, we considered these activities as indicators that there was an epistemic community. It involves the creation of an internal code and the creation and communication of a code to the external world.

The third level refers to the implementation of the rule system. Gaining legitimacy in the relevant area(s) of the partnership is the main mechanism. This includes a search for the processes and partnerships that would help achieve a higher degree of dissemination and promote effectively increased organizational adoption of SLCA.

The fourth level regards the growth of the practice. If there is business uptake, students and practitioners will search for opportunities to build their capacities and, reversely, interns will bring new understanding would be a better word to businesses that may increase the rate of adoption and thus expand the practice. The dissemination and capacity building effect of the epistemic community reinforce the interactive processes at play.

The last activity, changing the political order, may be a deliberate outcome, but also the unintended societal consequence of the partnering process according to Glasbergen (2011). For example, it could refer to requirements set by investors regarding the social impacts of supply chains or change in trade policies.

Glasbergen has envisioned the Ladder to be further encapsulated in three dimensions. About the first, he writes that "in the course of the partnering process a gradual shift will take place from a focus on interactions among the partners themselves to interactions of the partnership with its relevant external environment" (2011). These are indicated as internal and external interactions.

The second dimension, of changing methodology, according to Glasbergen, refers to the core methods applied to bring the partnership forward over time. "The dimension of actor versus structure indicates the objects that are influenced: from the intentions of actors in a process, and their collaborations, to the more permanent impacts in the issue area in which the partnership is active and on the characteristics of the governance system" (2011).

In the third and final dimension, the Ladder of Partnership Activity (Fig. 4) represents an idealized form of the full partnering process. In reality, partnering is a continuous process with many feedback loops—for example, induced by evolving experiences of the partners, changes in their definitions of problems, their roles in the process, and changing circumstances (Collins and Ison 2009).

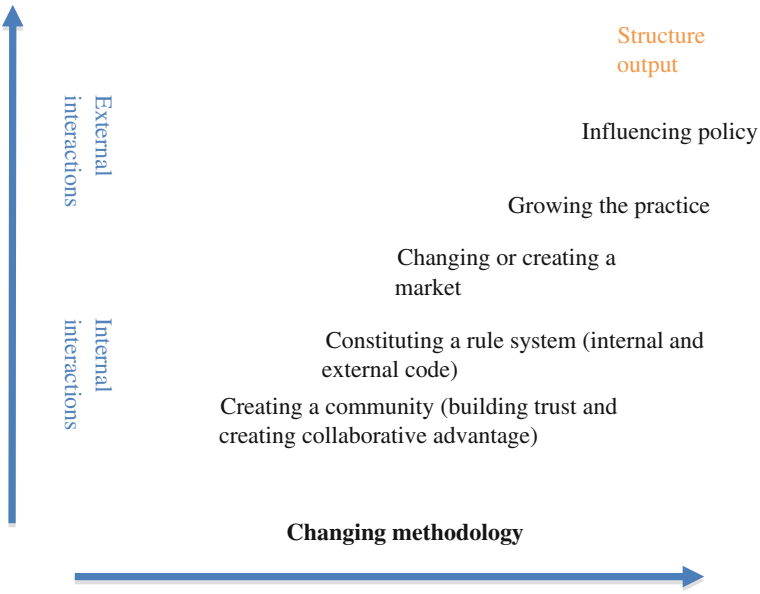

Fig. 4 Evolution of multi-stakeholder initiatives

However, the Ladder helps us better understand the heuristics of the partnering development processes in terms of the critical issues. It can also help us reflect on which types of organizational elements are most useful at which moment in the life of a multi-stakeholder initiative.

5 The Growth of the Epistemic Community, the Development of the SHDB

The publication of the SLCA guidelines and the complementary methodological sheets (UNEP-SETAC 2013) sparked interest in the technique and breathed life into a new domain of inquiry. The number of published articles has risen each year since the publication of the Guidelines, and the gray literature accounts for an increasing number of case studies (Jorgensen 2013).

In order to go beyond being a niche market curiosity, and to foster a greater uptake, SLCA practitioners needed supporting data and software, as was the case with Environmental LCA (ECLA). It has been remarked many times in the SLCA literature (e.g., UNEP-SETAC 2009; Dreyer 2010) that it is not possible to collect site-specific data for all processes in product supply chains. Therefore, these processes need to be prioritized. The SLCA guidelines proposed using the variables of labor intensity and risk level to prioritize production activities to be researched in

more detail. This can be done by making available what LCA practitioners call the "background data" that is used to conduct "scoping or hotspot assessment" (Curran 2012).

It was with the goal of making comprehensive and detailed information on supply chain human rights and working conditions available to everyone that the Social Hotspot Database (SHDB) project was launched in 2009. The SHDB is a project centered at New Earth, a not-for-profit organization focused on information systems for sustainability. A key aspect of the project has been to ensure that users have full, transparent access to information about working conditions and impacts in global supply chains, and also about the hundreds of sources drawn upon as well as the methods used to characterize risks within the SHDB. It can be considered a follow-up initiative to the development of the SLCA Guidelines.

Technically, the SHDB is an input/output life cycle inventory (LCI) database providing a solution to enable (1) the modelling of product systems, and (2) the initial assessment of potential social impacts. It is based on life cycle attribute assessment (LCAA), a methodology developed by Norris (2006). Each unit process has a number of different attributes, or characteristics, relative to a large set of social issues. The activity variable used in the SHDB is worker-hours; thus, the SHDB can be used to determine how many worker-hours are involved for each unit process in the supply chain, for a given final demand (final product or service output from the system). The sociosphere flows are expressed as worker-hours at a specified level of risk on a given risk indicator, per U.S. dollar of process output.

The SHDB system (Benoît Norris et al. 2013) is based on the Global Trade Analysis Project (GTAP) Version 7, a global economic equilibrium model (GTAP 2008). The total database contains data for 57 different sectors, in each of 113 different regions; most of these regions correspond to individual countries, while others are regions containing many countries. Thus, there are 6,441 unit processes in the database.

The labor intensity data were developed by converting GTAP data on wage payments into estimates of worker hours, skilled and unskilled, for each sector in each GTAP country/region. This was made possible by compiling and using wage rate data, for skilled and unskilled labor, by sector and region. These labor hour intensity factors are used, together with the social risk level characterizations, in order to express social risks and opportunities in terms of work hours, by sector and country, and at a given level of risk relative to each of over 22 social impact subcategories and nearly 150 different indicators. The risk data addresses five main impact categories: labor rights and decent work; human rights; health and safety; governance; and community.

The SHDB project draws upon hundreds of data sources from the International Labor Organization, the World Health Organization, the U.S. Department of Labor and State, the World Bank, and others. Quantitative statistics and qualitative information by country and sector are used to develop characterization models. These models assign a risk (or opportunity) level to the data so that users can identify target areas in their supply chains to verify or improve social conditions.

Although it is a project from a formal organization, the SHDB development process also has a lot in common with the ladder of activities specific to multi-stakeholder initiatives. As de Bakker et al. pointed out, the boundaries between different societal domains and their corresponding organizational forms have become increasingly blurred (de Bakker et al. 2013), and the SHDB is a good example of this situation. Even though it has been developed by a formal organization, in order to be relevant it needs to be supported by stakeholders and hence needs to rely on organizational flexibility and responsiveness to stakeholders' needs. One way to achieve this is to engage stakeholders in advisory boards; another way is to consult with stakeholders periodically. Hence, the SHDB has an advisory board composed of distinguished individuals from academia, businesses, governments, consultants, IGOs, and NGOs.

From creating a community (the advisory board), to constituting a rule system (the database), developing a market (making the database available and marketing it), and serving the SLCA wider epistemic community and user base (the main customers), the SHDB project follows the ladder of partnership activities model.

As this description implies, there is no doubt about the SHDB being socially shaped. It stems from the SLCA guidelines processes and is a hybrid tool that merges data, modelling, social sciences, CSR, and software. It is a tool at the intersection of a technique, social interests and business ethics—a tool created by researchers/consultants to serve the needs of businesses, governments, NGOs, consultants, and academics, and a tool constantly needing to be updated and improved to meet "customers" demands.

One critical point raised by Heiskanen regarding the uptake and institutionalization of ELCA was about the inclusion of ordinary market actors—namely, business managers, in the development, roll-out and application of the technique. Since business managers are the ones that will ultimately make use of the technique or its results, the tool needs to bring answers to problems that they face, be user-friendly, and be adaptable to different contexts.

Heiskanen also highlighted the discrepancy between global and local. She agreed that there is a necessity to transform local information to globally relevant data; however, she also argued that transforming this global information back to information relevant to the local context was a great challenge.

Perhaps this is also a challenge for SLCA in general, and the SHDB in particular. Although the science basis of the technique and tool is appreciated, are the tools grounded enough in the business and local context to achieve the primary goal sought: to bring enlightened understanding of the social impacts of supply chains?

6 Discussion and Conclusions

One of the main values of LCA discussed earlier, is that it can bring together the perspective of stakeholders at different stages of knowledge creation and utilization process, thus possibly leading to converging problem definition. However, how

possible is it to bring together people from the entire supply chain? Which stakeholders are most important to bring together? These are questions still largely unanswered. Perhaps the literature on value chain governance (for example, Gerrefi et al. 2005) can provide some useful perspective.

LCA and SLCA, with the SHDB, succeed in taking local information to produce global knowledge. They offer insights about the potential environmental and social impacts, but what else is needed to make this information meaningful to local actors and recipients of SLCA studies? Even if some businesses took part in the Life Cycle Initiative Project Group, or are members of the SHDB advisory board, or are member companies of CIRAIG International Life Cycle Chair or of the Sustainability Consortium, it is legitimate to ask whether the framework and tools available completely meet the needs. The epistemic community is spreading in the private sector, with many of the interns and managers being tasked with adapting the methodology and assessing the usability of various tools such as the SHDB. The existence and persistence of groups such as the Social Pioneer Roundtable, launched by a Pré consultant and comprising over a dozen participating companies, testify to the need that businesses have to boil down the research and the science-based tools to something very practical for their context.

We have seen that there seems to be a strong voice calling for increased stakeholder participation, both in LCA and SLCA development, but also regarding the involvement of stakeholders in studies. How can we make this practical? Based on this paper's findings, can we think of improved ways to organize multi-stakeholder methodology development activities that would encourage increased participation?

From our perspective, the SLCA Guidelines and the SHDB offer a broadening vision of reality in the sense intended by Ruggie (Haas 1992). We are right at the point where we might see the emergence of policies being shaped by its epistemes (for instance, EU 2013), but it remains critical to continue reflecting on how best to organize to create a more powerful and useful wave—which could foster more responsible and positive supply chains.

In conclusion, this article has refined our understanding of the social shaping of the SLCA technique and its institutionalization process. It has also demonstrated how multi-stakeholder partnerships organize to generate outputs, augmenting and validating the partial organization theory. We have also applied a modified version of the Ladder of Partnership that helped convey the dynamics of such initiatives. The efforts engaged in SLCA and SHDB development have succeeded in creating an episteme and expanded the practice significantly. In this paper, we have highlighted some avenues that could support a greater uptake of the method and intensify its institutionalization. Mindful care in the choice and design of organizational elements and attention to the flow of interactive processes could support initiatives reaching their objectives, and help make developments, such as the SLCA framework, even more effective in the future.

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Social Life Cycle Assessment in a Managerial Perspective: An Integrative Approach for Business Strategy

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Abstract The attention regarding social, economic and environmental impacts and the increase in the attention on sustainability by the customers and the other general stakeholders has led businesses to adopt several tools for sustainable development patterns and, in particular, for social development patterns. The development of social impacts' evaluation is one of the cornerstones of products and services sustainability. Concerning that, Social Life Cycle Assessment (SLCA hereafter) focuses on studying the social impacts of life cycles, but as this is a relatively new analytical approach, no globally shared application tools have yet been developed. The purpose of this study is to analyze the tools of stakeholder management and Corporate Social Responsibility (CSR) to create a pathway of integration between the tools of social responsibility, SLCA and Stakeholder Management Approach. The research has characterized two main phases; the first is devoted to the critical analysis of the literature on the subject, and specifically on SLCA methodology. The objectives to be achieved are to carry out a comprehensive review of the existing literature on the subject for developing a conceptual model for the interpretation of the behaviour observed. In conclusion, we can say that the innovative model is properly inherent in the various interpretations of the stakeholders and the assessment of social impacts of product or services.

Keywords Social life cycle assessment · Corporate social responsibility · Stakeholder's management · Social evaluation tools

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1 Introduction

Corporations have become indispensable members of our society who need to be "incorporated" socially as well as legally. Recent institutional changes have made social and environmental sustainability an important source of the institutional legitimacy of corporations (Lee 2008).

The 10 key steps that led to the current concept of sustainability should be noted. The table below lists the authors' strategic characterization of the evolution of the concept of sustainability to the concept of corporate social responsibility (Table 1).

In the Life Cycle Management concept (LCM), the integration of different sustainability aspects shows a priority in the development of a better link between the analytical tools and the procedural approaches and strategies.

There is a significant problem regarding the communication of results, such as the different types of labels, to develop communication and stakeholders' participation at the dates of the life cycles of products. In the development of a better link between the analysis tools and the procedural approaches, and strategies between business and government communications tools, such as the different types of labels, to develop communication and stakeholder participation reported in life cycle of the product through the LCM practices and application in business strategy (Arcese 2013).

The LCM is not intended to replace the existing concepts, programs and tools, but rather to offer a new synthetic approach to improve the application of these concepts, several programs, and tools in the life cycle perspective (Fig. 1).

In recent years, the attention paid by scientists to business studies regarding governance has increased and the "corporate governance" definition has broadened considerably and started to cover some aspects traditionally seen as being part of corporate social responsibility (CSR). This is based on the assumption that such standards increase legitimacy among stakeholders (Freeman 1984).

The SA8000 (SAI 2013) was the first auditable social standard and is based on the international workplace norms of the International Labor Organization (ILO) as well as the Universal Declaration of Human Rights of the United Nations in order to improve the working conditions in everyday life.

The CSR and the Social Accountability and its standards, such as SA8000 (SAI 2013), have been theorized and standardized to support the social ethical engagement of companies, which seek to find a consensus. Economic reasons also fostered the development of this standard (Benoît et al. 2010).

Social impacts' evaluation is one of the cornerstones of product sustainability. Models of indicators designed to assess social sustainability are many and varied in nature and composition, although some studies show that these are still incomplete and most of them are not objective.

Social life cycle assessment (SLCA) is a method that be used to assess the social and sociological aspects of products, their actual and potential positive as well as negative impacts along the life cycle. It looks at the extraction and processing of

Table 1 Social sustainability concept evolution in literature (our elaboration?)

Authors	Concepts of sustainability
Freeman (1984)	Starting from his studies, the "stakeholder theory" related to the activity of the company has developed and evolved through the creation of what is called" stakeholder management"
	Sustainability is often meant to refer to equity within and between generations
Guatri (1991)	This approach draws on the extensive research field of Corporate Social Responsibility but also the method of preparation of sustainability reporting, analytical tools such as the balanced scorecard and embedded systems performance evaluation and, more generally, corporate governance instruments
Donaldson and Preston (1995), Hinna (2005), Sacconi (2005), Schwartz (2006a, b);	The classification of stakeholders is still controversial and not universally harmonized in the various analysis models. There are common point balance categories: customers, staff, suppliers. And the local community
	Clarification of the concept in the triple bottom line is often used to illustrate the need to investigate the social, environmental, and economic decisions
Hinna (2005)	The creation of a new vision of the company passes to a logical view of stakeholders in which we highlight the different stakeholders from legitimate expresses precisely the need of management to meet their needs
	How do you manage your responsible business? CSR tools
UNEP and SETAC (2009)	The Guidelines for the SLCA presents an operational framework in order to adopt the model in the evaluation of social impacts, defining the impact categories and each of their subcategories
Benoît et al. (2010)	The SLCA methodology can be described as a tool that shows a strategic and management vision of the social product sustainability. It takes the form of an analysis that lets the company observe the social impact of the product through its sustainability evaluation throughout its life cycle
Arcese and Martucci (2010)	Models of assessment of social impacts based on Life cycle thinking, and especially through the application of the methodology of (SLCA) suitably integrated with the models until now no in the literature

raw materials, manufacturing, distribution, use, reuse, maintenance, recycling and final disposal. SLCA makes use of generic and site-specific data, can be quantitative, semi-quantitative or qualitative, and complements the environmental life cycle assessment (ELCA) and Life Cycle Costing (LCC).

Discussions on how to handle social and socioeconomic criteria of products throughout a product's life cycle began in the 1980s (UNEP 2009). At that time, in Germany, a specific Group on Ecological Economics project was started within the

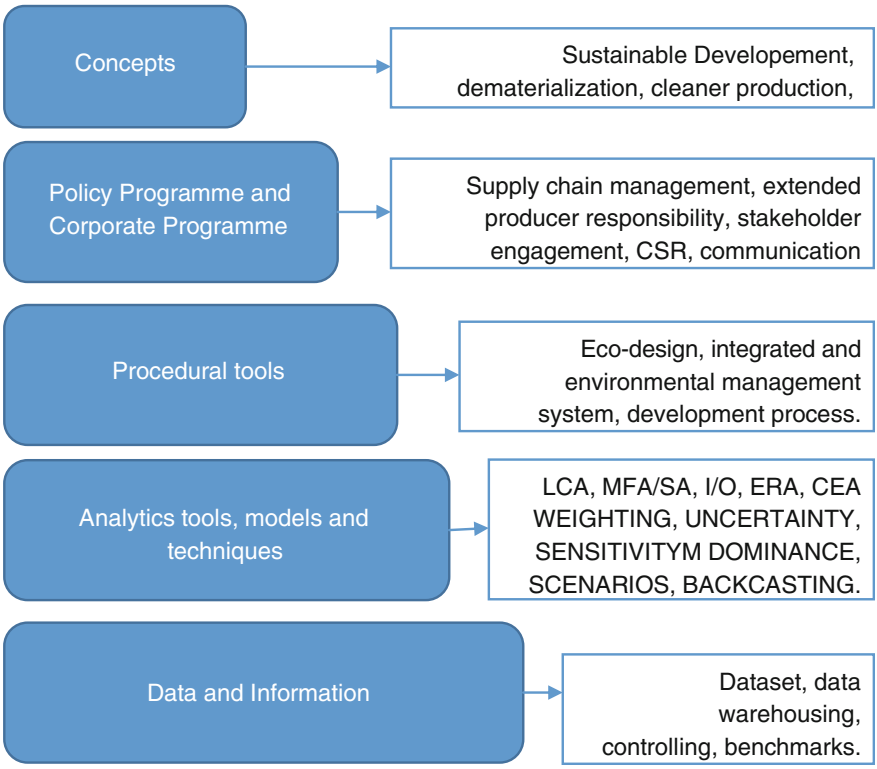

Fig. 1 Life cycle management framework. UNEP/SETAC, life cycle approaches. The road from analysis to practice, 2005

ÖkoInstitut, and the Society of Environmental Toxicology and Chemistry (SETAC) Workshop, reported on a conceptual framework for the impact classifications that already included social aspects for holistic assessment (Fava and Hall 2004).

With this awareness, SLCA focuses on studying the social impacts of life cycles, but as this is a relatively new analytical approach, no globally shared application tools have yet been developed.

SLCA can be described as a tool that allows a strategic vision and management of the social sustainability of a product and takes the form of an analysis that allows the company to examine the social impact of the product through its sustainability evaluation, throughout the life cycle (Russo and Perrini 2010).

The classification of stakeholders is still controversial and is not universally harmonized in the various analysis models, are; however, a common point balance categories:some common categories include customers, staff, suppliers and the local community (Hinna 2005; Schwartz 2006a, b; Sacconi 2005; Donaldson and Preston 1995).

Finally, SLCA can be a methodology that complements existing CSR tools and the assessment of social sustainability because it is comprehensive and evaluates the entire life cycle of a product or service (Arcese et al. 2013).

In the literature there is still evidence of a few SLCA analyses conducted on products or services, and the ones that have never used the results as a tool for CSR or business strategy. There are also publications that compare the various tools and methodologies, highlighting the commonalities and where they overlap or complement each other.

In this chapter, after analyzing SLCA, we will analyze corporate social responsibility, stakeholder engagement and the stakeholder analysis, highlighting how the new document GRI, social variables vested with a key role in sustainability assessments. Finally, we will give an overview of the risk assessment vested with a key role in sustainability assessments. Finally, we will give an overview of the risk assessment tools and the danger of greenwashing.

The discussion and conclusions section will highlight similarities and differences in the belief that they are integrated

2 Materials and Methods

In this study, we have used national and international publications, online material, and material distributed at various conferences on social issues.

The same objectives are at the bases of these different instruments, but their application and implementation is, in many cases, very different. The aim of this study is to highlight the similarities and key differences to ensure that the application of all instruments is done jointly.

The study presents a review of the literature on three critical concepts related to social sustainability:

- Social Life Cycle Assessment framework, methodology and tools (Sect. 3);
- CSR tools for social business evaluation (Sect. 4); and
- Stakeholder management theories and practices (Sect. 5).

The ultimate objective for conducting an SLCA is to promote the improvement of social conditions and of the overall socioeconomic performance of a product throughout its life cycle on behalf of the stakeholders, for the promotion of an integrative approach (Arcese 2013).

The models and tools have been analyzed through a comprehensive review of the existing literature on the subject, based on two steps for the contextualization model analysis for assessing the possibility of tool integration:

1. Develop and evaluate the results of empirical research: whether there are, and if so, what are the most common practices?
2. Develop a conceptual model relevant for the interpretation of the observed behavior.

3 Social Life Cycle Assessment Framework, Methodology and Tools

The SLCA is a methodology of the assessment of social impacts—actual or potential—on a product at various stages of its life cycle.

The phases, the analysis, and the framework of the model were established through the drafting of the guidelines of the UNEP-SETAC in 2009, and the implementation of the analysis procedure. It may reflect the same phases of a product LCA.

One can then identify the four main phases related with the requirements of ISO 14044:

- Definition of the objectives and goals;
- Drawing up an inventory of data;,
- Analysis of the impacts; and
- Interpretation of results.

Different environmental life cycle assessment, play a central role throughout the analysis the stakeholders, which are already considered from the analysis of impacts. Stakeholders can be divided into five major groups, which are:

- Workers
- The local community
- Society
- Consumers, and
- All the other actors in the life cycle of the product.

For each category of stakeholders there is an association with its objectives and impacts that go to identify, model and modify the boundaries of the system, contributing to the definition thereof (as defined in the LCA with slight differences, as it is also the functional unit). In the second step of the preparation, the inventory of data is considered to be the most appropriate indicators (Jørgensen et al. 2008; Dreyer et al. 2006; Ehrenfeld 1997)(Fig. 2).

The international scientific community has defined this differently, with the aim of reaching a comprehensive set able to respond to all the needs of the analysis—in particular, Jørgensen et al. (2008), which represents a matrix structure indicators for the various impact categories and is broken down into subcategories as established by international guidelines (UNEP 2009).

The main subcategories of indicators relating to workers was expressed by indicators relating to collective bargaining and freedom of association, child labor, data on salaries and remuneration, working hours, gender discrimination, health-related indicators, and social security benefits. The values of the set of indicators should be both qualitative and quantitative in relation to the impact associated with it. It is important in this scenario to understand the characterization in terms of

Stakeholder categories	*Subcategories*
Employees	1. Freedom of association and collective bargaining 2. Child Labor 3. Working hours 4. Forced labor 5. Equal opportunities / Discrimination 6. Health and Safety 7. Fair salary 8. Social Benefit/ Social security
Local community	1. Access to material resources 2. Access to immaterial resources 3. Delocalization and Migration 4. Cultural Heritage 5. Safe and Healthy living Conditions 6. Respect of Indigenous rights 7. Communities engagement 8. Local Employment 9. Secure Living Conditions
Society	1. Public commitments to sustainability issues 2. Contribution to economic developmen 3. Prevention & mitigation of amend conflict 4. Technology development 5. Corruption
Consumer	1. Health and Safety 2. Feedback mechanism 3. Consumer privacy 4. Transparency 5. End of life responsibility
Value chain actors not including consumers	1.Fair competition 2. Promoting social responsibility 3. Supplier relationships 4. Respect of intellectual property rights

Fig. 2 Stakeholders classification for SLCA. *Source* GuideLine UNEP-SETAC 2009

geographic presence and intensity of the impact of a single factor on the territory, a feature that is different from the LCA, to account for the influence of the local scenery on social realities.

Analysis techniques and specific impact assessment were studied in the early stages, and other applications were already present on the international scene. The first is the methodology of Weidema, where the impacts are quantified in terms of years of life lost and in relation to life expectancy average. The data source usually derived from direct interviews (Weidema 2006).

What is very important at this stage is the comparability of the results for each indicator and performance at various stages of the life cycle of the product. The most popular tools in the literature that perform this function are, in particular, the Life Cycle Sustainability Dashboard (Traverso and Finkbeiner 2009), and tools for the analysis of SLCA designed by the Natural Step (Arcese and Martucci 2010).

The former (the most complete) combines quantitative elements by assigning a score to each performance on a qualitative color scale (Traverso and Finkbeiner 2009). The tool is used for assessing sustainability of a product according to the SLCA model.

In many examples and case studies analyzed, this tool translates into numbers and color groups the value of sustainability variables in a matrix structure. The sustainability assessments traditionally carried out often begin with the recognition of a criticality. This tool uses an alternative approach that defines the boundaries of the system in relation to the goal of sustainability and pre-set allows us to consider not only the most visible and best-known factors, but the less visible impact factors as well (Arcese and Martucci 2010).

The purpose of the tool is to enable designers and managers to focus on sustainable development by seeking to exclude all aspects of product potential unsustainability during the course of the life cycle, by determining how the products can be developed to meet human needs in a sustainable society, and by reducing the risk of violation of the principles of sustainability in the macro lens of the instrument.

The SLCA analysis begins with an overview of the whole system, considering all aspects of the life cycle that are in conflict with the basic principles of sustainability. It takes into account four parameters that begin with the assumption that nature is not subject to systematic increases and they correspond to concentrations of substances extracted from the earth's crust, concentrations of substances produced by society, degradation by physical means, and the lack of conditioning people in meeting their needs. Typically, data are collected through interviews and questionnaires.

The results are displayed in a matrix of five dials and four colors that were assigned, based on the responses. The colors provide a visual clue that highlights the critical points that occur in the early stages of the life cycle (the "hotspots").

4 CSR Tools for Social Business Evaluation

During the last thirty years, the diffusion of standards of corporate social responsibility has had grown rapidly, with more than 300 different standards produced, all in order to encourage the dissemination of quality practices on the entrepreneurial management of social sustainability.

The Social Report is the first reporting tool to allow social effective efforts to communicate made by an organization in the field of sustainability (Massa et al. 2014).

The Social Report also enables the ability to import in a controlled manner the information on the social and environmental performances related to the activities carried out (Contrafatto 2009).

Due to its ability to meet the demands of dialogue and exchange between the company and its stakeholders, the BS is widespread, particularly among large organizations that operate in the areas recognized by the public as particularly impacting on the environment and society.

In many cases, the social report coincides with the sustainability report, and this is subjected to much criticism for the resources that companies use for its preparation by both the public reporting that considers only a mere means of communication (Massa et al. 2014).

However, the need for legitimacy in the category classifications and the necessity of stakeholders' dialogue demand verification on the principle of transparency. This is the aim of standardization, and it has led to the creation of a large number of standards in order to ensure the information credibility through the control exercised by an independent and external organization (Marimon et al. 2012; Asif et al. 2013).

With the sustainability reports, as they can handle a large amount of information (Mahoney et al. 2013; Roca and Searcy 2012; Ramachandran 2000), and the business strategy more specifically adopted by large organizations, about 71 % of the 100 largest companies have drawn up a sustainable in 2013 (Massa et al. 2014).

The spread of the sustainability report is derived from an increase in the external pressure exerted by the companies' stakeholders.

The major points of discussion are the relationship between business and the environment; the welfare of workers; the procedures for managing relationships with suppliers; and relationships with consumers and communities located approximately production sites.

In particular, the institutional stakeholders, through their legally recognized authority, exert coercive pressure on regulatory organizations to change their acts (Delmas and Toffel 2004). Stakeholders, however, urge organizations to put in place the measures best suited to their respective needs.

In this category fall the citizens, consumers and competitors (Delmas and Toffel 2004).

The commitment of companies—in fact, in the preparation of sustainability reports—have led to the development of a strategic tool able to demonstrate to its stakeholders for the adoption of a proactive stance to limit and prevent adverse environmental and social impacts (Geibler et al. 2010).

The changed approach lies in the awareness by companies that these issues are closely related to the economic sustainability of the enterprise itself (Wilson 2013). In fact, companies that enjoy a good reputation have access to a number of advantages that are not equally reserved for those companies whose act was perceived as not in line with the values considered socially important. The "ethically responsible" companies have more funding opportunities (Orlitzky et al. 2011), are better able to attract and retain skilled workers (Greening and Turban 2000) and are also favored by consumers (Marin et al. 2009).

For the sustainability report preparation, companies have several standards, but at the time of this writing the most widely used is that of the Global Reporting Initiative (GRI), an international, not-for-profit organization with a network-based structure. To enable all companies and organizations to report their economic, environmental, social and governance performances, GRI produces free sustainability reporting guidelines, which are currently in their fourth generation ("G4").

The GRI Sustainability Reporting Guidelines (the Guidelines) offer reporting principles, standard disclosures and an implementation manual for the preparation of sustainability reports by organizations, regardless of size, sector or location. The Guidelines also offer an international reference for all those interested in the disclosure of governance approach and of the environmental, social and economic performance and impacts of organizations.

The GRI has developed a system of voluntary standards for the preparation of reports on sustainability that uses methods of measurement and control systems to classify the BS based on the quality of the information provided by businesses, separating them into three bands (A, B, and C) and indicating with "+" reports that have been audited by external auditors (Prado-Lorenzo et al. 2009; Brown et al. 2009).

The GRI guidelines, now in their fourth year, are the result of cooperation between the worlds of research and enterprise, and processing the output result of consultations with the multi-stakeholder approach (Massa et al. 2014); it should be noted that the multi-stakeholder approach is often used in analyses of SLCA (Arcese et al. 2013).

The GRI encourages the use of stakeholder involvement; in fact, by analyzing complaints, it can provide important insights for improving the company's relationships with stakeholders as well as enhance the image of the company (Burritt et al. 2002).

The GRI Reporting Guidelines include economic, environmental and social indicators. Regarding the social indicators, it is useful to consider that they coincide only in part with the classification of categories and subcategories of stakeholders in the SLCA analysis (Fig. 3).

Category	**Social**			
Sub-Categories	Labor Practies and Decent Work	Human Rights	Society	Product Responsibility
Aspects	Employment Labor-management relations Occupational Health and Safety Training and Education Diversity and Equal Opportunity Equal Remuneration for Woman and Men Supplier assessmentfor labor practices Labor practices Greivance Mechanisms	Investiment Non-discrimantion Freedom of Association and collective bargaining Child Labor Forces or compulsory Labor Securety Practices Indigenous Rights Assessment Supplier Human Rights Assessment	Local Comminities Anti-corruption Public policy Anti-competitive Behavior Compliance Supplier Assessement for Impacts on Society Grievance Mechanisms for impacts on Society	Customer Healt and Safety Product and Service Labeling Marketing Communications Customer Privacy Compliance

Fig. 3 Stakeholders classification for SLCA. *Source* GRI social indicator categories

5 Stakeholder Management Tools: The Stakeholder Engagement and the Stakeholder Analysis

The stakeholder's choice question in the SLCA approach, despite the UNEP-SETAC Guidelines of 2009, remains much debated (Mathe 2014).

The international literature often presents new contributions that challenge or complement the categories of stakeholders to be taken into account in the analysis of social sustainability.

There is not yet a common regulatory approach to the involvement of stakeholders in the development of LCA. Some advances have been made through the streets of integration of various tools, but these additions have often not been generalized. However, they strongly emphasize the interrelationship between research on the increasing integration of stakeholders and the selection of stakeholders. According to the criteria of stakeholder theory for the identification of stakeholders, it should be implemented with a participatory approach (Mathe 2014; Freeman 1984; Mitchell et al. 1997; Geibler et al. 2006).

After the recent publication of the exposure, a draft of the standard AA1000 Stakeholder Engagement is one of the results of these efforts; the UNEP, along with the Accountability and Stakeholder Research Associates, has published two volumes of interest that give an overview of the involvement of various stakeholders (companies, industrial associations, unions and NGOs).

This publication is intended to provide guidance on how to raise awareness, knowledge, capacity and legitimacy of the companies when undertaking stakeholder engagement. The purpose of the proposed model of stakeholder engagement is to help identify the synergy space between these two advantages by aligning the strategy at the corporate level with sustainable development.

In order to understand the strategies better, involved stakeholders are classified into three generations:

1. Involvement solicited from external influences to reduce the problems with targeted benefits.
2. Involvement aimed at systematic risk management and the understanding of the key stakeholders of the organizations. and
3. Involvement of integrated policy for sustainable competitiveness.

This third generation of stakeholders, the most advanced and complete, implies that the more advanced strategies consider the involvement of a variety of individuals and entities on social, environmental and economic issues as an important aspect in the management of their activities. This generation represents a shift from the need to involve external stakeholders in order to eliminate conflicts of interest, in proactive and constant dialogue, until the management and prevention of the risk of conflict are reached. Up to the integration strategies development contribute to learning and innovation of company and improve the sustainability of strategic decisions both within and outside the enterprise.

The step towards the concept of social performance is short!

These stakeholder engagement processes, involving a variety of resources (e.g., knowledge, finance, and human and operational resources), can help all the parties involved to understand, solve problems and achieve new and complex goals. The first step in the stakeholder engagement process is identifying the characteristics of the stakeholder's categories.

The Stakeholder's Engagement Manual tracks the stakeholder's profile, answering three questions:

1. Is the stakeholder authentic?
2. Is it fair and well informed?
3. What difference does his involvement make for corporate decision-making?

The second step is the mapping of stakeholders; these are individuals or groups who affect or are affected by the organization and its activities.

There is a generic list of stakeholders that fits all companies, or even a single firm (change over time); the list of those who affect and are affected by the organization depends on the type of industry, from the company, according to geography, and according to the issue in question. New business strategies and changes in the environment in which it operates lead to a new set of stakeholders.

There are a number of variables that one can consider when identifying stakeholders:

1. Accountability: people to whom there are, or might be in the future, legally liability, whether financially and/or operationally, who are enshrined in regulations, contracts, corporate policies, or codes of conduct.
2. Influence: people who are, or may be in the future, able to affect the ability of the organization to achieve its goals, i.e., whether their actions are likely to be able to improve or hinder performance. These include both those who have and those who have informal influence on formal decision-making power.
3. Proximity/nearness: those with whom the organization has the most interaction, including internal stakeholders; those with longstanding relationships; those upon whom daily operations depend; and those who live near the headquarters.
4. Dependency: those who most depend on your organization—for example, employees and their families; the customers who depend on the products for their safety, subsistence, health or welfare; or suppliers for whom you are a primary customer.
5. For representation: those who, for legal or culture/tradition reasons are entrusted with the task of representing other individuals, such as local community leaders, union representatives, advisers, representatives of associations, etc.

Grouping stakeholders into categories (using the general categories shown below, or adopting other methods) and sub-groups share similar perspectives.

6 The Global Reporting Initiative

Inclusiveness can be achieved through adherence to the following three principles:

1. Relevance: requires knowledge of what concerns and it is important for the organization and its stakeholders.
2. Completeness: requires the understanding and management of material impacts and the points of view, needs, perceptions and expectations of stakeholders associated with them.
3. Compliance: requires an answer consistent with the issues relevant to stakeholders and to the organization.

These principles are not unique to the AA1000 Series and will need to be integrated into the specific language and existing frameworks.

The Guidelines for Sustainability Reporting of the Global Reporting Initiative also uses the principle of "inclusiveness" as the primary key to a process of sustainability reporting, using a systematic involvement of stakeholders in the development and improvement of the report.

The GRI defines the principle of "completeness," applied in the context of reporting, and refers to the scope (in terms of time, thematic and organizational entities) of what is included in a report. This ties in again with the above-mentioned principles applied within the context of stakeholder engagement—namely, the challenge of engaging with stakeholders based on an agenda that is clearly outlined in terms of period, thematic and organizational entities considered.

7 The Risk Management Tools

Risk assessment involves several steps that require the contribution of various disciplines. On the international scene, perhaps even in the wake of the economic crisis, we are witnessing increasing interest in the security and quality of service in various economic and industrial environments by hiring more and more of a role in this social relevance.

The prospects for increased productivity and recovery efficiency, which have been the central goal of companies over the last 20 years, have given way to the search for a balance between product quality and customer satisfaction, with greater emphasis on global sustainability. In this changed environment, which also are referred to as the tools of risk management.

Performance measurement is always the chance of concrete quantification of the quality of performance in any industry. Risk management is applied, especially for the function of communication and information that can provide quantitative data on the work outside of an organization (Asif et al. 2013).

The formalization of control measures for risk management is done through the selection or construction of indicators, a "*tableau de bord*" that represents the

synthesis tool that collects all the indispensable data for determining the quality of the performances and the quantification and risk management on performance. The tableau de bord is a tool used as part of the control systems of evolved management, which starts from the recognition of the financial results until there is a more detailed analysis of the causes of physical-technical and operational variances related to the results of each business process. This concerns not only the indicators of economic and financial but allows the analysis of the efficiency of business management and operational processes, the level of customer satisfaction, and comparison of financial data with indices of the quality delivered and perceived by the customer.

The use of this instrument meets two objectives: monitoring the performance of key variables (key performance indicators) and monitoring key processes accordingly, and concise and comprehensive reading of the deviations of the results of the company for the definition of corrective actions.

In this context, performance control means to direct, quantify and monitor its progress against the objectives and reduce the risk to a minimum with an acceptable margin of error.

Even in the management of environmental systems, ISO 14001 provides for the establishment of "emergency response" preventive action that has no direct effect other than environmentally and economically. The risk management is indispensable in any field, such as in the case of traceability in food, or the risk related to ethics and safety. However, the environmental performance of a company, as well as social ones, are difficult to measure. Currently, due to the lack of methodologies and indicators, universal results of these analyses are easily found. The ISO 14031 specifies that the assessment of environmental performance (EPE) is an internal process and a management tool that provides the reliability and truthfulness of the information that is used to check whether an organization meets the criteria, and, as a result, the objectives established by the organization itself. The EPE can then be defined as a set of indicators that provides measurable results and can be used even in the absence of implementation of an environmental management system (Axelsson et al. 2013). These types of indicators can be divided into two subcategories: performance indicators and status indicators. The construction of the instrument is selected from a plurality of indicators—world, international, national and local authorities—to build a set that identifies a tableau de bord. These data can be reclassified and used as indicators of performance analysis SLCA.

The set of risks that the company faces at a given time is defined by its risk profile (generally understood). The nature of this profile, and its composition are influenced by corporate purposes, as well as by the characteristics of the internal and external environment in which it operates. The description of the risk profile is an operation that cannot be generalized and should be based on evaluations conducted in the specific business context, integrating all the information possible. In addition, the risk profile is very dynamic, so that the management has the responsibility to adopt systematic detection systems constantly monitor the evolution. In the analysis of SLCA, identification of the risk profile of a company can

support the identification of the items of inventory on the basis of analyzing the integration impacts/risks, and the social sustainability of the enterprise.

The risk profiling can also be useful for better defining subcategories of impact with a twofold advantage: an identification of the items of the two analyses in common with the possibility of harmonization of data, and at the same time to have quantitative elements from the analysis of risk management that are not always available in SLCA.

In this direction, a valuable contribution may come from the overview of the environmental factors that lead to the emergence of demand for greater safety and appropriateness of the stages of production, especially for the "workers" and "consumers" categories. In the search for factors that interact with the cycle of life, is increasingly seeking indicators marked on the criteria of scientific evidence, effectiveness and appropriateness. These pressures lead to the development of actions and instruments that fall within the evidence-based scope, including continuing education, review, and activation of the circles of quality assessment and audit, implying a vision of explicit accountability of professionals and performance evaluation of assistance as a basis for engaging actions to improve effectiveness and safety.

The simplified models of risk management can be adapted to compare the relative potential for harm and its causes. The harm in this case is understood in terms of both the environment and human health. A proper consideration, however, must be specified—namely, that these types of indicators do not specify an absolute risk or actual harm, but rather only the potential for them. For example, risk assessments are very often focused exclusively on a single aspect in a specific location. In the case of a traditional risk assessment, it is possible to create very detailed models of the expected impacts on the population exposed to the risk and to predict the probability of the population being affected. The number of factors impacting over the course of the evaluation, the variety of places, and the diversity of impact categories can also be identified, although the models currently available are only estimates but still use pooled data for calculation and values defaults.

8 Social Attention and Greenwashing Risks

Sustainability seems to have become a recurring theme in the intention of buying. In Italy, as in the rest of the world, many studies have been conducted that demonstrate this; an example is the total number of consumers ready to differentiate their wallets and pay a premium price for a product labeled "green" amounts to 84 % in Italy, compared to 77 % in the United States.

The term "green consuming" appears to be widely used, making environmental management a key part in the process of relational management with the consumer. A well-known marketing research consultant, Arthur D. Little, shows how in samples analyzed in the investigation, 30 % of those asked said they would be prepared to pay more for a product that respects the environment.

The same report highlights, as in the statistical analysis, that the market is analyzed in four dimensions—company expectations, brand recognition, behavior/inclination in buying, and consciousness, –in understanding buyers' behavior, level of attraction and "driver" for value potential.

Since 2008 the results have shown that the buyer's behavior has greatly developed in the "green" market, independent of normative obligations. The company plays the key role independent of the industrial sector, which sends information on environmental sustainability initiatives of the company along diverse channels, and, above all, in great organized distribution (GDO), the brand is associated with environmental sustainability.

Moreover, the profile of the green consumer is well highlighted in research carried out by Target Research for Henkel Italia. Around 30 % of consumers can be considered to be sustainable consumers, sensitive to environmental problems, and possessing wide knowledge that is constantly updated. Some 27.8 % of them are not particularly environmentally aware but have often adopted behavior that is oriented towards sustainability. Finally, 13.2 % are skeptical and 27.8 % are indifferent.

There are many authors in the literature who reach different conclusions on the theoretical perspectives, and there are two who come to differing conclusions about the connection between the costs and benefits of using the tools of social responsibility: the theory and signaling, and the theory of greenwashing. The latter finds its basis in the fact that the reporting tools are optional tools, and also in cases where the jurisdiction of individual states provides for the obligation of realization on the part of organizations; it is a standard drawn up by the private research institutions, without any connection to international financial reporting procedures.

In order to protect stakeholders from receiving false information and organizations from receiving a virtuous from the risk of image damage to be confused with competitors who spread unrealistic information, several organizations and institutions with the role of qualified auditors have emerged in order to bridge the gap credibility that characterizes the sustainable reporting.

9 Discussion and Conclusions

After its initial stage of development, the S-LCA is now a well-defined framework, but its practical application is lacking. The bibliography does not yet list many case studies; those that are listed, in many cases, are not comparable.

The strategic role that seems to be in the overall context is a tool to support decisions at the level of decisionmaking and high-level strategic planning. However, it is important to note that S-LCA can be very useful as a strategic business tool.

Especially for the CSR stakeholder management, the classification of stakeholders is still controversial and not universally harmonized in the various analysis models, are the common point balance categories: customers, staff, suppliers and the local community.

The research is positioned as a first step towards the integration of multidisciplinary analysis models for the construction of an integrated model. The appraisal value of stakeholder management is adaptable to the global context, since the issue still lacks solid interpretative and empirical models.

The possible solution for this gap can be shown by models of the assessment of social impacts based on life cycle thinking, especially through the application of the SCLA methodology that is suitably integrated with the models that were until now not found in the literature.

As part of the risk management of any organization that produces goods or delivers services, the set of indicators is an instrument of primary importance, the basis of the information system with which they built and supported the information flows that create a common thread between the processes and the company's strategic decision-making system. The optimization of the system of indicators and their rationalization enables a complete view of the overall picture of the company's system. In an economic and social scenario, with increasingly limited resources and a market subject to a great variability of conditions, the standardization of these tools and the establishment of uniform methods of calculation and quantification of the impact seem to be more and more a priority.

The integration of tools in the analysis of risk management may be important to consolidate its position and the strategic role among the tools for the assessment of sustainability. In general, it can be concluded with regard to the fact that the SLCA is still a tool that requires defining a set of suitable and recognized indicators, unlike models of risk management in well-established business practices. Starting from this theoretical approach, it may be possible to study the information available for integrating the two instruments.

The Global Reporting Initiative has set the standard for social reporting that is more globally widespread. The GRI guidelines were developed in order to help organizations assess the material aspects to consider before beginning on the path of accountability, providing a list of what to check for after the trial, and helping manage the information.

There are conflicting opinions about the instrument in the literature, with the main criticisms involving the risk of greenwashing. This risk arises when the instrument is used by organizations that are not interested in improving the sustainability of their performance, but only to show their image of sustainable businesses.

The managerial approach used for such preparation involves separation into categories of stakeholders, and defines a set of sector-specific indicators for each of them, and does not consider cross-cutting aspects of materials identified by the organizations. The latest changes focus on the material aspects relevant to identifying and adopting more stringent objectives of the measurement systems that are evidence of the results obtained from specific interventions, as well as avoiding confusing the reader with information regarding dispersive with the general policy business.

The only way to classify the quality of the contents of the report remains the banding system, and then signaling that they check out.

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