



Life Cycle Initiative

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Guidelines for

**SOCIAL LIFE CYCLE ASSESSMENT OF
PRODUCTS AND ORGANIZATIONS 2020**

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SOCIAL LIFE CYCLE ASSESSMENT OF
PRODUCTS AND ORGANIZATIONS 2020

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Foreword


In 2009, UNEP's Life Cycle Initiative launched the first Guidelines for Social Life Cycle Assessment (S-LCA). Since then, researchers and practitioners have used these Guidelines to assess the positive and negative social and socio-economic impacts of products over their lifecycle. In parallel, the practice of S-LCA has evolved from a small circle of academic practitioners to one that now includes stakeholders from industry, policy makers, and business.

This evolution from theory to practice requires having updated information and guidelines that do not need prior understanding of lifecycle approaches. It also means ensuring that the right tools are in the hands of those who can inform the decision-making processes. These updated Guidelines for Social Life Cycle Assessment fulfil both these objectives.

This 2020 edition also looks at how to link the social impacts of a product's production and consumption to the larger impacts associated with an organization's influence across the life cycle of a product. Social organizational LCA (also known as SO-LCA) strengthens S-LCA by providing an organizational perspective that guides many organizational decisions. SO-LCA also complements Organizational LCA guidance, another tool developed by the Life Cycle Initiative.

The importance of social sustainability in moving towards sustainable development is undeniable. UNEP's Life Cycle Initiative has joined forces with the Social Life Cycle Alliance to deliver this publication as a practical guide to understand and improve the social sustainability of our consumption and production processes. Now, more than ever, social sustainability, social inclusion and leaving no one behind must be critical parts of our thinking and efforts to build back better and greener.

My thanks go to the authors, researchers, and stakeholders who have contributed their knowledge and expertise to this publication, much of it given in kind. I trust it will encourage and increase attention by decision makers on the social aspects of products and organizations.



Ligia Noronha

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Table of Contents

Executive summary	12
Reader's guide	13
Preface	15
1. Introduction	16
1.1 References	19
2. What is social life cycle assessment?	20
2.1 Definition and structure of social life cycle assessment	20
2.2 Stakeholder categories, impact categories, and impact subcategories	22
2.3 Main definitions of core concepts	24
2.4 Where to start and the two main approaches in S-LCA	27
2.5 Positive impacts	29
2.5.1 Social handprinting	31
2.6 Uses of S-LCA	32
2.7 Linkages with international frameworks	33
2.8 Linkages with other corporate social responsibility tools	34
2.9 Implementation of S-LCA and SO-LCA	37
2.9.1 Path 1: Experience with social assessment at organizational level	38
2.9.2 Path 2: Experience with environmental life-cycle approaches	38
2.9.3 Path 3: Experience with product/organizational social life cycle approaches	38
2.10 References	39
3. Goal and scope definition	41
3.1 Goal definition	41
3.2 Scope definition	42
3.2.1 Defining the functional unit	43

Table of Contents

3.2.2	Defining the reference flow	45
3.2.3	Defining the product system	46
3.2.4	Identifying the system boundaries	48
3.2.5	Activity variable	48
3.2.6	Cut-off criteria	49
3.2.7	Limitations of data access	50
3.2.8	Stakeholder categorization & involvement	50
3.2.9	Impact assessment method and impact subcategories	52
3.2.10	Indicators, data type, and data collection strategies	53
3.3	References	54
4.	Life cycle inventory	56
4.1	How to conduct the life cycle inventory analysis?	56
4.1.1	The basics of life cycle inventory in the context of S-LCA	56
4.1.2	Prioritizing data collection	59
4.1.3	Activity variables	63
4.1.4	Collecting data for impact assessment method	65
4.1.5	Determining data sources and social inventory indicators	66
4.1.6	Collecting generic and secondary data	68
4.1.7	Collecting site-specific and primary data	72
4.1.8	Refining the data collection strategy	73
4.2	Handling co-products	74
4.3	Data quality	75
4.3.1	Appropriate instruments, sources and collection methods	76
4.3.2	Data quality management	76
4.3.3	Challenges for generic and secondary data	78
4.3.4	Documentation of data quality	78

Table of Contents

4.4	References	79
5.	Impact assessment	80
5.1	What is lcia in S-LCA?	80
5.1.1	Definition	80
5.1.2	Characteristics of the two main approaches in S-LCIA	81
5.2	Implementing reference scale approaches	81
5.2.1	General guidance on developing reference scales	82
5.2.2	Establishing performance indicators to prepare for data collection	88
5.2.3	Aggregation and weighting	89
5.2.4	Impact pathway approaches	92
5.2.5	General structure in IP S-LCIA	93
5.2.6	What is an impact pathway?	95
5.2.7	Pathways following the regression-based modelling approach	104
5.3	References	105
6.	Interpretation	108
6.1	How to conduct interpretation	108
6.1.1	Completeness check	109
6.1.2	Consistency check	110
6.1.3	Uncertainty, sensitivity and data quality check	111
6.1.4	Materiality principle	113
6.1.5	Aggregation	113
6.2	Critical review	113
6.3	Conclusions, limitations, recommendations	114
6.4	References	115

Table of Contents

7. Social organizational life cycle assessment (SO-LCA)	116
7.1 How does SO-LCA relate to S-LCA?	116
7.2 Conceptual framework	117
7.2.1 Goal and scope	117
7.2.2 Life cycle inventory	118
7.2.3 Impact assessment	119
7.2.4 Interpretation	119
7.3 Limitations & further research needs	119
7.3.1 Distribution of impacts	120
7.3.2 Complex organizations	120
7.3.3 Social performance tracking	120
7.4 References	121
8. Communication	122
8.1 Principles for communicating social impacts	122
8.2 Internal communication	124
8.3 External communication: B2B	124
8.4 External communication: B2C	125
8.5 Communication on social performance – a possible pathway	127
8.6 References	127
9. Next: Outlook for the future	128
Annex - Glossary	130
References	137

Executive summary

The Guidelines for Social Life Cycle Assessment (S-LCA) of Products provide a roadmap and a body of knowledge to help stakeholders in the assessment of social and socio-economic impacts of products' life cycles, their related value chains and organizations.

Awareness about value chain social issues such as child labor used for harvesting cotton, unpaid wages of factory workers and safety issues when using a product, raises the question of what the extent of product and organization social impacts are and how they can be improved. To answer this question, the S-LCA Guidelines present a methodology to assess the social impact of products using a life cycle perspective. This methodology builds on the more commonly known Life Cycle Assessment (LCA), which focuses on environmental impacts.

A key and unique feature of S-LCA, within the landscape of social assessment methodologies, is that a life cycle perspective is used to assess the social impacts of a product or organization. This means looking not only at the factory or process that produces the product, e.g. flour milling, but also at the social impacts related to all the associated processes, both upstream and downstream, e.g. grain production, transport and final distribution of the flour.

In the past decade since the original S-LCA Guidelines were published, S-LCA has gained in maturity and established itself as a standalone methodology. These 2020 Guidelines provide additional information and consensus-based guidance for each step of the S-LCA, explaining the strengths and challenges of different approaches to address a varied set of questions related to the social sustainability of products and organizations. For instance, to support measuring and assessing progress towards the UN Sustainable Development Goals (SDG).

The expanded framework builds on the previous edition to cover new methodological and practical developments such as social organizational LCA (SO-LCA) as well as the refinements and additions of social impact subcategories that have emerged in the literature and that are now integrated in the guidance.

Reader's guide

In this Reader's Guide, we present the S-LCA method concisely to enable the readers to quickly grasp S-LCA's scope and characteristics. References direct readers to the sections in the Guidelines where each topic is discussed in more detail. To illustrate the process of a S-LCA, we will use the example of a garment brand named Shirtz which has requested an S-LCA of their latest product: a pack of white cotton T-shirts.

To get started, see *Chapter 2 "What is Social Life Cycle Assessment?"*, which provides a general explanation of the methodological approach, before going deeper into each step in the subsequent chapters.

Context: garment brand named Shirtz produces T-shirts. Shirtz has requested an S-LCA of their latest product: a pack of white cotton T-shirts.

Step One: Specify the question(s) to be answered by the Social LCA

Examples are:

- What are the social hotspots of the T-shirts' life cycle?
- What are the total social impacts associated with the value chain of the company Shirtz?
- If we switch to an alternative cotton producer or use a different fiber, what would be the effects on social impacts?

Along with specifying these research questions or goals, the affected stakeholders are also identified, e.g. the workers, the consumers, etc. Based on this information, it is determined which processes will be analyzed by setting system boundaries for a specified quantity, e.g. 1 T-shirt. The type of the impact assessment method (whether to consider potential impacts and/or cause-effect chains) will also be selected. For example, if the question is "What are the social impacts on workers of a T-shirt supply chain up to the factory gate?", upstream processes to be considered will include cotton production, ginning, spinning, knitting, dyeing, cut and sew and transportation. The impact on workers and the communities will be assessed at each upstream process. The impact assessment method to be used will be Reference Scale. See *Chapter 3 "Goal and Scope Definition"*.

Step Two: Collect inventory data

In the case of environmental impacts, the inventory consists in building the product system and compiling emissions data (e.g. greenhouse gases such as methane) as well as data about resources used by each and every process. For S-LCA, data is needed to describe social impacts within the product system.

For example, in the case of T-shirts, working conditions of the people producing the T-shirts need to be considered, such as, their working hours, wage, and any potential for accidents at the factory. Conditions in the local community surrounding the T-shirt factory should also be considered such as, local employment at the factory, access to drinking water, and safe and healthy living conditions. Similarly, data on the social conditions of cotton production, ginning, spinning, knitting and dyeing should also be collected. Databases and related software should also be used to complement data collected on site to ensure that all social impacts related to the product system (which often consists of thousands of processes) are captured. This secondary data may only be available at a country or sector-level, e.g. human rights violation estimates are generally available at the country and/or sector level, which serves as an approximation of potential risks. Overall, data collection is often a tedious part of an S-LCA, but data consistency and representativeness are important to ensure robust S-LCA results. See *Chapter 4 "Life Cycle Inventory"*.

Step Three: Translate collected data and information into a resulting social impact, or a risk for a social impact

Two main approaches can be applied here. In the first approach, reference scale (RS), impact indicators can be

benchmarked to provide social hotspots or social performance results. An example of a reference scale is:

+2 Ideal performance; a positive output achieved and reported – this could be that a wage at living wage level or higher is being paid.

+1 Progress beyond compliance is made and monitored – this could be that a wage higher than the legal minimum wage is being paid and programs are in place to improve the remuneration package.

0 Compliance with local laws and/or aligned with international standards – a minimum wage is paid.

-1 Non-compliant situation, but actions to improve have been taken – a wage below the legal minimum wage is sometimes paid because of deductions, a program is in place to make changes.

-2 No data, or Non-compliant situation; no action taken¹, wages paid are below the legal minimum wage.

Note that living wages tend to be much higher than the legal minimum wages established in countries.

The second approach, Impact Pathway or IP, attempts to describe the actual cause-effect chain. For example, lower future well-being related to poor nutrition because of wages unpaid. For both approaches, the impacts are assessed along the value chain and may be aggregated, with some weighting. See *Chapter 5 "Impact Assessment"*.

Step Four: Interpret results and indicate hotspots and areas for improvement

At this step, for example in terms of labor, Shirtz will know the share of its entire life cycle worker hours that possesses a range of social attributes, such as (e.g. potential for fair wages, risk of hazardous conditions, etc.).

In order to gain further insights and verify a hotspot for low wages, it could be decided to collect site-specific data instead of using secondary data from databases or the literature in the inventory. This could be followed by adopting a living wage policy. As S-LCA is an iterative process, the impact of the change (potential handprint) could be captured in a subsequent iteration of the study. See *Chapter 6 "Interpretation"*.

Alternative: Consider the social impact of a complete organization

Shirtz, like many organizations, may produce more than one type of product. In addition, there are other impacts occurring on-site that may not be easily related to a specific product or set of products. To analyze the impact of an organization's value chain, including its portfolio of products and infrastructure, Social Organizational LCA (SO-LCA) should be applied. SO-LCA can help an organization to improve its social performance as decisions are often made at the company level, such as the selection and development of suppliers. See *Chapter 7 "SO-LCA"*.

Step Five: Communicate results

While results are first communicated internally to address issues of concerns, in a next step, Shirtz may want to communicate its S-LCA results with its stakeholders. Attention should be paid to relevance, reliability, and transparency. Shirtz or its products may qualify for specific labels which can be communicated via its advertising. A tag could also be attached to the T-shirt with a link to a website where an explanation of the social performance would be available in layman terms for the public as well as a detailed report for stakeholders. See *Chapter 8 "Communication"*.

Step Six: Consider limitations and future research

In closing, users should be aware of the limitations inherent to any type of sustainability assessment, including S-LCA. With increased application of Social LCA, collaborations between society, industry and scientists will be crucial. See *Chapter 9 "Next: Outlook for the Future"*.

¹ Reference scale from PSM Roundtable, 2018



Preface

In 2009, the UNEP/SETAC Life Cycle Initiative published a first set of Guidelines for Social Life Cycle Assessment (S-LCA). These Guidelines were said to provide a map, a skeleton, and a flashlight to guide stakeholders engaging in the assessment of positive and negative social and socio-economic impacts of the life cycle of products.

The practice of S-LCA has evolved tremendously since then, as well as its context. From a small circle of practitioners, mostly in the academic sphere, the field has grown to include many stakeholders, including companies, consultants, academics, and policymakers. However, far from being completed, the growth of this field is still at the early stage. Revising the Guidelines is a pivotal exercise, necessary to make the method more approachable to the new interest it receives.

In 2009, the key audience of the Guidelines was without question the experts of Environmental Life Cycle Assessment (E-LCA). The purpose of the document was to explain how the method of E-LCA could be adapted to apply to the assessment of social and socio-economic impacts.

Primary users and audiences of S-LCA are frequently human rights and sustainability managers or experts, or social scientists and policymakers without a conceptual understanding of E-LCA. These new Guidelines offer, therefore, a practical reference for anyone wanting to become familiar with and start applying the method.

This document covers the four phases of an S-LCA: setting the Goal and Scope of a study (Goal and Scope), collecting data (Inventory), assessing the risks and potential impacts (Impact Assessment) and interpreting results (Interpretation). In addition, the new Guidelines provide insights on how to apply Social Organizational Life Cycle Assessment (SO-LCA), a method to study the impacts of an organization's life cycle.

Because different S-LCA methods have diverging purposes and applications, these Guidelines do not dictate one path over another but rather explain the strengths and challenges of different approaches to solve multiple questions.

Each sections of the revised Guidelines define the main steps, provide examples and direct to additional resources and references, providing users with a refined framework and detailed guidance.

The new Guidelines should quickly become a helpful reference in new explorations or expert application of S-LCA methods.

The Steering Committee



1. Introduction

The ultimate goal of sustainable development is to achieve and sustain human well-being, while considering the needs of current and future generations. Over the past decades, a range of actors from the academic, private, and public sector spheres have developed tools, metrics, policy instruments, and strategies in order to integrate sustainable development into decision-making.

In the field of product assessment, some methodologies and tools have been developed to support policies and strategies relating to all pillars of sustainable development. When considering products, services and organizations' sustainability, a life cycle perspective (from extraction of raw material to end of life) brings powerful insights. This includes highlighting potential transfer of impacts among impact types, steps of the life cycle or stakeholder groups. It aims to provide increased knowledge on the 3Ps - three-pillar approach of sustainable development: People, Planet, and Profit.

S-LCA is one of three methodologies that have been developed to assess the sustainability of the three Pillars of organizations, products and services, focusing on the People Pillar. E-LCA provides information on the effect on the Planet, looking at the potential impacts on the natural environment of economic activities and, to some extent, impacts on human health and natural resources. Life Cycle Costing (LCC) focuses primarily on the direct and indirect costs and benefits from economic activities for Profit. This distinction between pillars and life cycle methods, encompasses some overlaps (e.g. E-LCA commonly also covers the impact on human health which relates to the People-pillar and is also covered by S-LCA), but it is a rough common classification that provides clarity.

The application of the three methodologies to assess sustainability performance leads to a Life Cycle Sustainability Assessment (LCSA). Although some more integrated alternative approaches for sustainability and LCSA have been developed (Guinée et al., 2011; Schaubroeck and Rugani, 2017), combining E-LCA, LCC and S-LCA based on the three-pillar sustainability concept is not easy to implement in practice due to the above mentioned overlapping issues when interpreting results.

The first Guidelines for S-LCA were published by the UNEP/SETAC Life Cycle Initiative in 2009. Since then, the relevance of S-LCA has increased, and a plethora of initiatives promoting value chain due diligence has continuously positioned social issues as a central concern, for private and public sector actors alike. According to the Organisation for Economic Cooperation and Development (OECD), "Due diligence" is the process through which organizations identify, consider and address the potential environmental and social impacts and risks relating to concerned activities as an integral part of their decision-making and risk management systems. In this context, LCSA and S-LCA can be regarded as tools

for exercising due diligence in life cycle management (Mazijn and Revéret, 2015).

In particular, two pivotal developments have underscored the relevance in researching and applying methodologies that help to better understand and reflect upon the negative and positive social impacts of value chains. One of them is the launching of the United Nations (UN) Sustainable Development Goals (SDGs) in 2015², defining goals to “address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice” (UN, 2015). The seventeen SDGs and their 169 targets have been internationally accepted by governments, industries and organizations and now represent the main reference for efforts geared towards sustainable development. Fourteen of the seventeen goals concern social impacts, most of which have obvious connections with the S-LCA framework.

Another crucial development is a policy instrument endorsed in 2011 by the United Nations Human Rights Council: The Guiding Principles on Business and Human Rights (United Nations, 2011). These Principles clarify the duty of governments and businesses towards human rights. The Guiding Principles positioned Human Rights Due Diligence as the most important process a company can apply to demonstrate its commitment and respect towards human rights associated with its activities, relationships or value chains across the globe. Human Rights Due Diligence is a reasonable investigation of the human rights risks related to business operations, value chains and other relationships.

In the wake of the Guiding Principles, a growing number of countries have passed laws that integrate its recommendation on Human Rights Due Diligence, such as France, the United Kingdom, Australia, the Netherlands, and Switzerland. Furthermore, the EU non-financial reporting directive seeks to foster human rights accountability within global value chains (Directive 2014/95/EU). In North America, the U.S. has enacted the Trade Facilitation and Trade Enforcement Act (H.R. 644), with Section 910 having been fortified to empower restrictions on the import of goods produced with forced labor.

This wave of legislations related to the Guiding Principles coupled with strong corporate support for the Sustainable Development Goals are now incentivizing companies to establish a process to learn about, prioritize and act upon their value chain social risks. In this context, S-LCA provides an assessment method that can be applied for the purpose of Human Rights Due Diligence and to highlight positive impacts associated with business activities.

Historical background

The discussion on how to deal with social and socio-economic criteria in E-LCA already started more than 25 years ago. In 1993, a SETAC Report: “Conceptual Framework for Life Cycle Impact Assessment” (Fava et al., 1993) proposed a social welfare impact category. Research on this topic was then initiated and various teams globally developed and started publishing methods and case studies. By the end of 2003, the UNEP/SETAC Life Cycle Initiative recognized the need for a Task Force on the integration of social criteria into LCA, which actively explored approaches for Social LCA.

The first *Guidelines for Social Life Cycle Assessment* were published in 2009 (UNEP/SETAC, 2009). Those Guidelines have represented the main reference for S-LCA for a decade. They were complemented by the publication of *Methodological Sheets for Social Life Cycle Assessment* in 2013 (Benoît et al., 2013). The Methodological Sheets presented each impact subcategory in a practical way, provided their definition, introduced the political context, defined generic and specific indicators, and gave database sources for collecting both types of indicators.

Since 2009, experiences, case studies and publications in S-LCA have increased, contributing to the numerous reference documents published on this topic. One example is the *Handbook for Product Social Impact Assessment* (PSIA), which was published in its complete form (Ver.3) in 2016 by the Roundtable of Product Social Metrics³ and updated in 2018 (Fontes, 2016; Goedkoop et al., 2018). The Handbook builds on the UNEP 2009 S-LCA Guidelines and the Meth-

2 <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

3 The Roundtable is a group of companies moderated by PRé Sustainability which aims to develop a feasible methodology to guide companies in assessing social impacts

odological Sheets to present a method with a specific set of indicators that can be applied to assess social impacts at the product level.

The World Business Council for Sustainable Development (WBCSD) published in 2016 a reference document specific to the assessment of social impacts for the chemical sector: *The Social Life Cycle Metrics for Chemical Products* (WBCSD, 2016). This initiative used the Roundtable PSIA and the UNEP Guidelines as a starting point and focused on the development of a qualitative methodology. One of the primary goals was to identify social indicators and aspects that are especially meaningful for the chemical sector, for instance the potential impact on consumers' health and safety.

More recently, the increased interest for S-LCA in the scientific community is demonstrated by the rising number of published papers, conferences and conference sessions, scientific journals publishing on the subject, and inclusion in special issues on the subject in journals. For example, in a special issue on the topic published in 2018 in *The International Journal of Life Cycle Assessment* (Macombe et al., 2018), about 30 papers were presented. In addition, it is relevant to mention the first white paper on the topic published by UN Environment Programme as an output of the Consumer Information Programme of the One Planet network 'Shout it Out: Communicating Products' Social Impacts' (UNEP, 2018). This report presents the state of the art in measurement of social impacts and has compiled and presented relevant examples of social impact communication related to products, highlighted best practices, and made suggestions for further developments on this topic.

Process of development

The objectives of the Guidelines revision included from the start:

- Expanding the audience;
- Focusing on capability development;
- Capturing methodological developments;
- Recognizing a plurality of established approaches;
- Positioning S-LCA in the current context;
- Developing areas where minimum guidance prevailed;
- Integrating SO-LCA to extend the focus from products to organization.

The development of the updated Guidelines has been accomplished by bringing together a large group of practitioners, academics, and members of the private sector. Working groups developed the first version of chapters which were then revised and compiled by the steering committee. We organized two expert meetings (in August 2018 in Pescara, Italy and in April 2019 in Paris, France) where drafts were discussed and amended. Practitioners and experts were also surveyed to gather perspectives on the list of impact subcategory. In addition, experts provided line by line comments which were considered and integrated in the draft whenever possible. An international public consultation was held in the spring of 2020 and results have also been brought into the final draft. In parallel, these Guidelines are being piloted and the experiences will be shared in a companion document. The Methodological Sheets have also been updated during the revision process and are available as another supporting reference.

In the following chapters, a step-by-step description of S-LCA will be provided to guide LCA practitioners and new users in their implementation of the technique to a product or organization life cycle.

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2. What is social life cycle assessment?

2.1 DEFINITION AND STRUCTURE OF SOCIAL LIFE CYCLE ASSESSMENT

Social Life Cycle Assessment (S-LCA) is a methodology to assess the social impacts of products and services⁴ across their life cycle (e.g. from extraction of raw material to the end-of-life phase, e.g. disposal). See Table 1. It offers a systematic assessment framework that combines quantitative as well as qualitative data. S-LCA provides information on social and socio-economic aspects for decision-making, in the prospect to improve the social performance of an organization⁵ and ultimately the well-being of stakeholders. In this Section 2.1 we succinctly present the structure of S-LCA and its main aspects which will then be further detailed in subsequent sections.

S-LCA rests upon a combination of methods, models, and data. S-LCA methods can be found in reference documents like this one and various journal articles. Models are used to provide a representation of the product life cycles/systems under study; several types of models can be used, e.g. a process model. Data is the information about the product life cycle/system and its potential impacts that enables the assessment to take place. Software tools can be used to apply methods, access generic data, and deliver summary reports with graphical layouts of the information processed.

S-LCA employs some of the modeling capabilities and systematic assessment processes of Environmental Life Cycle Assessment (E-LCA) combined with social sciences methods. The impact categories and subcategories assessed in S-LCA are those that may directly affect stakeholders positively or negatively during the life cycle of a product. They are largely defined by the international community through its policy frameworks and other social responsibility references, and in respect to the best available science.

S-LCA can either be applied on its own or in combination with E-LCA and/or Life Cycle Costing (LCC). It differs from other social impact assessment techniques by its object: products or services and their life cycle; by its scope: the entire life cycle; and its systematic nature: systematic process of collecting and reporting about social impacts and benefits across the life cycle.

4 The term 'products' will be used as a short form for 'products, services' hereafter, for the sake of simplicity

5 Note: Whenever we refer to organizations or companies, we implicitly refer to public and private bodies. We use both terms synonymously.

In recent years, Social Organizational Life Cycle Assessment (SO-LCA) methodology has been developed. It builds on S-LCA methodology, but its object of study differs: SO-LCA focuses on organizations, and their impacts. Guidance on SO-LCA is presented in these guidelines in Chapter 7 and Section 2.9.

Table 1: Scope, impact types and object of S-LCA.

System scope	Impact types	Object of study
<ul style="list-style-type: none"> • Full Life cycle of products and services (cradle-to-grave; from resource extraction to end-of-life). • Supply chain of the product (cradle-to-gate; exclude use phase and end-of-life). • Parts of the Life Cycle (gate-to-gate or gate-to-grave). 	Potential or actual Social and Socio-economic impacts (depending on its application).	Products or services.

S-LCA is in large part based on the ISO 14040 framework for E-LCA. Therefore, it includes four phases: Goal and Scope, (Social) Life Cycle Inventory (S-LCI), (Social) Life Cycle Impact Assessment (S-LCIA) and Interpretation. It is an iterative methodology, which means that we can improve the assessment over time, going through several assessment loops and moving from more generic/potential results to more site- and case-specific ones. These four phases are explained in detail in their respective sections of these guidelines.

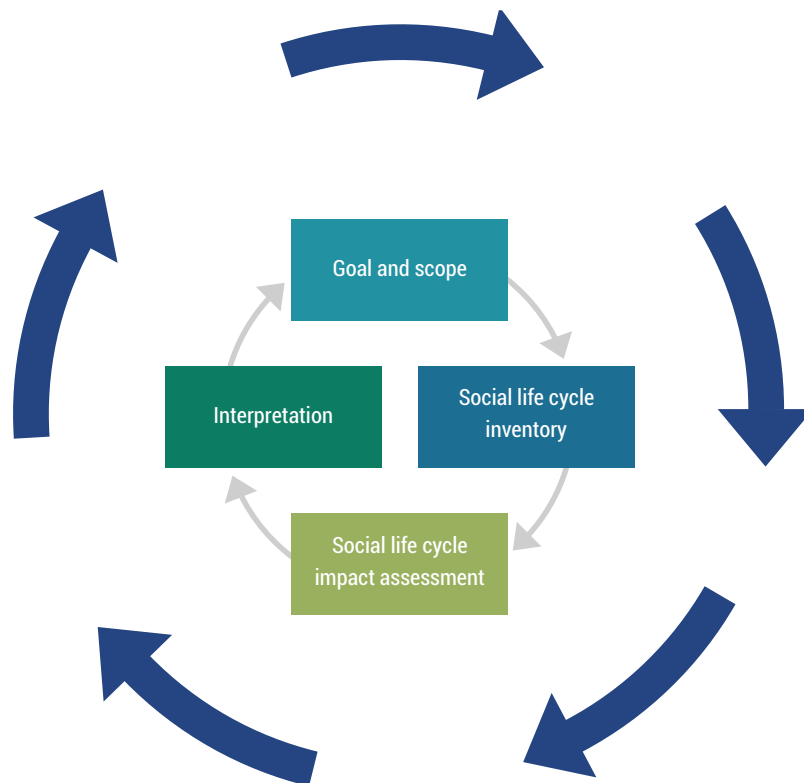


Figure 1: The four iterative phases of S-LCA (adapted from Benoît Norris, 2012). The arrows represent connections between all phases.

2.2 STAKEHOLDER CATEGORIES, IMPACT CATEGORIES, AND IMPACT SUBCATEGORIES

The S-LCA framework calls upon a stakeholder approach where the potential impacts on different stakeholder categories are considered. This mirrors the fact that social sustainability is about identifying and managing impacts, both positive and negative, on people (stakeholders). Social impacts are classified by stakeholder categories to assist with the operationalization and to ensure the comprehensiveness of the framework.

The stakeholder categories are at the basis of an S-LCA assessment because they are the items on which the justification of inclusion or exclusion in the scope needs to be provided. Linked to the stakeholder categories, are the impact subcategories that comprise socially significant themes or attributes. These subcategories are assessed by the use of impact indicators, of which inventory indicators link directly with the inventory of the product life cycle. See Figure 4 for an example. Several indicators may be used to assess each of the subcategories. These indicators may vary depending on the context of the study. The purpose of the further classification of impact subcategories into bigger groups of impact categories, besides stakeholder categories, is to logically group them and to support further Impact Assessment and Interpretation.

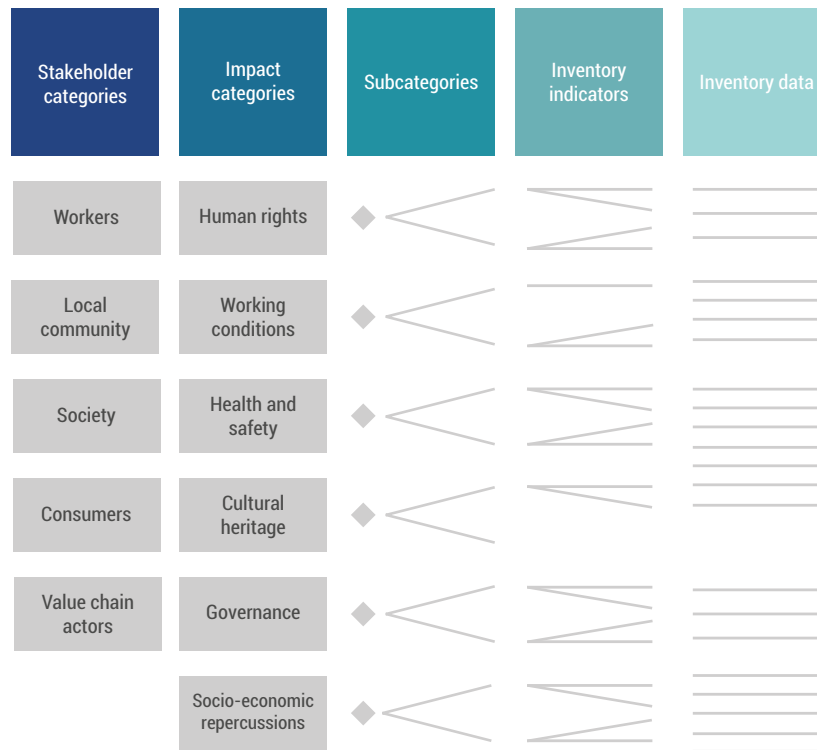


Figure 2: Assessment system from categories to inventory data. Adapted from Benoît et al., 2007. Connections are exemplary and not exhaustive.

Concerning stakeholder categories, the quality of an organization's relationships and engagement with its stakeholders is critical for its social performance. Directly or indirectly, organizations affect what happens to the stakeholders, and it is important to manage these social impacts proactively. The stakeholder categories that are considered in the S-LCA Guidelines, based on discussions among involved experts, are: Workers, Local communities, Value chain actors (e.g. suppliers), Consumers, Children, and Society. Alternative classifications are possible (e.g. per country) and allowed but should be explained and argued. See Section 3.2.8 on this matter. However, using the classification envisioned here, will facilitate a straightforward comparison with other studies that follow the Guidelines.

As previously mentioned, these potential impacts can be classified into a number of categories, depending on the issues of concern that are potentially affected. Common impact categories that can be considered are Human Rights, Working Conditions, Cultural Heritage, Governance, and Socio-economic repercussions. Other categories have been defined to support impact assessment and as a logical grouping of subcategories such as Education, Fair salary, Human health, etc. For example, Fair salary and Hours of work are subcategories of the impact category Working conditions (NOTE: The list of impact categories only serve as examples and shall not be seen as exhaustive. Additional impact categories can be defined - for further information see Chapter 5).

Table 2: List of stakeholder categories and impact subcategories.

Stakeholder categories	Worker	Local community	Value chain actors (not including consumers)	Consumer	Society	Children
Subcategories	<ol style="list-style-type: none"> 1. Freedom of association and collective bargaining 2. Child labor 3. Fair salary 4. Working hours 5. Forced labor 6. Equal opportunities/discrimination 7. Health and safety 8. Social benefits/social security 9. Employment relationship 10. Sexual harassment 11. Smallholders including farmers 	<ol style="list-style-type: none"> 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. Community engagement 8. Local employment 9. Secure living conditions 	<ol style="list-style-type: none"> 1. Fair competition 2. Promoting social responsibility 3. Supplier relationships 4. Respect of intellectual property rights 5. Wealth distribution 	<ol style="list-style-type: none"> 1. Health and safety 2. Feedback mechanism 3. Consumer privacy 4. Transparency 5. End-of-life responsibility 	<ol style="list-style-type: none"> 1. Public commitments to sustainability issues 2. Contribution to economic development 3. Prevention and mitigation of armed conflicts 4. Technology development 5. Corruption 6. Ethical treatment of animals 7. Poverty alleviation 	<ol style="list-style-type: none"> 1. Education provided in the local community 2. Health issues for children as consumers 3. Children concerns regarding marketing practices

The following impact subcategories have been newly introduced: Employment relationship, Sexual harassment, Smallholders including farmers, Wealth distribution, Ethical treatment of animals, Poverty alleviation, Education provided in the local community, Health issues for children as consumers, Children concerns regarding marketing practices.

The S-LCA framework, and related stakeholder and impact categories, have obvious connections to the seventeen SDGs that have been internationally accepted by governments, industries, and organizations. The figure below draws these connections.



SUSTAINABLE DEVELOPMENT GOALS



Figure 3: The S-LCA impact subcategories linked to the 17 SDGs. Most prominent ones are presented.

2.3 MAIN DEFINITIONS OF CORE CONCEPTS

This section defines the main terms and describes the different types of final outputs of an S-LCA. See Figure 4 for an overview and an example. As a methodology, S-LCA mainly focuses on assessing potential social impacts. However, some S-LCA studies also assess actual social impacts.

Potential social impact is understood as the likely presence of a social impact, resulting from the activities/behaviors of organizations linked to the life cycle of the product or service and from the use of the product itself. They are normally the result of an impact assessment step (for further information see Chapter 5).

Potential social impacts are often based on more than one (inventory) indicator (e.g. a **social risk**) and can contain aspects of causal relations, when they are calculated against the background of the Impact Pathway (IP) approach.

In turn, **actual social impacts** are understood as the positive or negative consequences ensuing from the causal relationship between an activity and an aspect relating to human well-being, as covered by impact subcategories.

Example of S-LCA outcomes of a piece of clothing (simplified fictional example)

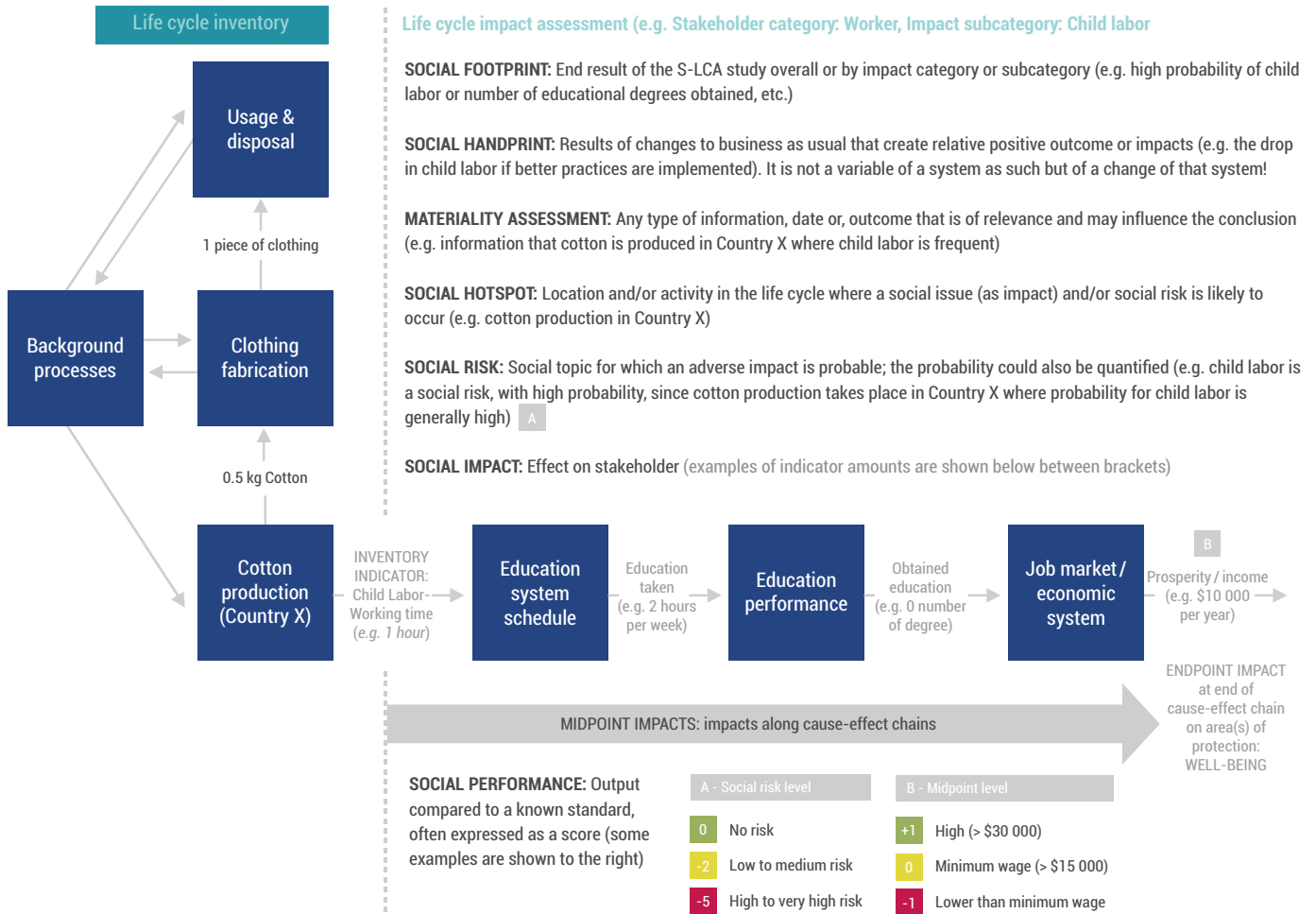


Figure 4: Overview of different outputs of Social LCA from a fictional simplified case study on a piece of clothing for which only one impact pathway is presented.

Therefore, **actual social impacts** are the changes that affect stakeholders as a result of an activity. Their assessment is based on observed data. For social impact along the cause-effect chain, the impact can be assessed midway through the cause-effect chain (midpoint) or at the end of the cause-effect chain (endpoint). See examples in Figure 4.

BOX 1: DELINEATION OF **ACTUAL SOCIAL IMPACTS** AND **POTENTIAL SOCIAL IMPACTS**

A study can only be said to assess **actual social impacts** if these are assessed with observed and verified primary specific data collected directly from stakeholders. Proxy indicators may not be used and the study may not be predictive in nature. It is important to use the term **potential social impacts** whenever these conditions are not met⁶ or note at the beginning of the communication how the term social impact is used (actual or potential).

As further explained in Chapter 5, some impact assessment methods in S-LCA can focus on evaluating **potential social impacts** and may do so through the assessment of **social risks**. **Social risk**⁷ is a topic for which there is a probability of adverse social effects on stakeholders through an organization's activities or business relationships. There can also be an assessment of the extent of the risk, e.g. low or high via a referencing step. Social risks are usually measured at country, sector, or company level. **They** are flags for **potential social impacts**.

A **social hotspot** is a location and/or activity in the life cycle where a **social issue** (as impact) and/or **social risk** is likely to occur. It is usually linked to life cycle stages or processes. It needs to contribute significantly to the impact (overall, by impact category, or subcategory). In other words, social hotspots are unit processes located in a region where a problem, a risk, or an opportunity may occur in relation to a social issue that is considered to be threatening social well-being or that may contribute to its further development.

Social performance refers to the principles, practices, and outcomes of businesses' relationships with people, organizations, institutions, communities, and societies in terms of the deliberate actions of businesses toward these stakeholders as well as the unintended externalities of business activity measured against a known standard (Wood, 2016). Commonly, social performance is measured at the inventory indicator level.⁸

A **social footprint** refers to the end result of an S-LCA study, in terms of adverse effects, overall or by impact category/subcategory (e.g. The total medium risk hours equivalent for labor rights and decent work by purchase category supply chain).

Social handprints are the results of changes to business as usual that create positive outcomes or impacts. They can be changes that reduce the social footprint or changes that create additional/unrelated positive social impacts. Those changes can apply to the product or organization value chain or they may be beyond its scope. For example, a company established a program with one of its suppliers which successfully prevented excessive working hours. The result of this change can lower that company's and its supplier's social footprint on excessive working time but also, if that supplier has other customers, it reduces the footprint of these customers as well which can be credited as a social handprint to the company which has instigated the change. For more information on handprinting, see Section 2.5.1.

Salient social risks/impacts are social impact subcategories that account for a greater share of the overall risk/impact. The UN Guiding Principles consider salient risks/impacts to be the ones that affect the most vulnerable stakeholders and that cause irreparable damages. For example, forced labor in DC Congo for mineral extraction.

6 This distinction is not present in E-LCA in which "potential" mainly relates to the modelling and normalization of result, and thus all impacts (including actual measured ones) are conventionally considered as potential in E-LCA. See ISO 14040, specifically page 9 of that document.

7 This interpretation of social risk relates only to probability and not to the scientific interpretation of a combination of probability and severity.

8 Social performance can also constitute the comparison of two social impacts or risks, e.g. at midpoint level as shown in Figure 4. If the reference scenario has no social impact/risk, then the social performance evaluation is in practice the same as an impact assessment, but conceptually these are different things.

Materiality (principle) constitutes social matter (information, data, performance, impact, stakeholder) that is of such relevance and importance that it could substantially influence the conclusions of the study, and the decisions and actions based on those conclusions. In the Interpretation section, we use this definition.

Materiality assessment is a process to select topics that are more important because of their impact on stakeholders and/or on the business. The Global Reporting Initiative considers material issues to be the ones that reflect the organization's significant social impacts; or that substantively influence the assessments and decisions of stakeholders.

2.4 WHERE TO START AND THE TWO MAIN APPROACHES IN S-LCA

When planning to conduct an S-LCA a number of key decisions have to be made. Figure 5 illustrates the main decisions by phase that a user needs to make at the onset of a study.

First, it has to be decided if the assessment will focus on a product or organization⁹. Then the specific product or organization needs to be identified. Next the goal(s) of the study needs to be thought out and described (product design, Human Rights Due Diligence, etc.) as well as the scope (e.g. full life cycle? raw material to assembly (cradle to gate)?)

In addition, the type of impact assessment method to be used needs to be defined as well as the topics that will be the focus of the assessment (stakeholder categories, impact subcategories). A data collection strategy needs to be developed. In particular, will the study use an S-LCA database and/or other sources of generic data (e.g. scientific articles)? If so, will that be followed by the collection of site-specific data? Finally, the impact assessment method(s) selected needs to be implemented and the results interpreted and communicated.

For a detailed description of each phase, we refer to each of the respective sections.

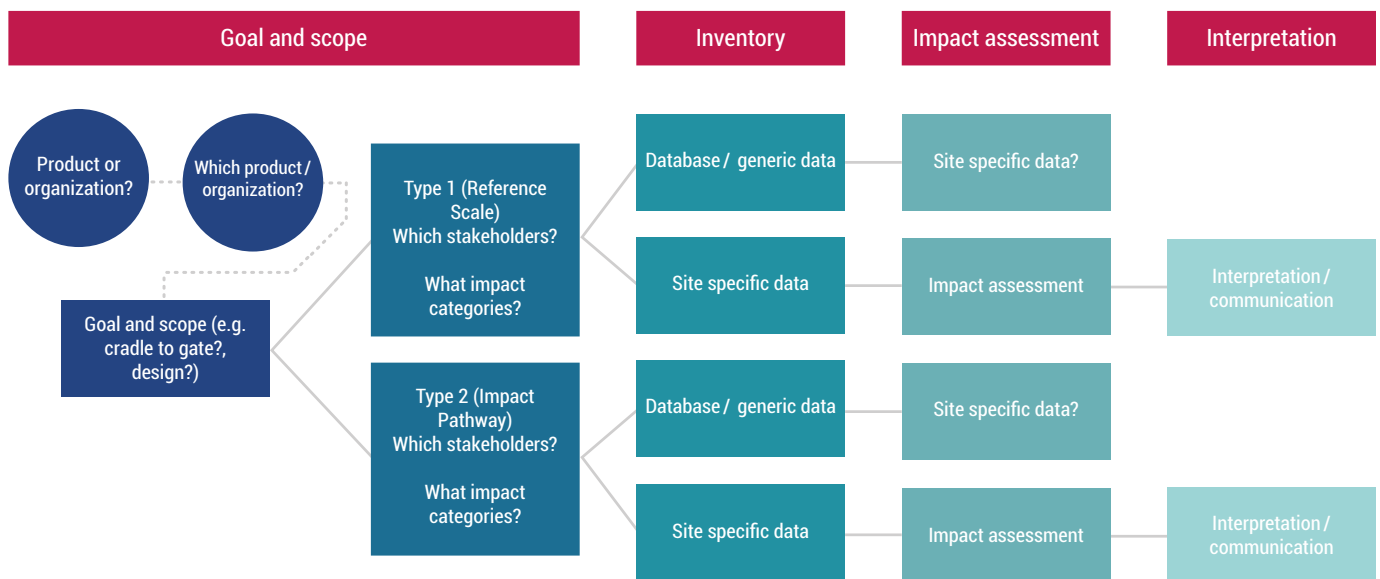


Figure 5: S-LCA decision tree.

⁹ An S-LCA study could also focus on an industry, an individual consumer, a country, a product or investment portfolio, etc. Typically, users study a product or an organization.

In S-LCA, there are two main families of impact assessment (or Social Life Cycle Impact Assessment – S-LCIA) approaches, the Reference Scale Approach (also known as Type I or Reference Scale S-LCIA) and the Impact Pathway Approach (also known as Type II or Impact Pathway S-LCIA), each responding to different practitioner aims:

1. If the aim is to describe a product system with a focus on its social performance or social risk, use the **Reference Scale Approach**.
2. If the aim is to predict the consequences of the product system, with an emphasis on characterizing potential social impacts, use the **Impact Pathway Approach**.

Reference scale S-LCIA assesses the social performance in the product system. More specifically, it assesses the social performance of activities of organizations in the product system (e.g. the practices implemented to manage social impacts) based on specific reference points of expected activity (called performance reference points - PRPs). Reference Scale Assessments rely on data, information, or judgement, and provide results that focus primarily on the activities of companies in the product system and commonly consider their immediate evaluation (e.g. at inventory indicator), i.e. no further propagation of effects. As such, Reference Scale approaches do not commonly in practice establish a link between the activity and longer-term impacts. Rather, based on available information, they estimate the likely magnitude and significance of potential social impacts further down the line.

Impact pathway S-LCIA assesses potential or actual social impacts by using causal or correlation/regression-based directional relationships between the product system/organizations' activities and the resulting potential social impacts – a process called “characterization”. Here, the analysis focuses on identifying and tracking the consequences of activities possibly to longer-term implications along an impact pathway¹⁰. This approach is more in line with E-LCA, where inputs (inventory or collected data, e.g. CO₂ emissions) are linked with environmental problems (midpoint impacts, e.g. global warming) and with further endpoint impacts, e.g. impact on human health. Table 3 summarizes the two main families of social impact assessment approaches. One type is not guaranteed better than the other in practice because of restrictions (e.g. data availability).

Examples and further guidance for both approaches can be found in Sections 3.2.9 and 4.1.4 as well as Chapter 5.

Table 3: Characteristics of S-LCIA approaches.

Characteristics	Reference Scale Approach (Type I)	Impact Pathway Approach (Type II)
Aim for users	Assessment of the product system in terms of its social performance or social risk.	Assessment of consequences resulting from the product system, with a focus on potential social impacts.
Relation between activity and potential social impacts ^{a/b}	Relation assumed. Analysis focuses on activity and its direct evaluation, more specifically on their positioning with regards to performance reference points.	Cause-effect relations established through 1) developed and justified characterization models or 2) qualitative descriptions of existing relations along an impact pathway.

¹⁰ An Impact Pathway describes the underlying **social mechanisms** with regard to specific social aspects or impacts. Social mechanisms in S-LCA should be represented by **social impact categories**, **category indicators** and **characterization models**. Inventory results are therefore connected with impact categories (usually described as midpoint impact categories) and category endpoints (usually described by endpoint impact categories) – for further information see Section 5.2.6

Characteristics	Reference Scale Approach (Type I)	Impact Pathway Approach (Type II)
Scope of analysis	Variable coverage of life cycle stages. Variable coverage of multiple stakeholder categories and impact subcategories.	Variable coverage of life cycle stages. Variable coverage of stakeholder and impact categories and their defined impact pathway (e.g. human health) – some studies focus on one impact pathway, other on many.
Type results ^c	Social performance or risks, organized along impact subcategories, stakeholder categories, and/or life cycle steps typically towards social well-being as the area of protection.	Impact categories comparable to E-LCIA towards defined Areas of Protection, such as well-being, addressing one or more stakeholder categories and/or life cycle steps.
Nature of indicators	Qualitative, quantitative, or semi-quantitative with more studies focusing on the latter.	Qualitative or quantitative with more studies focusing on the latter.
Object of the assessment ^d	Immediate activities and their effects.	Commonly short- and longer-term social consequences characterization.
Existing S-LCA databases	Databases that focus on but are not limited to performance evaluation at risk level (e.g. SHDB & PSILCA ^e).	Databases that focus on but are not limited to single or multiple impact pathway issues (e.g. Fair wage, EXIOBASE extension).

^a adapted on the basis of Chhipi-Shrestha et al. (2015)

^b adapted on the basis of Parent et al. (2010)

^c as defined by in the UNEP/SETAC 2009 Guidelines

^d adapted on the basis of Iofrida et al. (2018)

^e SHDB refers to the Social Hotspots Database and PSILCA refers to the Product Social Impact Life Cycle Assessment database

2.5 POSITIVE IMPACTS

Social impacts in product life cycles can be positive or negative; social conditions do not merely need to be protected from deterioration, but also need to be actively improved. This is underscored by the 17 Sustainable Development Goals (SDGs), where several of them, like Goal 1: No Poverty and Goal 2: Zero Hunger, address immediate needs for improvement. Until now, most S-LCAs have focused mainly on negative impacts. Yet, in the list of subcategories, there are some subcategories, such as Local employment, Technology development and Contribution to economic development, which highlight that we also expect to consider positive social impacts. However, there are some challenges linked to identifying, assessing, aggregating, and interpreting positive social impacts, which are comparable to the challenges associated with (negative) social impacts in general.

Positive impacts are benefits accruing through the product life cycle that make a positive contribution to the improvement of human well-being, i.e. beneficial impacts (as opposed to negative impacts, which are detrimental). They can be assessed by looking at positive effects experienced by affected stakeholders or through potentially positive proxies, such as positive social performance. An example of this would be the changes made by businesses that result in improvements of social conditions beyond mere minimal compliance conditions.

Including positive social impacts in the assessment of product life cycles is needed for several reasons:

- Product value chains/life cycles generate measurable positive impacts in the real world and the S-LCA framework should reflect them accordingly;
- Like negative impacts, positive impacts often create spill-over effects onto the production system and the society (e.g. positively influence the lives of family or community members through ripple effects or improve the performance of the workforce of a factory);
- For businesses, the ability to recognize and report positive impacts creates an incentive to advance their social sustainability strategy beyond legal compliance.

The inclusion of positive impacts should not compromise the continuous work on minimizing negative social conditions, nor should positive impacts be accepted as a waiver for negative impacts (offsetting is not accepted nor foreseen in S-LCA). Rather, the consideration of positive impacts is a prominent expansion of the current S-LCA framework and makes the options to pursue sustainability more complete.

There are differing views on what should be counted as a positive impact. It can be that a positive impact has to go beyond compliance with international law or reference points in international conventions and treaties or is an impact that intrinsically improves social conditions. Guidance on how to assess positive impacts is provided in Chapter 5. In general terms, there is an understanding that like negative social impacts, positive impacts are:

- The outcome of an activity in the life cycle;
- Related to how a particular activity is implemented or organized (e.g. a poor training will not create the positive impact expected in terms of better performance such as improved health and safety record);
- Context dependent;
- Direct or indirect (e.g. direct job creation by the company that provides the product or indirect job creation for road work required to provide the infrastructure needed to transport goods to the company);
- Assessed at the indicator or impact/subcategory level and non-transferrable (i.e. a positive impact on wages cannot make up for a negative impact on workers' health and safety);
- In addition, positive impacts are not the mere absence of negative impacts.

In practice we can differentiate three types of positive impacts:

1. **Type A – Positive social performance going beyond business as usual;**
2. **Type B – Positive social impact through presence (product or company existence);**
3. **Type C – Positive social impact through product utility.**

Multiple types can be occurring at the same time or be combined, e.g. positive impact through presence because an organization is going beyond business as usual by building a factory and creating jobs at a site where they would normally not put one because of other reasons (e.g. less profitable). Type C has rarely been assessed in S-LCA studies and only recently some first steps were taken to address this in E-LCA. Yet, this type C is specified here in order to acknowledge its existence and that it is also an element of S-LCA. It relates to the concept of Functional Unit, which is explained in Section 3.2.1. However, there are different views on whether it is relevant, warranted and fair to account for the positive social impacts related to the product utility. The characterization of types A and B occurs during the S-LCIA phase. The characterization of type C could be performed during S-LCIA or by the functional unit specification.

Table 4: Approaches from literature by type.

Type of positive impact	Type A	Type B	Type C
Description	Often business as usual is at compliance level but sometimes business as usual is below or above this level. A characteristic of the social performance is that it is often on a spectrum from positive to the related inverse negative performance. It also includes best practices that do not have an equivalent negative performance, such as employee volunteering programs.	Product life cycles also create positive social impacts through their presence. These tend to be impacts like employment, capacity building, or improved infrastructure. These impacts are either positive if the company is present in a location, or there are no impacts if the company is not present. They are important to consider when, for example, location changes in the life cycle are considered in order to mitigate negative impacts.	Positive social impacts can also result from the intrinsic characteristics of the product utility. For example, vaccinations or water treatment plants are products aiming at improving the well-being of people. Impact of this type, Type C – Positive social impact through product utility, happens in the use phase of a product. However, this should not cancel any adverse impacts occurring in other phases of the life cycle.
Literature	Assessing companies' performance on a scale from non-compliant to best-practices and considering the levels above compliance as positive impacts (e.g. Goedkoop et al., 2018).	Connecting economic activity or economic development to gains in public health (Norris, 2006).	Appreciating the positive social value of a product, for example of vaccines or a water treatment plant (Di Cesare et al., 2018; Kühnen and Hahn, 2019).
	Assessing positive impacts in terms of value created in stakeholders' favor (Di Cesare et al., 2018; Kühnen and Hahn, 2019). Assessing the positive impacts from companies going beyond business as usual and addressing root causes (Benoit Norris et al., 2019).	By identifying which subcategory of impacts has a positive connotation (e.g. job creation) (Ekener et al., 2018).	

2.5.1 SOCIAL HANDPRINTING

A social handprinting framework can be applied to identify and measure business positive social impacts. It assesses the impact of the changes being made by value chain actors (companies, suppliers) to improve their social impacts (reducing their social footprint and growing their social handprint). Handprints are the changes that we bring, compared to business as usual, which create positive impacts (reducing our footprint, namely, our own and that of others).

This framework starts with conducting a materiality assessment that includes an organization or product level social hotspots analysis. By implementing an intervention found to have leverage over the improvement of social conditions for an impact category, we bring about a change that can be considered as a Handprint. To measure the social handprint, we need to measure the outcome of the activity or change, and its impacts related to the impact category.

In order to consider handprints, we need to start with building an in-depth understanding of a company or product social footprint. These initial steps consist of an industry or sector supply chain materiality and footprint assessment,

a company or product supply chain hotspots and baseline assessment, and baseline refinement. Once the social footprint and social hotspots are known for the relevant impact subcategories, root causes have to be identified that provide the blueprint for the intervention/change. It is the measure of the outcome and impact of that change that goes beyond business as usual that constitute the social handprint.

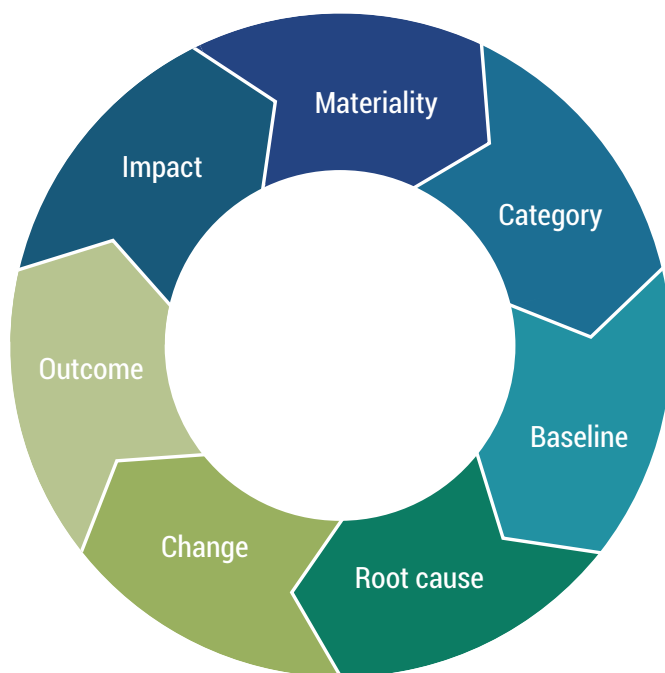


Figure 6: Handprint assessment process (Benoît Norris et al., 2019).

2.6 USES OF S-LCA

To summarize, S-LCA can be applied to calculate a social impact, social footprint, identify social hotspots (location or activity with high risk/impact), social handprinting, or to assess the potential impacts of a policy or investment choice. S-LCA can be applied for value chain social risk assessment, Human Rights Due Diligence, social handprinting, reporting, communication/labeling, as well as sustainable purchasing. S-LCA is a methodology that supports decision-making in order to improve social conditions in life cycles and value chains worldwide.

In summary, S-LCA may be embedded in organizational processes to:

1. Support companies in building a targeted strategy for future development of social policies;
2. Support decision-making processes that involve a variety of stakeholders with different knowledge and background;
3. Manage social risk thanks to the identification of social hotspots;
4. Provide structure, credibility, and consistency to supply chain materiality assessment;
5. Support the disclosure of non-financial information.

BOX 2: HOW SOCIAL LCA ADDS VALUE FOR STAKEHOLDERS?

- S-LCA provides a consistent view of social hotspots along the life cycle or value-chain;
- S-LCA ensures hotspots are understood rather than overlooked in product sustainability efforts;
- S-LCA, performed together with E-LCA, helps to understand the intersection of social and environmental issues, better aligning environmental sustainability efforts with social efforts;
- S-LCA results help focus stakeholder surveys on certain aspects and add depth to sustainability reports.

2.7 LINKAGES WITH INTERNATIONAL FRAMEWORKS

S-LCA's framework has numerous linkages with international initiatives and frameworks, including the 2030 Agenda and its SDGs, the 10-Year Framework of Programmes on Sustainable Consumption and Production (10YFP), the International Labour Organization (ILO) Decent Work Agenda, as well as the UN Guiding Principles for Business and Human Rights. More specifically, S-LCA is uniquely positioned to support numerous objectives sought after by these initiatives. Some examples and specifications are given in the following paragraph.

S-LCA can be positioned as a tool that can support reaching SDG 12 on Responsible Consumption and Production. It also has relevant connections with ten other SDGs: (1) No Poverty, (2) Zero Hunger, (3) Good Health and Well-Being, (4) Quality Education, (5) Gender Equality, (6) Clean Water and Sanitation, (8) Decent Work and Economic Growth, (10) Reduced Inequalities, (16) Peace, Justice and Strong Institutions, and (17) Partnerships for the Goal.

S-LCA can also support Goal 8 of the 2030 Agenda, which calls for the promotion of long-lasting, inclusive and sustainable economic growth, full and productive employment, and decent work. As such it can be seen as a tool that can contribute to the ILO Decent Work Agenda by contributing to the assessment of working conditions in value chains and life cycles worldwide. The ILO defines decent work as summing up the aspirations all people have for their working lives; for work that is productive, delivers a fair income with security and social protection, safeguards basic rights, offers equality of opportunity and treatment, prospects for personal development, and the chance for recognition and to have your voice heard. Decent work is also central to efforts to reduce poverty and is a path to achieving equitable, inclusive, and sustainable development. Ultimately decent work underpins peace and security in communities and societies, which is covered by S-LCA.

Another framework of importance to S-LCA is the 10-Year Framework of Programmes on Sustainable Consumption and Production (10YFP)¹¹. It was adopted in 2012 at the World Summit on Sustainable Development and is a global commitment to accelerate the shift towards sustainable consumption and production in both developed and developing countries. The One Planet network has formed to implement the commitment of the 10YFP. It is a multi-stakeholder partnership for sustainable development, generating collective impact through a number of sector-specific programs. As already highlighted by white papers from the Consumer Information Programme, S-LCA has an important role in enabling the assessment of the social impacts of production and informing more socially sustainable purchasing and consumption choices.

The UN Guiding Principles for Business and Human Rights has created a path for business to be actively engaged con-

11 <https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=1444&menu=35>

cerning human rights. S-LCA can support Human Rights Due Diligence mandated by the Guiding Principles.

2.8 LINKAGES WITH OTHER CORPORATE SOCIAL RESPONSIBILITY TOOLS

S-LCA is unique in the fact that it combines a systemic and comprehensive approach to value chains (the life cycle perspective) with social data and methods. This characteristic makes it valuable in the larger landscape of Corporate Social Responsibility (CSR)¹² tools. S-LCA can contribute to many of the methods and tools. It can serve materiality assessments, provide results used in reporting and communication, be used to prioritize social audits, and make sure certifications address the main social impacts in the product supply chain. As a tool, it can inform design and its results provide insights for policymaking. Obviously, the various tools have different objectives and scopes. The following table presents an overview of some of the main Social Sustainability tools and their usual scope.

Table 5: Overview of main social sustainability tools.

Type of technique or tool	Level of assessment		
	Project, intervention, or facility	Product	Organization
Assessment tools	Social Impact Assessment (SIA), Human Rights Impact Assessment (HRIA), Social & Human Capital Protocol, Social Return on Investment (SROI).	Social Life Cycle Assessment (S-LCA) including the Methodological Sheets for Social Life Cycle Assessment, Technology assessment, Social Footprint, Social Handprint, Handbook of Product Social Impact Assessment (PSIA).	Social Organizational Life Cycle Assessment (SO-LCA), Social Spend Analysis, Social Footprint, Social Handprint, Materiality Assessment, Human Rights Due Diligence.
Procedural and management tools	Social Fingerprint (SA 8000), Occupational Health and Safety Assessment Series (OHSAS) 18001.	Life Cycle Management.	Standards and Certifications: ISO 20400:2017 Sustainable procurement - Guidance Guidelines; ISO 26000 Social Responsibility, Sustainability Balanced Scorecard (SBSC); International Finance Corporation (IFC) performance standards.
Monitoring tools	Social Audits, Well-Being assessments.		Suppliers self-assessment.

¹² Although often social responsibility is regarded in a corporate context, it can also be regarded in a broader sense, not delimited to corporate

Type of technique or tool	Level of assessment		
	Project, intervention, or facility	Product	Organization
Communication tools	Certification.	Product certification (e.g. Business + Institutional Furniture Manufacturers Association (BIFMA)), Guidelines on Social Impact Product Communication.	Sustainability reports, Labeling, e.g. Fair trade labels, JUST, etc. Sustainability / Social Indexes.
Reporting tools	Oxfam Poverty Footprint.	Guidelines for providing product sustainability information.	Global Reporting Initiative (GRI) guidelines, Social reporting indicators, Sustainability Accounting Standards Board (SASB), Guidelines of International Integrated Reporting Council (IIRC), United Nations Guiding Principles (UNGP) Reporting Framework.

In addition, S-LCAs may be the source or use data coming from other data collection activities. This calls for the necessity to position S-LCAs in the greater context of social sustainability and social responsibility references and tools.

Pragmatically, conducting S-LCAs in a timely and cost-efficient manner necessitates knowledge of and making use of all resources available.

Six main types of references and instruments have been identified as relevant to social sustainability assessment:

1. International Policy Frameworks (i.e. International Conventions, Sustainable Development Goals, OECD Guidelines for Multinational Enterprises);
2. Codes of Conduct and Principles (i.e. company own codes of conduct, Global Compact);
3. Sustainability Reporting Frameworks (i.e. GRI);
4. Sustainability Implementation Guidelines (i.e. ISO 26000: 2011 Guidance on Social Responsibility, ISO 20400:2017 Sustainable procurement – Guidance);
5. Auditing and Monitoring Frameworks (i.e. Responsible Business Alliance, Social and Labor Convergence Project, Global Social Compliance Programme, certifications); and
6. Financial Indices (i.e. Dow Jones Sustainability Indexes).

In addition, other tools and frameworks may be relevant such as the World Business Council for Sustainable Development (WBCSD) Social & Human Capital Protocol. The references and instruments can be classified by their relevance for different phases of S-LCA.

Table 6: Social responsibility instruments (as listed above), references, and methods relevant for each phase of an S-LCA (adapted from Benoît 2012).

S-LCA phase	Types of instrument, reference, or method
Goal and scope/ determination and definition of subcategories and indicators	International Policy Framework, Codes of Conduct and Principles, Sustainability Reporting Frameworks, SR Implementation Guidelines.
Life cycle inventory	Sustainability Reporting Frameworks, Auditing and Monitoring Frameworks and Financial Indices, Social Impact Assessment.
Life cycle impact assessment	International Policy Framework.
Interpretation	International Policy Framework, SR Implementation Guidelines, Sustainability Reporting Frameworks.

The references are relevant to the Goal and Scope phase if they inform decisions relative to the assessment framework and the identification of indicators. The international policy frameworks constitute the foundation for all social responsibility initiatives, references instruments, and techniques including S-LCA. To be relevant to the life cycle inventory phase, the instruments and references need to offer data collection methods or be a source of data. Instruments and references are meaningful to the reference scale S-LCIA approach since they can provide performance reference points. Finally, references and instruments are useful at the Interpretation phase if they can inform the identification of significant issues or can be a useful tool to the presentation of results and the drafting of recommendations.

In comparison with other processes and tools, S-LCA can use most data of different scopes. It can make use of information at the level of the process, production site, organization, country, and country specific sector or commodity. Sustainability reports focus mostly on organizational level information. This is why S-LCA has so many connections with other tools.

SCOPE OF INFORMATION/TOOL

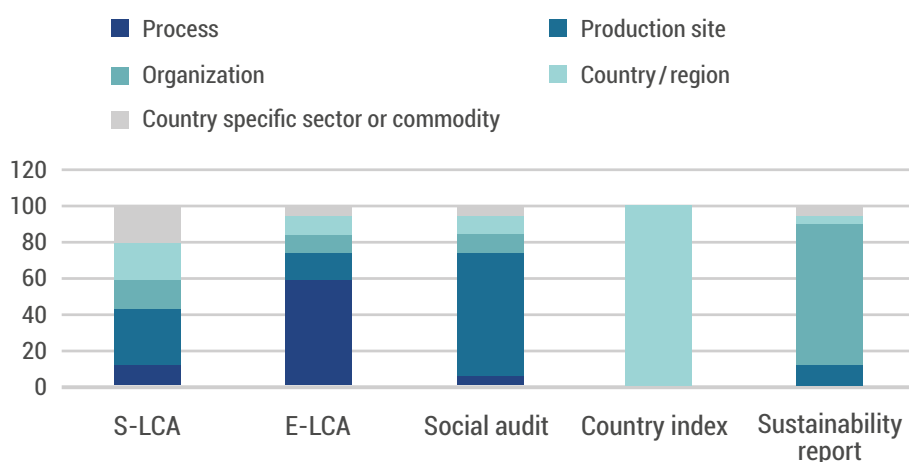


Figure 7: Estimate of the percentage of different scope level information used in a set of tools (adapted from Benoît, 2012).

Concerning use of data from other tools or approaches, for instance, practitioners can use data initially collected for a social audit or certification verification as part of their inventory. Practitioners could also use data from sustainability reports as part of their inventory. On the flip side, S-LCA results can be used to prioritize production activities that should be audited, and its results may be used in sustainability reports.

2.9 IMPLEMENTATION OF S-LCA AND SO-LCA

S-LCA and Social Organizational LCA (SO-LCA) implementation can benefit from previous experience and existing practice with other social and environmental assessment approaches.

For the general implementation of S-LCA and SO-LCA, three different paths are distinguished accounting for the organization's previous experience (see Figure 8). The blue and green outer circles of the figure represent the experience of organizations with social and/or environmental assessment approaches. The three paths indicate which of the three key features of SO-LCA are missing in the approaches already applied and need to be included for implementing S-LCA and SO-LCA.

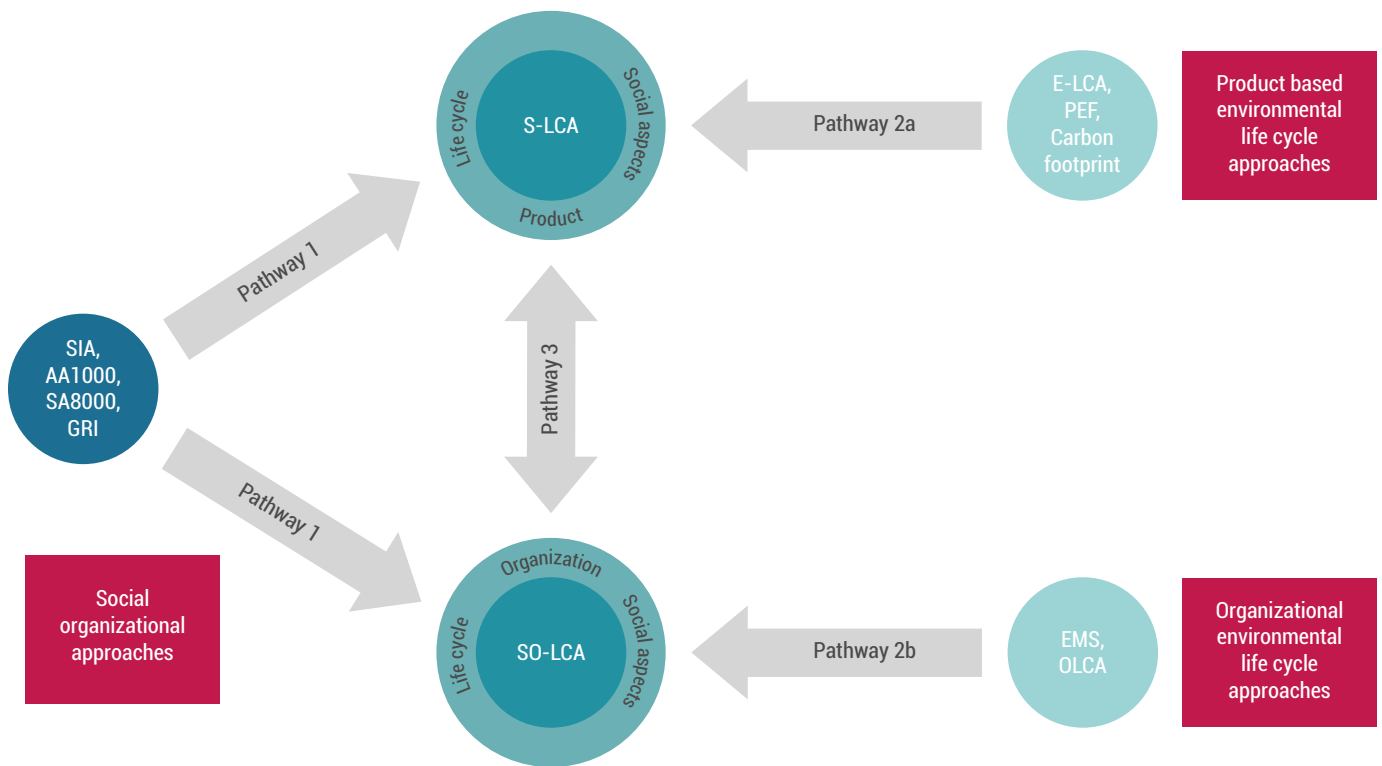


Figure 8: The three experience-based pathways to implement SO-LCA. The terms in the outer circles of S-LCA and SO-LCA describe the perspectives that need to be added when coming from pathways 1-3 source: Based on Martínez-Blanco et al. (2015c), abbreviations include: Social impact assessment (SIA), Accountability 1000 assurance standard (AA1000), Social accountability international sa8000 standard (SA8000), Global reporting initiative (GRI), Environmental management systems (EMS), Product environmental footprint (PEF).

2.9.1 PATH 1: EXPERIENCE WITH SOCIAL ASSESSMENT AT ORGANIZATIONAL LEVEL

Organizations that already apply social assessments at the organizational level, may use available results and experience as a starting point for implementing S-LCA and SO-LCA. Those schemes and standards can be helpful in two different ways:

1. They provide a preliminary definition of the organization's structure, inputs and outputs, etc. This may assist in the implementation of SO-LCA by defining the system boundary, the data needed, and the identification of the network of suppliers;
2. They allow for a straightforward data collection through transfer of existing data for completing the S-LCA or SO-LCA inventory on direct activities.

Further information on social assessments at the organizational level and details on which methods can support which S-LCA phases can be found in Section 2.8.

2.9.2 PATH 2: EXPERIENCE WITH ENVIRONMENTAL LIFE-CYCLE APPROACHES

While experience with product based environmental life cycle approaches (like E-LCA) can support the application of S-LCA, experience in organizational environmental life cycle approaches (like OLCA) can assist organizations in applying SO-LCA. Although the data collected for those approaches correspond to the environmental dimension, the existing experience can support in preliminary definition of the Goal and Scope, which would then be adapted to the social context. An example can be taken from Box 3.

BOX 3: O-LCA AS A PREREQUISITE FOR SO-LCA

When O-LCA is used as a prerequisite for SO-LCA, definitions of the reporting organization and the system boundaries may be also applicable for SO-LCA. Indeed, if the organization's overall aim is a sustainability assessment for the organization and its value chain, it should prefer to use the same scope in both O-LCA and SO-LCA. Additionally, with the combination, a preliminary inventory (data on inputs and outputs) may be provided of the reporting organization. This can be helpful for the identification of the suppliers, locations, and involved stakeholders. Furthermore, relations settled between different internal management levels and with suppliers, and data collection schemes developed by the organization for O-LCA, may provide a promising framework to apply SO-LCA.

NOTE: For small organizations and/or organizations with narrow portfolios, E-LCAs may bring comparable benefits for applying SO-LCA. The same may hold true for single-indicator footprints (Carbon and/or Water Footprints).

2.9.3 PATH 3: EXPERIENCE WITH PRODUCT/ORGANIZATIONAL SOCIAL LIFE CYCLE APPROACHES

Path 3 considers organizations that have already performed S-LCA of products from their portfolio and now want to further assess the social performance of the entire organization or, vice versa, organizations that have already accomplished SO-LCA and now intend to analyse the social performance of their products. Data on this level are highly useful, as most of the available social data and existing indicators used in S-LCA can also be used by SO-LCA and vice versa. Especially small organizations with a small product portfolio can benefit from existing S-LCAs when applying SO-LCA. In any case, performed S-LCA and SO-LCA studies may help to identify social hotspots. Caution is needed,

when transferring the S-LCA results to the organizational level, as unlike O-LCA where the results of previous E-LCAs could be weighted according to the number of products, a similar process may not be possible for SO-LCA. First of all, as qualitative or semi-quantitative values are difficult to sum up and second, as the risk of double counting may occur. Social impacts are often not expressed along impact pathways, which leaves the interrelations along the value chain open and unclear. For the same reasons, caution is needed when breaking down SO-LCA results to an organization's individual products.

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HOW TO CONDUCT SOCIAL LIFE CYCLE ASSESSMENT?



3. Goal and scope definition

Goal and Scope (G&S) definition is the first phase of an S-LCA study where the purpose, the object, as well as the methodological framework, are determined. The objective is to provide a clear statement of purpose of the study and define its breadth and depth.

This is a crucial phase of the process, which will have a significant impact on how the study will be conducted and, ultimately, on the results. The Goal and Scope, and by extension the complete S-LCA, are often carried out in an iterative fashion – it may be revised due to unforeseen limitations, constraints, or as a result of additional information uncovered along the way. Such modifications made during the process, together with their justification, should be documented. Participation of stakeholders (defined as those affected in any way by the study and its result) in the development of the Goal and Scope is strongly encouraged. This is in order to ensure optimal decision-making at this crucial phase.

3.1 GOAL DEFINITION

The first step of an S-LCA aims to specify why the study is being conducted. What is its goal? What is its intended use? Who is the target audience? What do we want to assess? Does the study intend to support decision making? On what topic? What are the potential improvement opportunities that are being sought through the knowledge that will be produced by the study? Which stakeholders are affected? The goal(s) should be clearly defined in order to ensure successful outcomes.

The goals sought by S-LCA case studies can vary. Examples of different purposes are:

- To support sustainable design of products;
- To support Human Rights Due Diligence of organizations;
- To identify main social Hotspots of a product and/or organizations;
- To quantify and qualify the potential social performance of products and/or related impacts, in order to support sustainable consumption;
- To examine potential social improvement options along the life cycle;

- To assess the most relevant stages in the social value chain in terms of social impacts/hotspots (materiality¹³, transparency);
- To assess and compare, when possible, potential social performance and/or social impacts of product-systems;
- To communicate the potential social performance and/or social impacts of the product to the public;
- To understand if the product value chain contributes to the social development of its stakeholders.

The target audience of a study can also vary – it may include the individuals or organization carrying out the study, trade unions and workers' representatives, consumers, governments, NGOs, international governmental organizations, shareholders, or product designers. It is central at this step to determine whether the study is intended for internal or external use, such as to be used in comparative assertions or to be disclosed to the public. In the latter case, it is recommended that a third-party external review be planned as part of the study.

Ideally, the goal of the study specifies whether to align it with attributional or consequential thinking. This will determine methodological choices in subsequent phases. This will not be discussed in detail in these guidelines, but more information on these two approaches can be found in the UNEP-SETAC report (2011; "Global Guidance Principles for Life Cycle Assessment Databases: a basis for greener processes and products") which describes these two modeling perspectives and associated methods.

3.2 SCOPE DEFINITION

The scope clarifies the object of the study and determines its methodological framework. It needs to be related to the goal of the study.

For this purpose, the following elements should be defined within the scope definition phase. Some elements are optional and may be excluded, depending on the goal of the study.

- Defining the object of the study, normally a product, a function, or a service (functional unit, explained later on);
- Defining the quantity of materials needed to produce the product or output (reference flow);
- Defining what steps, activities, and organizations are needed to comply with the functional unit (the product system);
- Identifying which parts of the product system are part of the assessment (the system boundaries)
- Choosing what variable(s) will determine the importance of different activities in the product system (activity variables);
- Stakeholders included and affected, and stakeholders' involvement strategy;
- Type of impact assessment method, and impact categories and/or subcategories included;
- Data collection strategies (inventory indicators, data type and data collection);
- Data quality requirements;
- Allocation procedures;
- Interpretation planned;
- Assumptions and value choices;
- Limitations;

13 For definition of Materiality, see Section 2.3 Main definitions and core concepts

- Type of critical review as elaborated in the ISO 14040-14044 if any;
- Communication strategies for the results (Selection of results to be communicated, communication format and specifications, type and format of report, other communication).

The system is pre-defined to a certain extent when setting its scope. The scoping decisions may be based on practical (e.g. data availability) or theoretical reasons (e.g. only processes until factory gate should be considered when comparing the same product but produced differently; see next section on system boundaries). Further detailed specification of the system is part of the life cycle inventory step. More details are provided on each of these elements in the next section.

3.2.1 DEFINING THE FUNCTIONAL UNIT

The function defines what is offered by the investigated product or service (referred to as 'product' thereafter, for the sake of simplicity), in measurable terms. It needs to be consistent with the Goal and Scope of the study.

The functional unit defines quantitatively the object of a study. It is particularly relevant in comparative studies, when two or more products are compared – it ensures that the product alternatives considered have been compared on an equivalent basis. Defining the functional unit is also important for determining the reference flow. It is necessary to define a functional unit to use an S-LCA database, typically in monetary terms because of the use of trade models. For more information see Section 4.1 on LCI.

In order to define the functional unit, it is helpful to first clearly identify the product to be investigated, including its main function(s) and product utility – in other words, the core characteristics of the product. The location for the use of the product can also be identified if relevant.

Product utility refers to the perception of the consumer in regard to what the product provides, besides its function (the capacity of a good to satisfy a need). This appreciation is linked with his/her cultural and social values, as well as his/her desires and satisfaction. Product utility can be identified in technical terms (quality, functionality, etc.) or in social terms (convenience, prestige, etc.). This respective characterization of a functional unit aligns with the specification of a type C positive impact (See Section 2.5). Implicitly, this type of positive impact is thus already present in the assessment, but this could be explicitly brought forward as a type C positive impact.

The following items can assist in identifying the core characteristics of a product. We are using the example of a T-shirt for illustration:

1. Functionality (to cover the body, being comfortable, dry...);
2. Technical quality (cotton, short sleeves, no buttons, durable, washable...);
3. Additional services (to be used as a cloth after discarding...);
4. Aesthetics (embroidered, printed, new cut/shape...);
5. Image (of a popular brand...);
6. Price (maximum cost, affordable for certain segments of the market...);

7. Specific environmental and social labelling (labels, certifications...);
8. Duration of function or utility¹⁴.

There may be several ways to fulfill the function. In the example of a T-shirt, either a T-shirt or a Shirt could fulfill the functionality 'to cover the torso'. One should add all relevant characteristics as a means of narrowing down the function as much as possible. For example, if a T-shirt is to be used for sporting activities, this should be specified. The characteristics listed for the product can provide information on other products that could meet the required function. In the example, T-shirts from different brands could be considered¹⁵.

An illustration of product utility, function and the functional unit is shown in Figure 9.

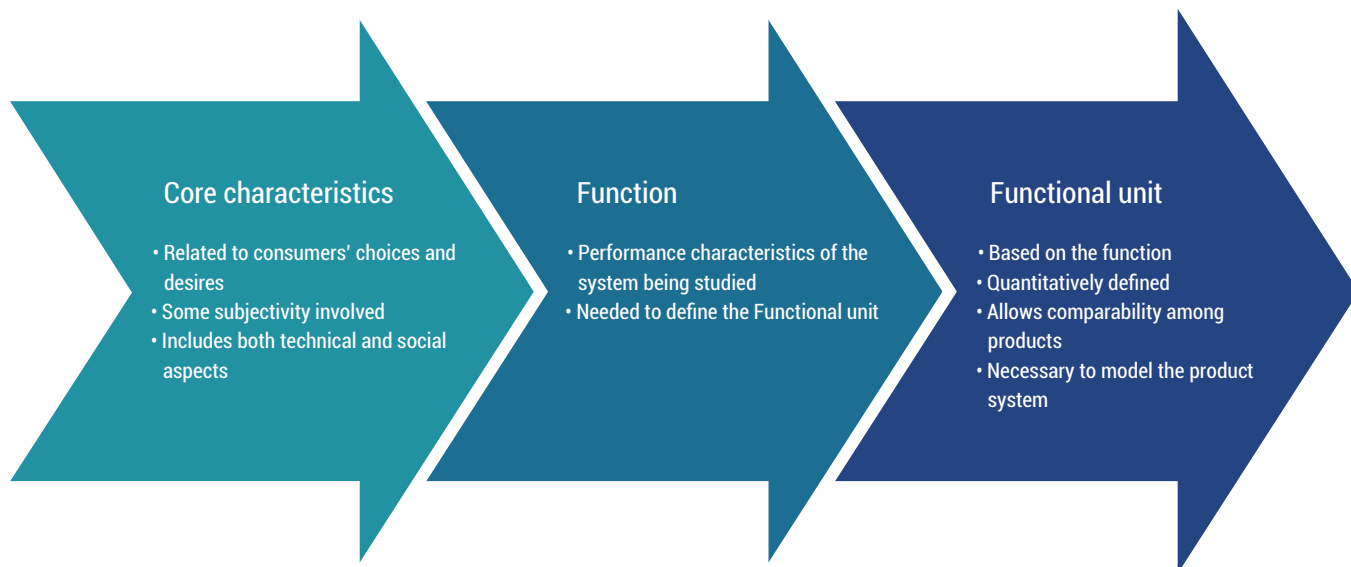


Figure 9: Steps to identify Functional unit.

A clearly stated functional unit should include reasonably narrowed down functions and utilities of the product, the duration of the function, and the location and year (ideally) when the function takes place. For example: "To cover the body of one person for 70 days during two years in the context of indoor sporting activities in Norway in 2019 and 2020". When using a modeling approach based on economic flows/ trade (see Section 4.1.1), which is usually the case when using an S-LCA database, the functional unit may be described as a currency amount (e.g. dollars, euros, or other depending on the currency used by the economic input output model). For instance, this currency amount can represent the economic value of a T-shirt or the economic value of T-shirts sold or produced over a period of time (e.g. financial year, quarter) depending on the goal(s) of the study. See Section 4.1.1 for more details.

Below are examples of functional units from past S-LCA studies. Some mention the core properties as well.

14 The duration of the function/utility is particularly relevant in order to identify whether other products/services are necessary to fulfill the required function. For example, if it is determined that the function of a T-shirt is to cover the torso of one person for 70 days over two years with its initial characteristics, it is necessary to consider that a certain amount of water and detergent are necessary for the fulfillment of this function, whose production and use might be linked to social issues. Accordingly, a T-shirt that lasts twice as long would reduce the amount of materials and energy needed, and thus probably the associated social impacts.

15 For practitioners who are aiming to seek alternative products to perform the comparison, guidance can be found in the work of Weidema et al. (2004).

Table 7: Functional Unit from S-LCA case studies (2009-2017).

Sector	Functional Unit / Properties	Reference
Floriculture	The functional unit is a bouquet of roses with 20 caulis per spray, packaged and transported to the flower auction in Aalsmeer, the Netherlands. The considered market segment is long stemmed roses. It is assumed that the quality of the roses produced in Ecuador and the Netherlands do not differ, even if the quality of roses is commonly better in Ecuador.	(Franze and Ciroth, 2011)
Hygiene	Functional unit: to assist in the cleansing and scenting of a person during a year (one shower a day). The product must contain organic material and the packaging should include recycled material. The producer should be recognized in the market, especially in regard to product quality and service offered. Because of the characteristics of the product, the purchase costs may be higher than the popular products. The product should contain material coming from local communities.	(Ugaya et al., 2011)
Electronic	The functional unit in the study is a laptop with generalized features and with a typical system of such a computer.	(Ekener-Petersen & Finnveden, 2013)
Waste	The functional unit is to collect the used cooking oil generated in neighborhood of 10,000 inhabitants for 1 year in the city of Barcelona considering the efficiency of each collection system.	(Vinyes et al., 2013)
Building	The functional unit is the amount of material (concrete and steel) needed for 1 m ² of floor area created for dwelling and working places for humans.	(Hosseinijou et al., 2014)
Fertilizers	The functional unit is to fulfill nitrogen fertilization demand to produce 1 ton of tomato (henceforth, 1 ton of fertilized tomatoes).	(Martínez-Blanco et al., 2014)
Agrifood	The functional unit is 1 kg of the tomato Cuore di Bue, which meets the nutritional needs of an individual, thus representing an excellent source of antioxidants, dietary fiber, minerals, and vitamins.	(Petti et al., 2018)
Clothing	The functional unit is defined as the production of 1 USD worth of clothing for Swedish consumption.	(Zamani et al., 2016)
Automotive	The functional unit is the production of an instrument panel for a midsize vehicle for an automobile life span of 200,000 km.	(Pastor et al., 2017)

3.2.2 DEFINING THE REFERENCE FLOW

The reference flow translates the functional unit into specific product flows and enables the practitioner to identify the material inputs necessary for the fulfillment of the functional unit. In the T-shirt example, the body of a person can be covered by T-shirts from different brands. If, however, *Brand X T-shirt* lasts one year and *Brand Y T-shirt*, two years; then the reference flows will be: **2 Brand X T-shirts** or **1 Brand Y T-shirt** respectively, to cover the period of 2 years. The actual number of T-shirts required will ultimately have an impact on the amount of material inputs required, in turn linked to social impacts in the life cycle of that material, even though it does not necessarily scale linearly due to potential thresholds.

BOX 4: HOW THE FUNCTIONAL UNIT AND REFERENCE FLOW ARE USED IN S-LCA

In all S-LCA studies, the functional unit and reference flow are used to identify the object of the study and to help determine the product system and thus the part of the inventory.

As will be described in Chapter 5, in some S-LCA studies, they are also used in order to scale the results obtained at the impact assessment phase. In other words, the results obtained become proportional to the material inputs necessary to fulfill the functional unit.

Given that some potential social impacts do not depend on the physical flows and the nature of unit processes but more on the behavior of the companies and stakeholders involved in the life cycle under analysis, some practitioners do not provide results that have been scaled to the functional unit. One such example could relate to the assessment of forced labor where its presence would be flagged but not scaled to the number of T-shirts part of the product system. The absence of scaling in impact assessment can be performed both for practical (shortage of data or confidentiality) or conceptual reasons (i.e. because of rule-based ethics in which the occurrence of an issue is evaluated and not necessarily the extent or their consequences, because of using qualitative social impacts, or because social impacts might not scale linearly). The reasons for the absence of scaling should be specified and discussed.

On the other hand, on the same impact type, other practitioners may say that if producing two T-shirts involves more hours of work and more material inputs than producing one T-shirt, it is likely that the identified (potential) social impact will be proportionally larger.

It is also worth noting that until all forced labor (or child labor, etc.) is eradicated, some amount will be found in all value chains. Therefore, providing an estimate of the scope of the value chain where the issue is of particular importance provides meaningful information.

3.2.3 DEFINING THE PRODUCT SYSTEM

Based on the definition of the functional unit, the product system is defined. The **product system** is the collection of interconnected unit processes in the life cycle of the product, as defined in the ISO 14040-14044¹⁶.

A **unit process** is the smallest element in a product system where data can be collected – it typically represents a transformative process in the life cycle or, in simpler terms, an activity of an organization (e.g. manufacturing in a factory) in the life cycle. Often, a 'unit process' can be associated with an 'activity', e.g. the unit process of washing vegetables with the activity of workers to wash them.

Ultimately, the product system should fulfill the functional unit. The product system is usually depicted in a process flowchart which shows the linkages with varying levels of detail. Given that geographical specificity is necessary for the adequate quality of S-LCA studies, it is also crucial to specify the geographical location of those unit processes and name the companies/factories involved in the system, if known. The system should include all inputs and outputs including not only raw materials, but also energy, ancillary materials, and services needed in each unit process along the product system. The product system may be built based either on information/data on the life cycle, on process

¹⁶ The latter is commonly relevant for attributional thinking. For consequential thinking, this would be the processes caused by a decision, usually an extra demand for the functional unit (for further information see the UNEP-SETAC guidelines (2011)). Despite some differences regarding the propagation of the product system, further elaboration holds for both.

data, on economic input-output data (see Box 5), environmental data, purchases/expenditures, or a mixture of these.¹⁷ At this stage of the Goal and Scope, it is usually useful to do a literature review to assist in developing a good understanding of the product's life cycle.

A simple product system of the T-shirt is shown in Figure 10, considering in this case all the stages of the life cycle, but limited to some inputs (for example, fuel need for transportation is not shown in the figure).

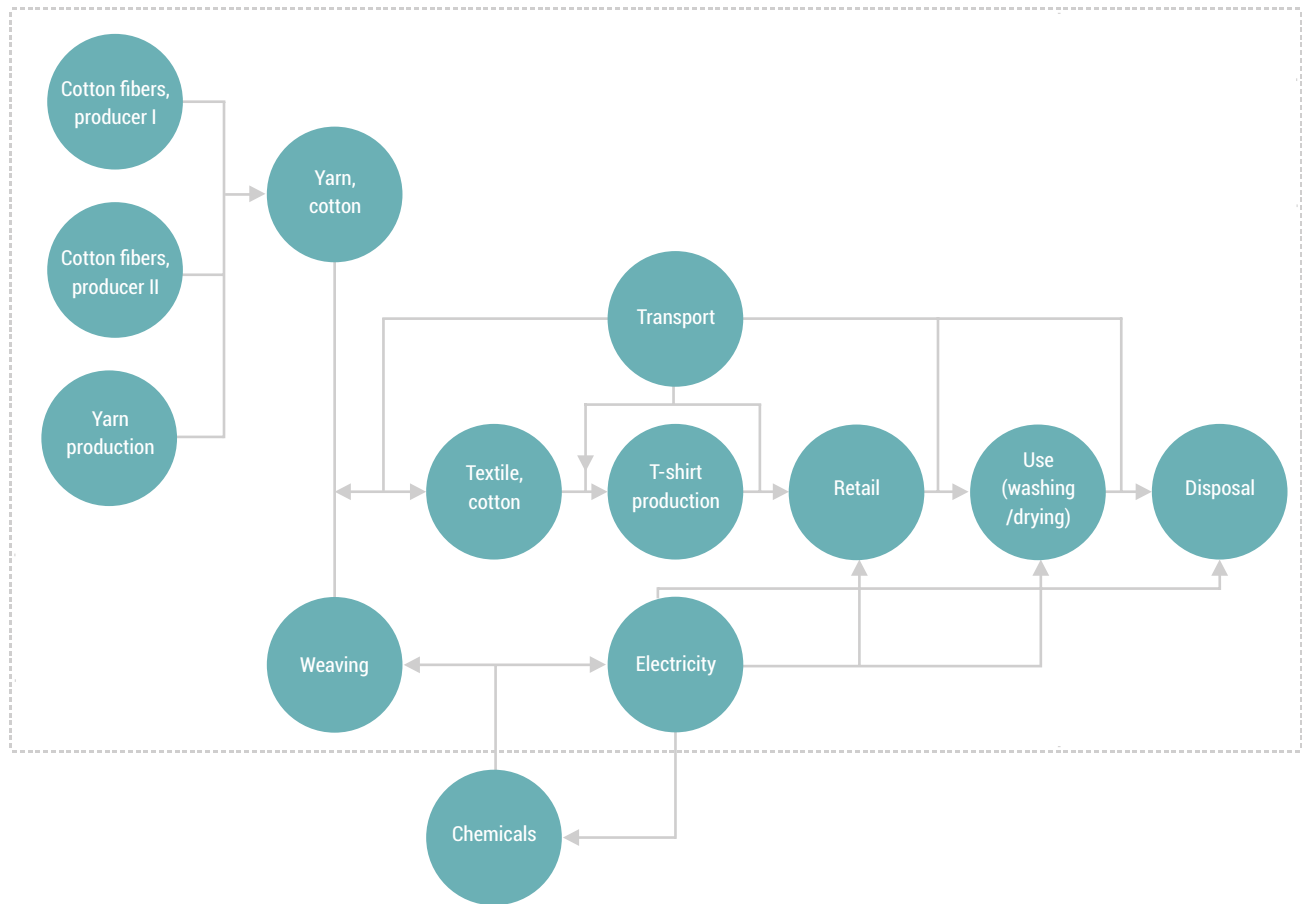


Figure 10: Example of a product system, here limited to technological processes.

17 Economic input-output models consider the transactions between industrial sectors in the world economy. In these models, the processes are relatively aggregated. The models allow to identify sectors involved far upstream in the making of a product but provide less details than a process-based model. Process data offer detailed information on specific processes but does not allow to have as much of an in-depth view upstream.

BOX 5: USE OF INPUT-OUTPUT ANALYSIS IN S-LCA

Input-output tables can be used to determine a product system. They are mobilized in such a way by S-LCA databases (SHDB, PSILCA). Input-output tables represent worldwide commercial exchanges between country specific sectors – as they take into account the whole economy. They provide a comprehensive overview of the supply chain of the system being studied. However, by essence their data are aggregated, e.g. on sector-country level. The tables include not only exchanges concerning material inputs, but also exchanges concerning immaterial goods and services (e.g. legal services, business services, etc.). See section on life cycle inventory, and specifically Section 4.1.1, for more practical information.

3.2.4 IDENTIFYING THE SYSTEM BOUNDARIES

The system boundaries determine the parts of the product system that will be included in the system being assessed. A system will typically entail foreground processes (situated closer to the studied product, thus more likely to be directly studied; for which often specific data are collected) and background processes (further upstream or downstream, for which often generic data from databases are applied) in the product system.

The system boundaries should be coherent and relevant in relation to the goal of the study. They should be defined according to the life cycle logic, which includes all phases from upstream processes (i.e. the processes linked to resource use, purchasing of goods, and services by the company) to downstream processes (i.e. linked to the distribution, use, and the end-of-life of products). Ideally, the system boundary should be from cradle to grave, but the goal, resources, and available data do not always warrant or allow assessing the entire life cycle. Boundary setting is often performed in an iterative way and if it is needed to narrow the scope of the product system considered, it should be properly explained and justified.

When setting the system boundary, two perspectives of the system can be taken into account (Zanchi et al., 2018):

1. **The physical perspective** based on the technological processes or economic flows that characterize the value chain;
2. **The effect perspective** based on the interaction between companies, stakeholders, and the relations among stakeholders involved in the life cycle, as a result of the activities carried out.

The physical perspective allows to define the production cycle and the life cycle stages; the effect perspective ensures that key life cycle stakeholders are included.

In the T-shirt example, illustrated by Figure 10, not all processes displayed were considered in the study from which the example is drawn. In this case, the study did not include the production of chemicals because of pragmatic limitations in data collection. This is represented with the grey outline (Figure 10), which includes all processes selected within the boundaries.

3.2.5 ACTIVITY VARIABLE

The activity variable is a measure of process activity which can be related to process output. Activity variables, scaled by the output of each relevant process, are used to reflect the share of a given activity associated with each unit process. As such, it does not represent an impact but rather an elementary flow used to compare the intensity of the processes and aggregate impact assessment results. The activity variable may be used to represent the impact share of a process compared to that of the product system (e.g. working injuries can be partitioned among processes based

on worker hour(s) per process; see Section 4.2 on co-products). Figure 18 presents an example. The activity variable is useful to represent the product system in a way that gives an idea of the relative significance of each unit process in the whole system.

Some studies use an activity variable and others do not. The decision to use an activity variable or not should be documented in the Goal and Scope. More information on the activity variable can be found in the inventory chapter in Section 4.1.3.

3.2.6 CUT-OFF CRITERIA

The studied system boundaries may depend on the goal of the study and the amount of resources available to obtain the necessary data. Because of practical limitations, e.g. data needed can only be obtained through onsite data collection, it may be necessary to reduce the breadth of the studied system, even when a cradle to grave scope would have been preferred.

Since the system under analysis may be substantial, out of practical reasons, cut-off criteria are needed that exclude some of the unit processes from the initially identified system. For example, the box for 'Transport' in Figure 10 would also include the vehicles being produced upstream (and the machinery and infrastructure to produce them and so on) – as vehicles are necessary for transport. Yet, Figure 10 excludes vehicles production. According to the ISO 14040 standard, all relevant parts of the life cycle shall be included in the study. There is a risk that cut-off may be used to leave out sensitive issues. Therefore, the question remains:

Which unit processes should absolutely stay in and what can be left out?

Cut-off criteria are not presently applied in a consistent manner in S-LCA. It is possible to identify three types of cut-off criteria which are:

1. Social significance;
2. Identical elements;
3. Available resources.

Figure 11 shows the different types of cut-off criteria, the approaches, and some suggested papers for further information.

Some authors use social significance cut-off criteria through quantitative (i.e. using activity variables) and/or qualitative (i.e. considering the processes which present more potential for social concern) approaches. It is also possible to leave out some processes in comparative S-LCAs, where only differing processes need to be included. Social significance as a cut-off criterion is recommended in S-LCA. Cut-off criteria based on lack of resources should be avoided if possible. It is important to be very transparent when presenting the system boundaries and the cut-off methods.

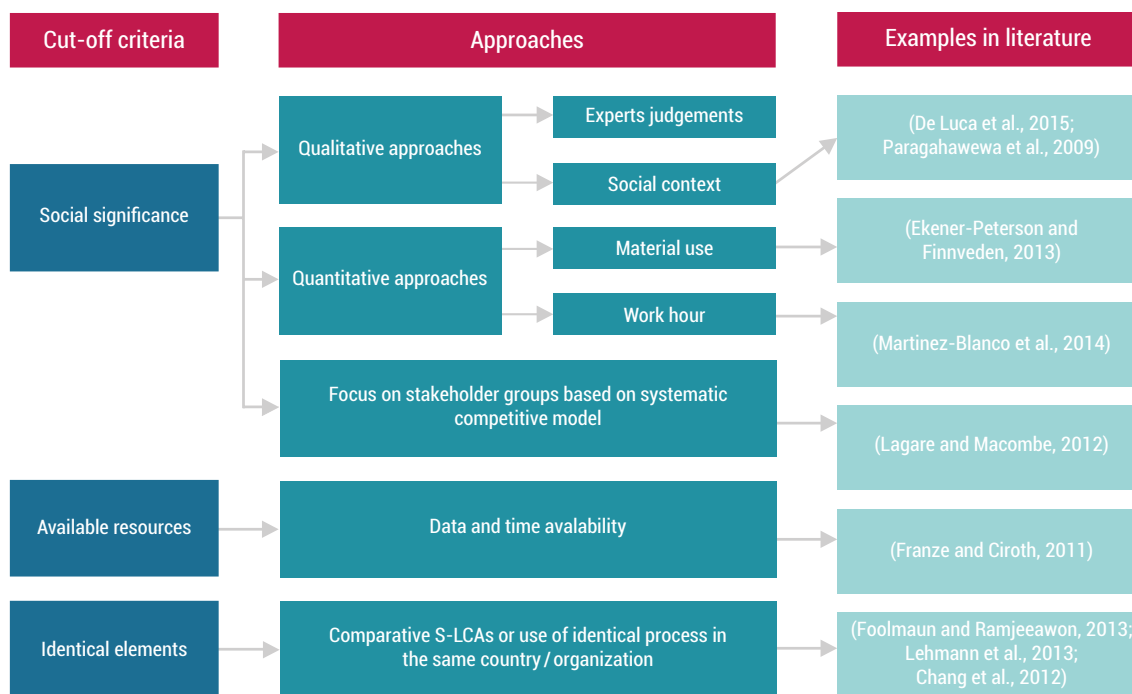


Figure 11: Summary of types of cut-off criteria, approach used, and literature suggested.

3.2.7 LIMITATIONS OF DATA ACCESS

In order to perform an S-LCA, generic and/or site-specific data need to be collected for the various steps of the value chain/life cycle. However, onsite data collection is resource heavy and time-consuming and conducting field investigations in all the phases of the life cycle (very often occurring in different locations of the world) is often not feasible. Consequently, the amount of resources available to obtain specific data is often the limiting factor in the definition of the product system. In general, site-specific data is more difficult to obtain in the outer ends of the product system, such as raw material extraction and waste handling. In order to keep a life cycle perspective, not cutting off the ends of the product system, **the practitioner can use generic data, or complement on-site data collection with generic data for some part of the value chain (often the case for background processes)**. Databases are available that provide generic information on social aspects in country-sector combinations (see Chapter 4).

3.2.8 STAKEHOLDER CATEGORIZATION & INVOLVEMENT

In S-LCA, a stakeholder category is a group type that can be affected by the activities of organizations involved in the life cycle of the product, service, or organization under consideration.

The list of stakeholder categories, considers the main categories potentially impacted by the life cycle of a product, as presented in Chapter 2. These stakeholder categories are: Workers, Consumers, Local Communities, Society, Children, and Other Value Chain Actors.

In addition, other stakeholder categories can be defined, and stakeholders should be involved when conducting an S-LCA (in line with the Goal and Scope).

Stakeholders to be involved can be identified through different approaches. The process for the selection of the stakeholder categories to include and the stakeholders to involve in the study shall be transparently documented including the justification. A materiality assessment can support stakeholder(s) selection.

BOX 6: EXAMPLE OF A NORMATIVE APPROACH TO IDENTIFY STAKEHOLDERS

An approach to the selection of stakeholders could use the following three criteria:

1. **Impact:** *This criterion is also used in E-LCA and in a Human Rights Due Diligence process and consists of gathering those affected by a certain production process;*
2. **Legitimacy:** *It consists of identifying the representatives of interests' groups;*
3. **Completeness:** *It consists of including stakeholders with different social representations and attributes.*

The stakeholder categories selected may have a direct relationship with a production activity of the product system or may be in relation to a stakeholder that is affected by one. Thus, the selection of stakeholders may vary from one study to another but can also vary within each step of the value chain of the same study. The selection of stakeholder categories also affects the choice of impact categories and subcategories at each step of the life cycle. The main rule is:

ALL RELEVANT stakeholders and impact categories should be considered in an S-LCA study.¹⁸

Practitioners may also choose to develop new stakeholder categories or subdivide existing ones, if relevant to the studied product, service, or organization. This may be relevant in order to ensure that the study takes into account more vulnerable stakeholders, which may not have a voice in power relations. For instance, the list of stakeholders could be further detailed by specifying different types of workers (e.g. women or migrant workers within the worker's category). Besides covering all individuals, double counting among categories (e.g. a person is both a worker and a consumer) is kept in mind when considering results of the stakeholder groups.

Few studies manage to cover all stakeholders and impact subcategories. Inclusion and exclusion of different stakeholder groups and/or impact categories should be justified on the basis of their relevance to the goal of the study, and the choice process should be described. In practice, consumers, value chain actors, and society are often overlooked as stakeholder categories, while workers and local communities appear to be frequently included.

Applying participatory approaches (i.e. approach in which actors participate and contribute to the study or scientific process) in stakeholder selection allows the perspective of different actors involved in the system under investigation to be taken into account and, in turn, makes S-LCA studies more locally relevant. Stakeholder participation can help in the selection of a final set of indicators that reflect stakeholders' values, improves democratic representation, and promotes empowerment and learning opportunities for communities while encouraging partnerships. Moreover, it increases the legitimacy of the assessment.

One well-known participatory approach is focus groups. A focus group is a type of group interview organized to acquire a portrait of combined local perspective on a specific set of issues. Focus groups with a range of actors can be used to identify relevant stakeholder groups and indicators. Focus groups can also be used in impact assessment when defining the relative importance (weight) of each impact (sub)category.

¹⁸ The choice of relevant stakeholders and impact categories varies according to the goal of the study, the intended uses, the analyzed territorial context, the complexity of the value chain, and other elements like cultural background and values.

3.2.9 IMPACT ASSESSMENT METHOD AND IMPACT SUBCATEGORIES

3.2.9.1 IMPACT ASSESSMENT METHOD

The choice of impact assessment methods ought to be specified in the Goal and Scope of a study. This includes (also compare to Figure 12):

1. Select the impact assessment approach;
 - a) Reference Scale S-LCIA; or
 - b) Impact Pathway S-LCIA;
2. Identify the social topic(s) of interest;
 - a) Select stakeholders, subcategories and/or impact categories (if using Reference Scale (RS) S-LCIA);
 - b) Select stakeholders and impact categories (if using Impact Pathway (IP) S-LCIA);
3. Present the prerequisites for the respective S-LCIA method chosen;
 - a) Reference scales used for assessment (if using RS S-LCIA);
 - b) Characterization model and type of impact pathway used for assessment (if using IP S-LCIA);
4. Determine the weighting approach (if applicable).

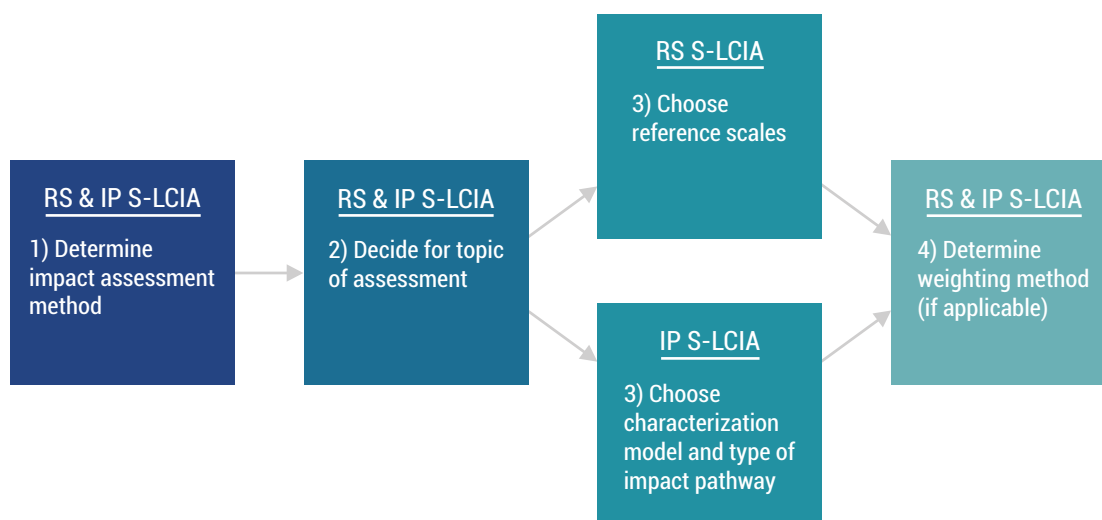


Figure 12: Steps in the G&S with regard to impact assessment dividing into RS S-LCI and IP S-LCI.

For further guidance see Section 2.4 and Chapter 5.

NOTE: As explained in Chapter 5, there are different types of impact assessment in S-LCA. RS S-LCIA utilizes subcategories (or impact categories) related to the stakeholders affected and the organizations evaluated according to reference scales. IP S-LCIA makes use of social impact pathways from the social activity/stressor to the social damage. The selection of the type of impact assessment is important, as it will have implications on the data collection during the inventory phase.

3.2.9.2 IMPACT CATEGORIES AND SUBCATEGORIES

Subcategories and/or impact categories (introduced in Section 2.2) to be covered in the study also ought to be defined at the Goal and Scope phase (this relates to the second step as described in the previous section and Figure 12).

The subcategories/impact categories can be independent from the type of impact assessment chosen (RS S-LCIA or IP S-LCIA) and should cover the relevant social and socio-economic impacts from the product life cycle associated with the stakeholders selected for the study. However, RS S-LCIA typically has a stronger focus on impact subcategories and stakeholder groups (compare Table 8) while IP S-LCIA typically classifies inventory indicators with impact categories at the midpoint and endpoint level (compare Table 9). As mentioned in previous sections, midpoint covers the characterization of impact midway through the cause-effect chain and endpoint at the stage of Area of Protection, i.e. the final impact on human well-being.

Table 8: Example of prominent linkages between stakeholders and subcategories for RS S-LCIA, within the impact category Labor rights.

Stakeholder	Impact Subcategory
Worker	Child labor
	Forced labor

Table 9: Example of linkages between inventory indicators and impact categories in IP S-LCIA, within the impact category Labor rights.

Inventory indicator	Midpoint impact	Endpoint impact
Worker	Wage level	Standard of living
	Schooling	Human development

An iterative refinement is recommended for the subcategory/impact category selection, comparing Goal and Scope and Impact Assessment phases when results have been obtained. In an earlier stage, materiality assessment can aid in identifying relevant categories.

3.2.10 INDICATORS, DATA TYPE, AND DATA COLLECTION STRATEGIES

The status of impact or subcategories is assessed by collecting data on one or several indicators, selected to cover the most relevant aspects of the category. The link can be illustrated with an example below.

Table 10: Example of a linkage between stakeholders, subcategories, and indicators.

Stakeholder	Impact Subcategory	Indicator
Worker	Child labor	Hours or percentage of child labor in the workforce

In the Goal and Scope phase, it is important that the list of indicators and metrics refer to the respective impact and/or subcategories which ought to be assessed in the study. Data collection methods should also be specified. A table with the subcategories, their corresponding indicators, and data collection methods should suffice to communicate this information. More guidance on indicator choice and data collection is provided in Chapter 4.

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4. Life cycle inventory

The Social Life Cycle Inventory (S-LCI) is about collecting data for all unit processes within the system boundaries (as defined in the G&S). It involves:

1. Identifying the data to be prioritized for collection;
2. Collecting data for hotspot assessment if this is part of the Goal and Scope;
3. Collecting data for the selected/relevant stakeholders and subcategories;
4. Collecting complementary data for the impact assessment (**NOTE:** This part is heavily dependent upon the Type of S-LCIA chosen);
5. Collecting site specific (primary) and generic (secondary) data for unit processes and activity variables;
6. Collecting data for scoring and/or weighting.

NOTE: This part is heavily dependent upon the Type of impact assessment chosen.

4.1 HOW TO CONDUCT THE LIFE CYCLE INVENTORY ANALYSIS?

4.1.1 THE BASICS OF LIFE CYCLE INVENTORY IN THE CONTEXT OF S-LCA

In the Goal and Scope section, the functional unit/reference flow (e.g. one banana) and the related product system including its system boundaries have been specified (e.g. cradle-to-gate of banana producer). The life cycle inventory consists of the inventory of all flows of that studied system normalized per functional unit (if implementing a quantitative approach). For example, for that banana system, 55 kWh of electricity is consumed worth 5.50 USD, 2 working hours are needed and the wage is below the living wage, etc. During the Life Cycle Inventory, we need to collect the information about the activity variable (e.g. worker-hours) when applicable (see Section 4.1.3 on activity variable). We also need to collect data for the social flows (indicators) (which link with the socio-economic system through the activity variable, e.g. worker hours, just like pollutants and resources from nature are elementary flows for an E-LCA).

To obtain this inventory, the following steps are taken:

1. The studied system is subdivided into interlinked **processes that provide products or services to each other** e.g. fertilizer production and agricultural cultivation etc. This results in a flow chart, which is already part of the G&S;
2. **For each process, flow amounts are obtained**, which are commonly normalized to a process output, e.g. 5 kWh electricity to produce 1 kg of fertilizer. Furthermore, information on the system can be collected;
3. The total amounts of the processes and their flows are **quantified for the reference flow**, which is **commonly done based on a linear relationship**, i.e. if 2 worker-hours are needed for 1 kg of fertilizer, then 4 worker hours are needed when 2 kg of fertilizer is indirectly needed;
4. Data on the social inventory data related to the main stakeholders defined in the G&S must be collected for all processes and flows before defined, e.g. salary of workers involved in the production of 2 kg of fertilizer as well as for 5 kWh of electricity.

When it comes to the **calculation method** of step 3, this can be done iteratively, tracing back amounts through the system, e.g. 1 kg of banana needs 0.1 kg fertilizer and 1 kg fertilizer needs 5 kWh electricity, so 1 kg of banana needs 0.5 kWh of electricity for fertilizer production. The linear models are apprehended to calculate all these flows in an LCA software. For an overview on this type of modelling in the context of LCA, see the work of Suh and Huppés (2005). Existing LCA software tools such as SimaPro and OpenLCA provide access to these linear models and to impact assessment methods.

Since a typical product system directly and indirectly encompasses thousands of processes, databases and models have been developed.

If collecting solely qualitative or semi-quantitative data, only step 1 needs to be applied.

For steps 1 and 2, **life cycle inventory databases** which already contain data on several processes (process-based) or sectors (Input/output-based) are available. For more on these databases, see Section 4.1.6 on generic and secondary data collection.

The **foreground system modelling** steps 1 and 2 (and possibly step 3) can be performed automatically via a database or manually, i.e. specify the processes and their flow amounts.

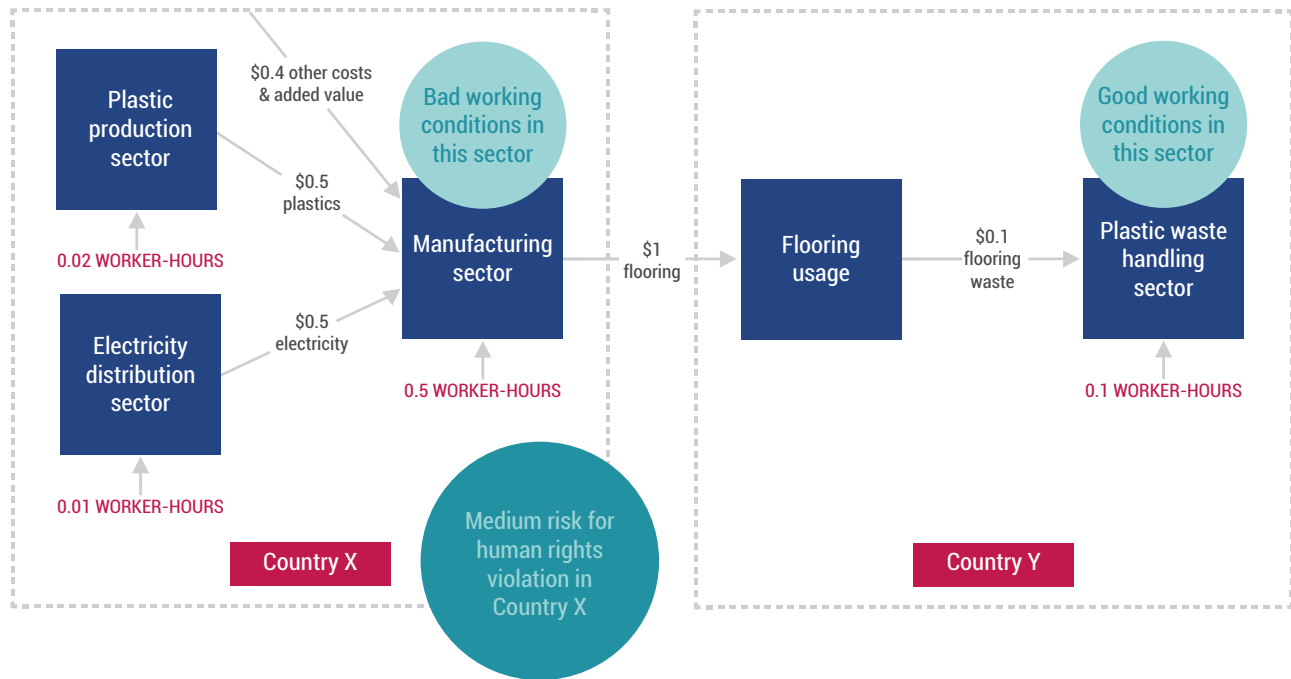
When applying a **qualitative approach**, the processes will simply be identified without attempting to link them quantitatively (i.e. it will just be identified whether there is a link/flow, not the flow amount).

For modelling the **background system, a database and software will usually be used**. When manually modelling the foreground system the results of it can then be combined with the automatically generated background to cover the complete product system. When it comes to software, some allow new processes to be directly implemented and linked with the database and calculations (e.g. GaBi, SimaPro, openLCA).

The above approach illustrates a "process-based"-model, i.e. a product system is subdivided into processes (process-based). **Similarly, the system can also be divided into "sectors"**. The sectors are related by economic flows from a specified currency (see example in Figure 13 and Box 7). This sector-based approach is often applied to S-LCA. These approaches can also be combined as hybrid approaches. See the work of Suh and Huppés (2005) for an overview on process-based, sector-based, and hybrid approaches.

Life cycle inventory based on sectors, fictional example for a part of the system of flooring products

Flows are valid for a certain time period, e.g. the year 2019



Life cycle inventory for 1 \$ of flooring with worker-hours as activity variable:

- 0.5 worker-hours in bad working conditions
- 0.53 worker-hours in a country with medium risk of human right violation
- 0.1 worker-hours in good working conditions

Figure 13: A generic example for a life cycle inventory approach based on sectors, which is often used in S-LCA databases. Economic flows between sectors are depicted, along with the activity variable of worker-hours (in red). Additional information on the sectors and countries (in turquoise) are shown, that are then associated with the activity variables in the inventory.

For further reading, in particular consider the Global Guidance Principles for Life Cycle Databases published by UN-EP-SETAC.

BOX 7: EXAMPLE OF LIFE CYCLE INVENTORY BASED ON SECTORS FROM AN ACTUAL DATABASE: SOCIAL HOTSPOT DATABASE

In the example below, for \$1000 (USD) of sugar, the economic flow in USD and related hours with medium risk (medium risk hours equivalent; Mrh) for labor rights and decent work infringement are presented. Not all sectors and flows are shown.

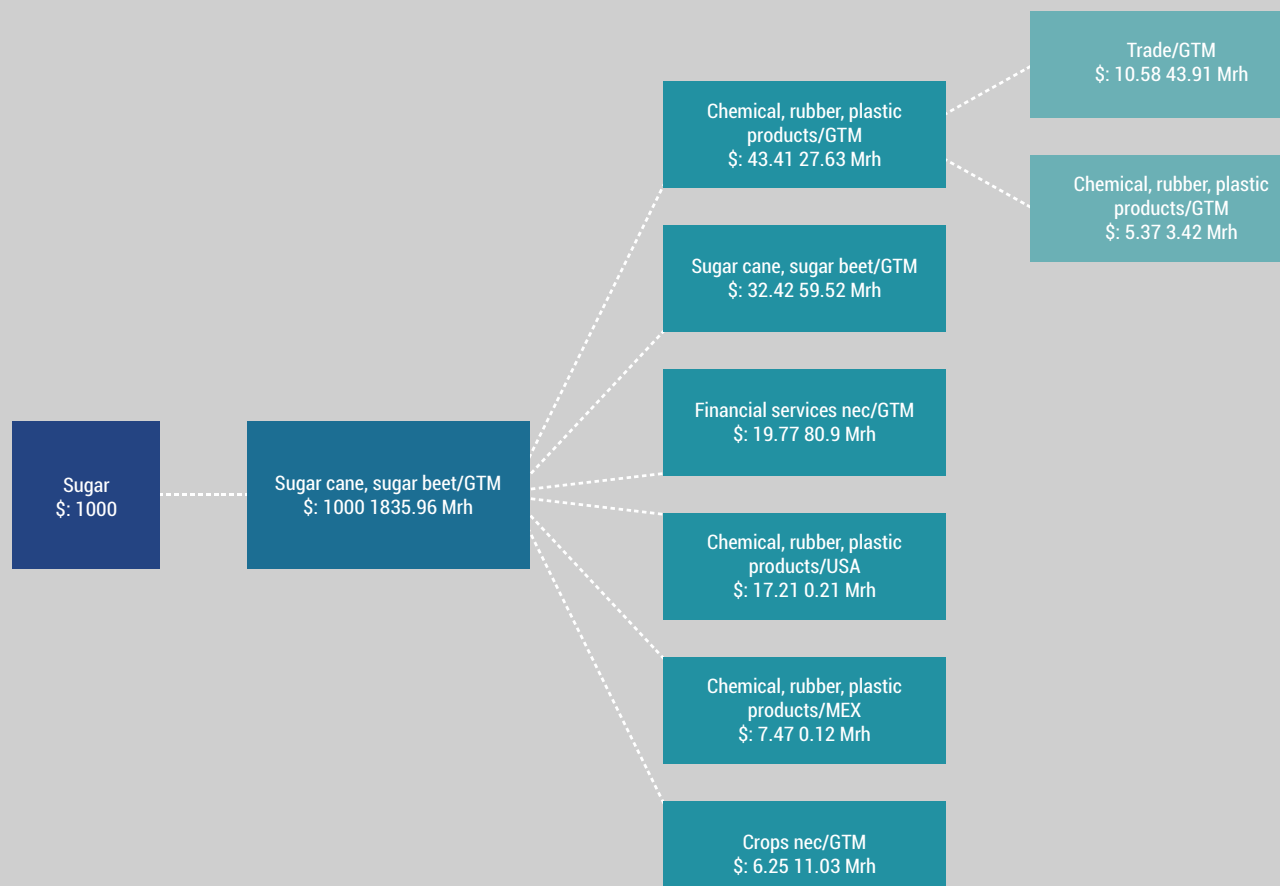


Figure 14: An example for a life cycle inventory approach based on sectors, which is often used in social LCA databases (adapted from SHDB Ethical Supply Chain Tool, 2020).

4.1.2 PRIORITIZING DATA COLLECTION

The most time-consuming step of data collection often consists in collecting specific data for the stakeholders and impact subcategories included in the study from the organizations and sites related to the value chain. Without prioritization, this would consist of visiting thousands of sites. This could be expensive and time consuming, even for a small value chain. Therefore, prioritization and estimation of the relative importance of all activities in a product system are relevant to guide data collection and allocation of efforts. Literature review information, data on activity variables, and social hotspots provide information that can guide the decision process on data collection prioritization.

- a) **First approach to prioritize data collection:** Does the literature review of the studied system identify key social issues not to miss in the S-LCA?

A literature review can highlight key potential social impacts that have already been documented in previous studies. This information can help identify specific unit processes for which data should be collected. For example, other stud-

ies point out that child labor is an important social issue in cotton production, thus studies on garments made of cotton should collect data on that particular process.

b) **Second approach to prioritize data collection:** Which are the most active or intensive activities/unit processes in the studied system, e.g. based on an activity variable?

In order to explore the relative intensity of different unit processes in a product's life cycle, an activity variable should be determined. The most commonly used activity variable is worker-hours.¹⁹ See more on how to collect activity variable data in the next section.

c) **Third approach to prioritize data:** Identify the hotspots in the product's life cycle.

As mentioned, an S-LCA is an iterative procedure. Therefore, a first analysis can be conducted using a database and software to identify the social hotspots of the product system. This generic analysis can form the core of the S-LCA study and be complemented with other data sources for some of the processes (foreground or background) and made more specific over time in an iterative fashion.

Social hotspots are unit processes located in a region (e.g. country) where a situation occurs that may be considered a problem, a risk, or an opportunity, in relation to a social issue that is considered to be threatening social well-being or that may contribute to its further development.

The social issues considered are those covered by the impact subcategories, as well as some other related issues also made available in the different tools and databases. More information about the databases is provided in Box 8 and Section 4.1.6 below and detailed guidance on how to use them can be obtained from database providers.

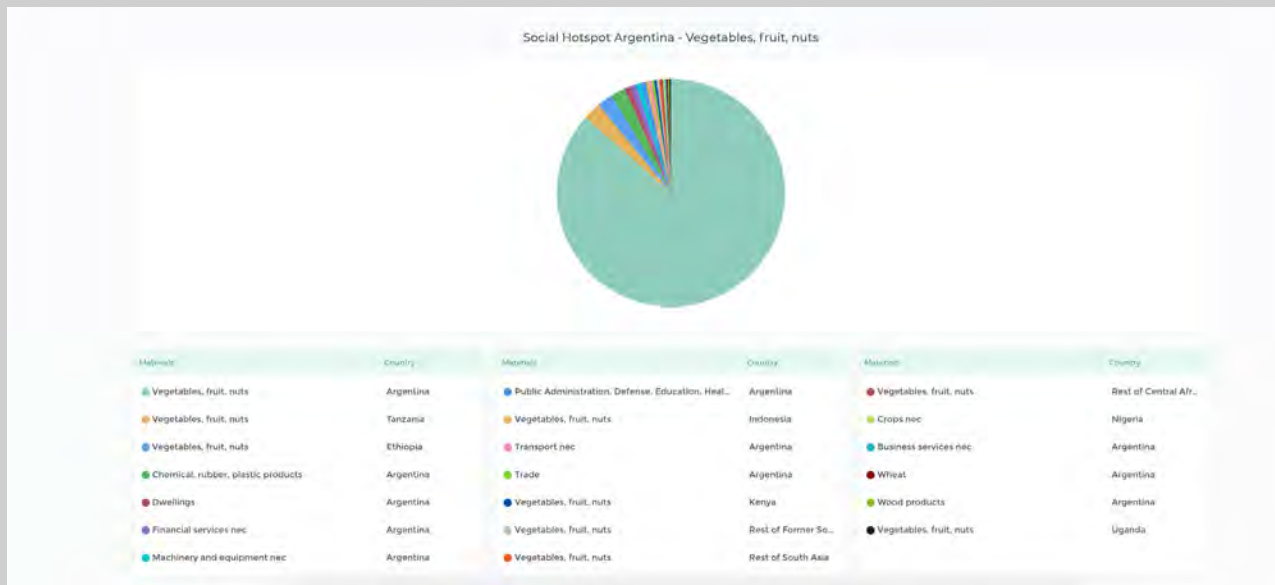
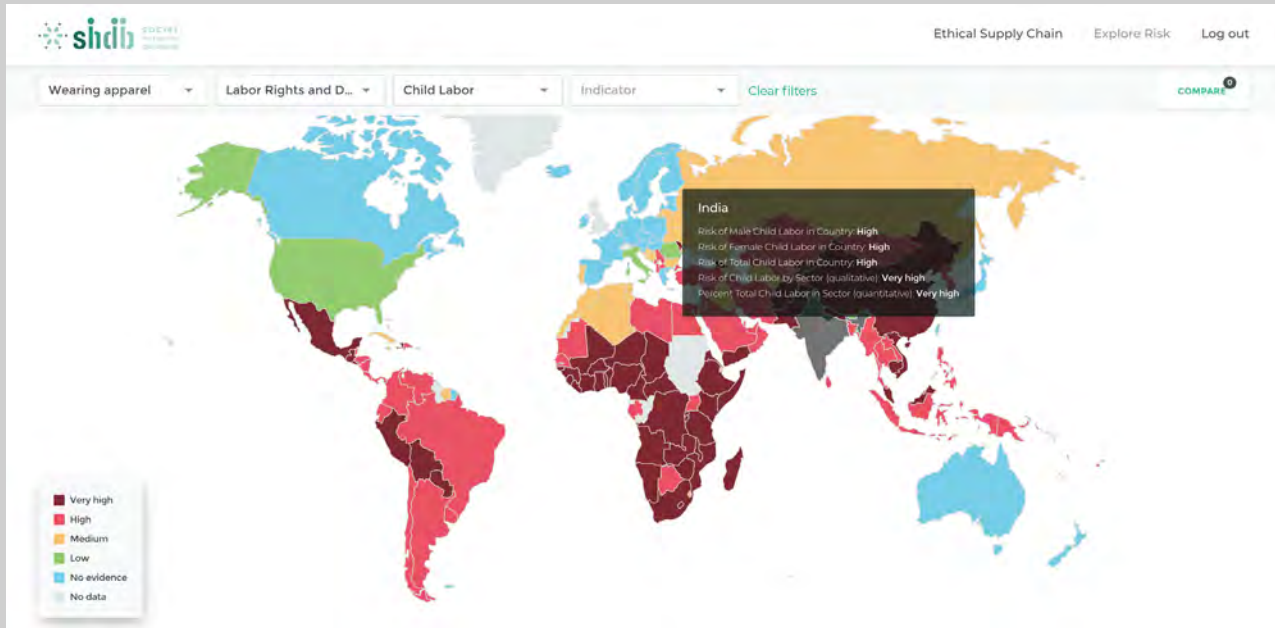
Social hotspots can be singled out as unit processes where data collection must be prioritized. In particular, if the goal of the S-LCA is to identify actual impacts, on-site visits must be organized to collect site-specific data (see Section 4.1.7).

¹⁹ As will be explained in Section 3.2.5, the greater the value of the activity variable for a given unit process, the greater the importance (in terms of worker-hours) of that unit process in the life cycle. Given the predominance of these unit processes, it can be relevant to prioritize data collection on them.

BOX 8: ILLUSTRATION OF DATABASE RESULTS FOR SOCIAL HOTSPOTS

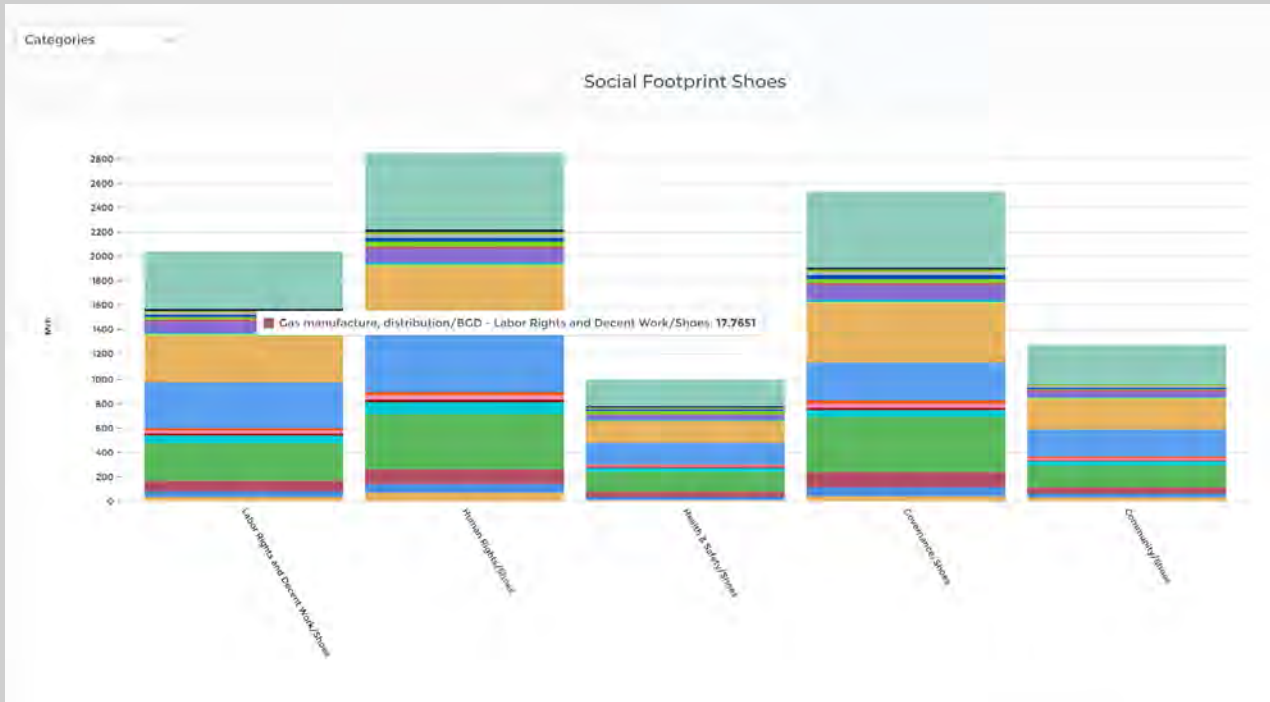
Below are sample pictorials depicting social hotspots. These have been derived from SHDB and PSILCA, respectively (see Section 4.1.6 for more details on these databases).

SHDB:

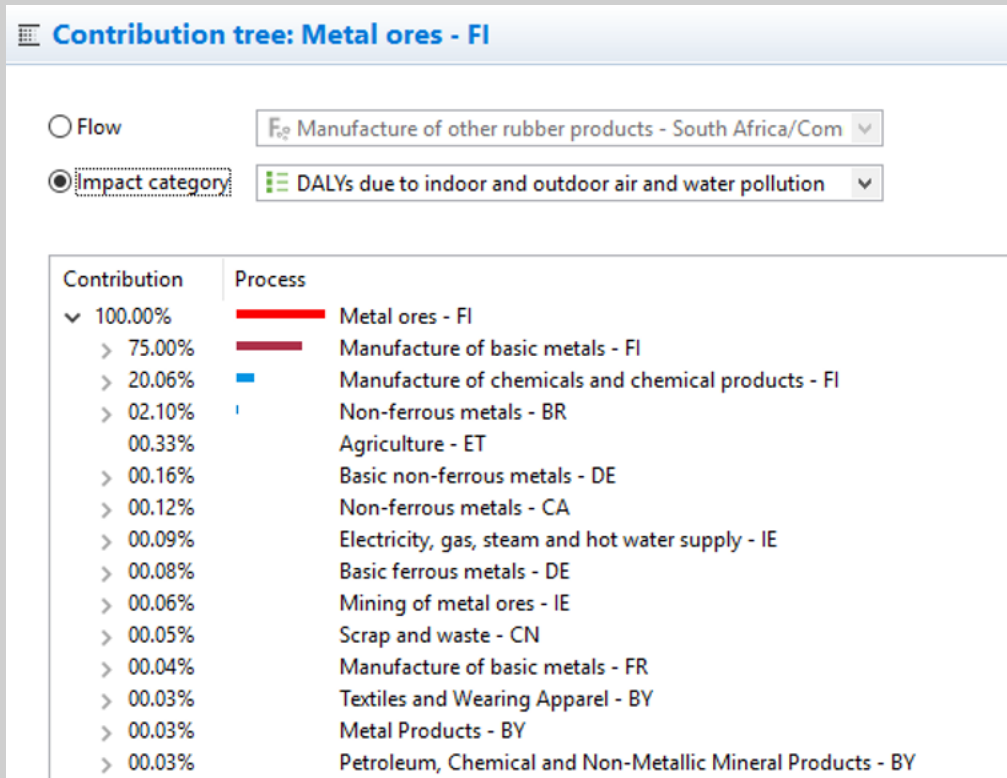


BOX 8: ILLUSTRATION OF DATABASE RESULTS FOR SOCIAL HOTSPOTS (Continued)

SHDB:

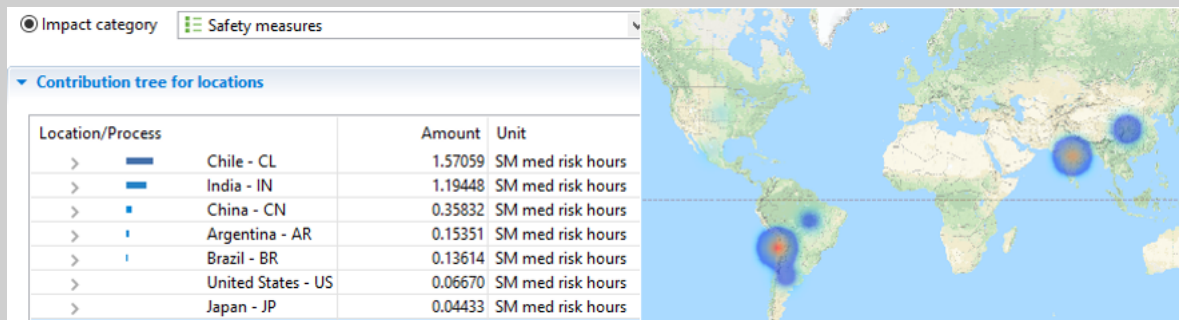


PSILCA:



BOX 8: ILLUSTRATION OF DATABASE RESULTS FOR SOCIAL HOTSPOTS (Continued)

PSILCA:



4.1.3 ACTIVITY VARIABLES

4.1.3.1 WHAT ARE ACTIVITY VARIABLES?

An activity variable is a measure of process activity or scale which can be related to process output. Activity variables, scaled by the output of each relevant process, are used to reflect the share of a given activity associated with each unit process. Thus, for attributes concerning labor conditions, a relevant activity variable is worker-hours. Process-specific coefficients of worker-hours per unit of process output are used to estimate the share of total life cycle worker-hours associated with each unit process. The activity variable is useful to represent the product system in a way that gives an idea of the relative significance of each unit process in the whole system. It is also a way to communicate the percentage of a supply chain which possesses an attribute of interest be it in terms of social impact or being fair trade certified (e.g. 90% of the product supply chain worker-hours are certified fair trade) (Norris, 2006).

Worker-hours²⁰ is the most commonly used activity variable – it consists in the number of worker-hours necessary to complete a production activity/unit process (e.g. harvest grapes). Another activity variable used is added value. It considers the amount of the added value created in each process. The selection of activity variables should be tested through sensitivity analysis.

20 Note: When referring to activity variables the term worker-hours is used. When we refer to the impact subcategory, we use Working hours. Reference https://www.jstage.jst.go.jp/article/jsas1989/13/3/13_3_121/_article/-char/en

BOX 9: ILLUSTRATION OF DATABASE RESULTS FOR SOCIAL HOTSPOTS

For example, if the functional unit is defined as “use of a T-shirt for 70 days”, fulfilled by one T-shirt, overall risks could relate to the total number of hours worked to produce, sell, use, and dispose of the T-shirt. This can be done in absolute terms using worker-hours as an auxiliary variable to quantify social risks and impacts, which is convenient to compare different product options. For example, there are “0.15 hours of high risk of female discrimination” related to the option T-shirt to fulfill the FU. Overall risks (or impacts) could also be expressed in relative terms, i.e. as the share of the life cycle (based on the activity variable) that possesses (or not) specific social attributes (Life Cycle Attribute Assessment (Norris, 2006)). For example, female discrimination occurs in 30 % of the product system. This is also interesting to express risks or opportunities external to the organization, e.g. in 75% of the product system, local communities have benefited from an increased access to clean water resources.

The chosen activity variable can be scaled to the functional unit (FU) of the study, thereby scaling the results of the study according to the functional unit. When this is implemented, social issues present in activities that require a higher (relative) amount of worker-hours or provide a higher added value are likely to become more relevant across a product’s life cycle than social issues that require less (relative) number of hours of work/ added value. The idea here is that if there is a larger number of hours being worked at a given unit process, there is more time during which stakeholders (especially workers) might be interfacing with the (potential) social impacts present in this unit process. Such information might be helpful to decide where data need to be collected on-site and where generic data are adequate.

Activity variables are considered as inventory indicators in E-LCA terms. Inventory indicators are making the link between the life cycle inventory (the process chain) and the life cycle impact assessment (socio-economic system). Although an inventory indicator is conventionally seen as part of the S-LCI, it can be considered as the first impact indicator within the cause-effect chain, as part of LCIA. For example, child labor hours would already be an estimate of further social impact. In conventional E-LCA literature this is called an “elementary flow”, as those are process chain emissions emitted to nature or process chain resources extracted from nature.

The scaling of the S-LCA results according to the FU has consequences that should be addressed. When using activity variables, it is useful to keep in mind:

- The worker-hours activity variable can be hard to collect and may be calculated using hypotheses and estimates. The values can thus carry some level of uncertainty;
- It is questionable whether worker-hours and added value always provide relevant information about the importance (in terms of social issues) of unit processes in a system – for example, one could encounter a specific unit process in a life cycle that contributes a relatively small share of the product system worker-hours but is very impactful as far as social impacts are concerned, e.g. the displacement of the local community for the construction of a hydropower plant. Therefore, the use of impact assessment methods that put more weight on higher level of risks is advisable when using activity variable, depending on the Goal and Scope;
- The data collected in an S-LCA can be quantitative or qualitative in nature. The connection between qualitative data and a quantitative activity variable can be done through the transformation of qualitative data into semi-quantitative values, but this data manipulation may entail levels of uncertainty in results;

- There are also questions about in which case added value is an appropriate activity variable and caution should be exercised when selecting this variable. High added values of unit processes may result from both high labor costs and a high degree of technology adoption/the use of more efficient, resource saving methods. Hence, if added value is used as the activity variable, highly technologized and high value processes (with low working time associated) could be related with high social impacts (and opportunities). In this case it is highly recommended to explore whether this variable is adequate.

Some practitioners may choose to not use an activity variable. Instead they assume each unit process in the product system to have either the importance associated with its cost/economic value or weight (which often puts a greater focus on foreground processes) or consider that all unit processes have the same importance which also has its downsides, especially when more complex products are involved.

4.1.3.2 HOW TO COLLECT ACTIVITY VARIABLES DATA

Three approaches can be used to collect activity variables data:

1. Through site-specific data collection;
2. Use of an S-LCA dedicated database (SHDB or PSILCA);
3. Through input-output or other databases.

Through site-specific data collection:

For details on how to determine the activity variable worker-hours based on on-site collection, we refer to 4.1.3.1.

Use of an S-LCA dedicated database (e.g. SHDB or PSILCA):

Many studies making use of an activity variable do so through the use of S-LCA databases, which integrate by default the calculation of activity variable data. They are listed in Table 12.

Through input-output databases:

Data on chosen activity variables may be accessible by using generic information on location (country, region) and activity type/sector. Generic information helpful in the calculation of an activity variable may be collected from Input-Output databases such as GTAP (Global Trade Analysis Project), EORA, EXIOBASE, WIOD (World Input Output Database), and also national statistical agencies or intergovernmental organizations such as ILO (International Labour Organization) or the World Bank, or national/international sectoral organizations. If one is not relying on databases, the following principles should be followed when defining activity variables:

- If wage rates (or unit labor costs) are used to estimate worker-hours they should be industry- and country-specific;
- If unpaid/informal/undocumented labor is of relevance within a considered product system, then it is necessary to document it, because it will not be captured via the worker-hours derived from economic data.

4.1.4 COLLECTING DATA FOR IMPACT ASSESSMENT METHOD

Generally, the data collection for impact assessment in S-LCA is comparable for the two types of impact assessment (RS S-LCIA and IP S-LCIA). Data are collected at the company and product level for the stakeholder groups and sub-categories (RS S-LCIA) or impact categories (IP S-LCIA), as defined in the G&S of the study (for further information see Section 2.4 and/or Section 3.2.9).

Specifically, for **RS S-LCIA** the data collection should contain (also consider Section 5.2):

- Collection of data for creating the **REFERENCE SCALES (or use of an established one)**;
- Collection of data for the different **STAKEHOLDER GROUPS** and the different **SUBCATEGORIES** identified as relevant for the study;
- (Optional) collection of data for applying the **ACTIVITY VARIABLE** or a **WEIGHTING** step;

Specifically, for **IP S-LCIA** the data collection should contain (also consider Section 5.2.4):

- Collection of data for all **INVENTORY INDICATORS** relevant to express the impact categories identified;
- Collection of data for the **CHARACTERIZATION FACTORS** of the underlying characterization model;
- (Optional) collection of data for applying the **ACTIVITY VARIABLE** or a **WEIGHTING** step.

In all cases the collected data shall relate to the life cycle stages as defined in the product system. Site-specific and/or generic data as well as quantitative and/or qualitative data may be used depending on the requirements resulting from the definition of the G&S phase (see Figure 15).

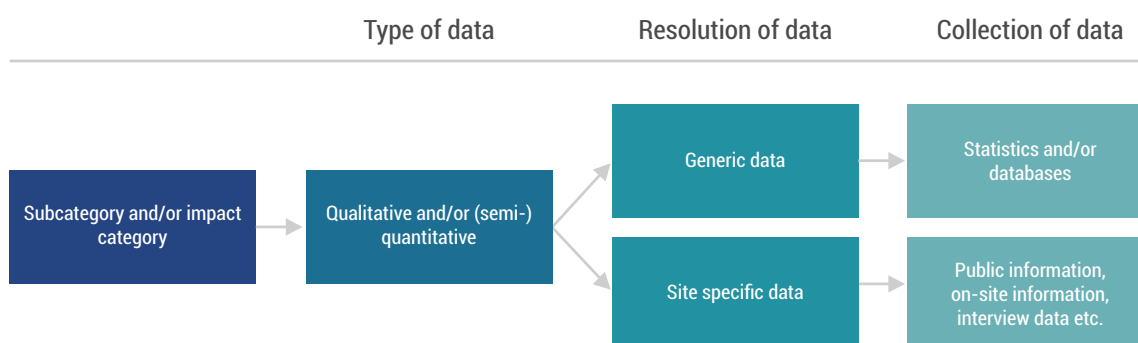


Figure 15: Data collection and interrelations in S-LCA.

4.1.5 DETERMINING DATA SOURCES AND SOCIAL INVENTORY INDICATORS

For each of the impact and subcategories selected and to be covered in a study in accordance with the Goal and Scope section, it is necessary to identify corresponding inventory indicators. These indicators should be compatible with the selected approach of impact assessment.

Social inventory indicators (or social flows) are usually defined as simple variables (e.g. salary, number of accidents at workplace) providing the status of a certain topic/life cycle stage/process (Vanclay, 2002). They provide the most direct evidence of a social condition. The choice of social inventory indicators will determine the data that ought to be collected. In S-LCA, indicators can be of qualitative, semi-quantitative, or quantitative nature. They can also be company specific, site-specific, generic, primary, or secondary, as presented in Table 11.

Social inventory indicators have been proposed by many sources. The Methodological Sheets for Subcategories in S-LCA provide a comprehensive overview of such indicators. S-LCA databases (see Table 12) are a good source of indicators for which generic data are available. The literature provides indicator definitions for many topics, e.g. fair wage or level of education. In addition, several studies assessed impacts on human health and adapted the appropriate impact categories and indicators from E-LCA, such as DALY and number of fatal injuries.

Table 11: Types of data in S-LCA.

Aspect of differentiation	Subtype of data	Definition
Output type	Quantitative data	Quantitative data is data expressing a certain quantity, amount, or range (UNECE, 2000).
	Qualitative data	Qualitative data is data describing the attributes or properties that an object possesses. The properties are categorized into classes that may be assigned numeric values. However, there is no significance to the data values themselves, they simply represent attributes of the object concerned (UNECE, 2000).
	Semi-quantitative data	Semi-quantitative data is data coming from an index or similar tools, which were given a certain value/ranking based on defined characteristics/ criteria.
Level of resolution	Company data	Derived from a company but not allocated to a specific production site.
	Site-specific data	Refers to data collected for a specific production activity/ process, occurring in a specific organization and facility, at a specific location. It might be collected by the company, customer, or a third party. It might be collected from stakeholders or from managers of the company – as part of a social audit, questionnaire or similar/other process. Its origin should be made clear.
	Generic data	Refers to data that has not been collected for the specific process concerned. It can be data collected from other manufacturers of the same kind of product or in the same country. In other words, it is data with a lower resolution than site-specific data.
Source of collection	Primary data	Refers to data that has been directly collected by the practitioner through, for example, interview, survey, or participant observation. (Data on aspects that are not compliant with regulations may not be voluntarily and honestly provided!)
	Secondary data	Refers to data that has been initially collected and manipulated by another person/institution than the practitioner or collected for another purpose than the one being currently considered or, often a mix of the two. For example, a publication, third party audit, or a database.

Typical sources of data for S-LCA comprise: interviews, surveys, audit results, scientific and grey literature publications, generic databases, and others. Each of these demands different levels of involvement in terms of methods and time from the practitioner and therefore, depending on the goal of the study and the resources available, the strategy for data collection should be defined.

The following figure illustrates data sources and strategies that are part of the S-LCA data system. All of these data sources and strategies are relevant, and each may be the best choice to meet the Goal and Scope of a study. In social studies, it is generally recommended to triangulate the data used which means using more than one method to collect data on the same topic. This is a way of assuring the validity of research throughout. The use of a variety of methods to collect data on the same topic involves using different strategies, types of samples, methods of data collection, and sources.

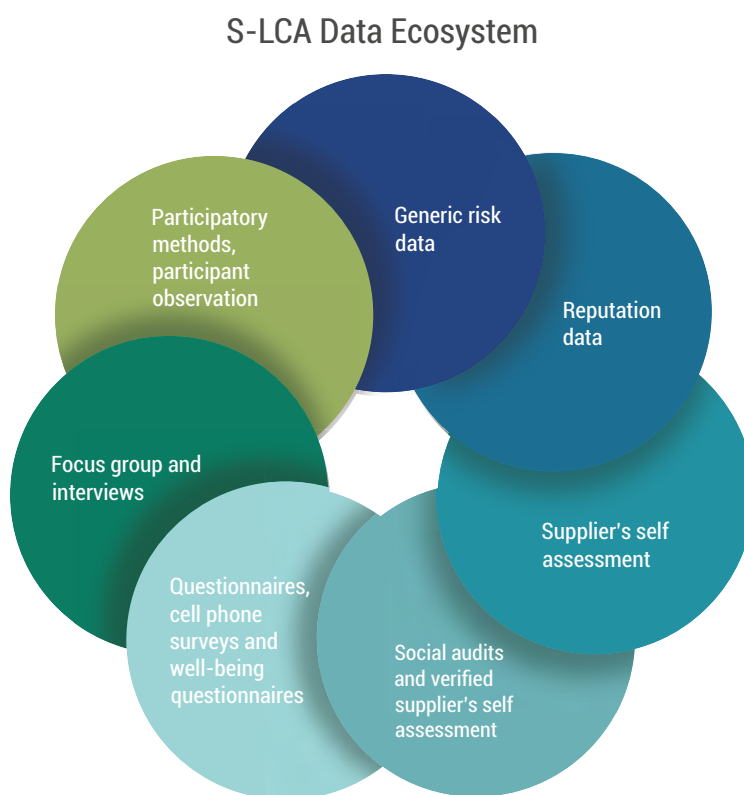


Figure 16: S-LCA data ecosystem.

4.1.6 COLLECTING GENERIC AND SECONDARY DATA

Secondary data can be collected through a literature review or web search. It can also be collected through existing databases with data for different purposes and level of detail. Information on some of the databases is provided in Table 12.

The first two databases in Table 12 (SHDB, PSILCA) directly conduct hotspot assessments and S-LCAs of products using software or internet tools. Other databases, such as RepRisk, provide data on corporate risks. Some databases provide country and commodity risk information (e.g. Maplecroft) or company self-assessment (e.g. EcoVadis) or compliance data (e.g. Sedex). In addition, there are statistical databases that provide raw data, e.g. on economic development, labor conditions, wages, education, etc. Some or all of these statistical databases have been used as sources

for the specific S-LCA databases.

NOTE: This table provides the information available at the redaction time of this report. It does not claim to be exhaustive.

Table 12: List of licensed and free databases which can be used to establish the S-LCI and S-LCIA by extension.

Database	Content	Bound to software / specific online platform	Licensed or subscription-based	URL
Databases for social and socio-economic risks and impacts				
Social Hotspots Database (SHDB)	<ul style="list-style-type: none"> • Database directly adapted to the needs of S-LCA (developed in compliance with these Guidelines). • Contains data for 26 subcategories using over 160 qualitative, quantitative, and semi-quantitative indicators on social risks, opportunities, and positive impacts. • Covers ca. 13,000 country-specific industry sectors in 244 countries based on the GTAP Input/Output database. • Includes an impact assessment method. • Social risks and opportunities are measured in worker-hours and value-added activity variables per process. 	Yes (used in E-LCA software) and through its standalone web platform.	Yes	https://www.socialhotspot.org/
Product Social Impact Life Cycle Assessment (PSILCA)	<ul style="list-style-type: none"> • Database directly adapted to the needs of S-LCA (developed in compliance with these Guidelines). • Contains data for 19 subcategories and 65 qualitative, quantitative, and semi-quantitative indicators on social and environmental risks, opportunities, and positive impacts. • Covers ca. 15,000 country-specific industry sectors and commodities in 189 countries based on the Eora Input/Output database. • Option between two activity variables per process and indicator to measure the risks/opportunities: worker-hours and value added. • Information on data quality is provided for every data point and can be calculated for the entire product system. • Sources, collection time, and basis for risk assessment are documented. 	Yes (used in E-LCA software).	Yes	https://psilca.net/ https://nexus.openlca.org/database/PSILCA

Database	Content	Bound to software / specific online platform	Licensed or subscription-based	URL
GaBi Life Cycle Working Environment (LCWE)	<ul style="list-style-type: none"> Database providing social inventory data (accidents, employee qualifications, and a few others...) for the 15,000 distinct processes and products of the GaBi database, i.e. all resource extraction, production, manufacturing, and end of life processes. The data combines US-based sector-specific data, on working-time per value-added of individual unit processes with data from the Bureau of Labor statistics, ILO, and other sources on qualification profiles of the workforce in that sector, lethal and non-lethal accident rates, and some other indicators. This unit-process level social inventory data is aggregated in parallel to environmental LCI data along the life cycle to cradle-to-gate inventories, making it methodologically the most differentiated, specific LCWE data source for quantitative data, one level more specific than sector-level S-LCA databases. - Own data (e.g. foreground system, other background processes), also other indicators can be added by the user and be combined. Measured in seconds of labor per value added. 	Yes (used in E-LCA software).	Yes	http://www.gabi-software.com/index/ http://www.gabi-software.com/international/software/gabi-software/gabi/functionalities/life-cycle-working-environment/
RepRisk	<ul style="list-style-type: none"> Offers a suite of premium risk management and compliance solutions, mainly to institutional investors (e.g. Banks, insurance providers, asset managers, etc.), to prevent and manage business conduct risks. The main feature is the ESG Risk Platform, which is the largest due diligence database on ESG and business conducts risks. It supports data-driven decision-making by providing quantitative and qualitative data regarding companies, projects, sectors, countries, ESG issues, NGOs, etc. 	Yes (on a web-based platform).	Yes	https://www.reprisk.com/
Sedex	<ul style="list-style-type: none"> Sedex is an online collaborative membership platform for sharing ethical supply chain data (both company and factory level data) to minimize the risks and improve the supply chain practices of companies. 	Yes (on a web-based platform).	Yes	https://www.sedexglobal.com/
EcoVadis	<ul style="list-style-type: none"> Supplier assessment and rating tools to monitor the sustainability performance of suppliers. 	Yes (on a web-based platform).	Yes	https://www.ecovadis.com/

Database	Content	Bound to software / specific online platform	Licensed or subscription-based	URL
Maplecroft	<ul style="list-style-type: none"> Offers a portfolio of risk solutions and services including expert analysis of risks (Local, country, issue, and sector level), quantitative risks indices, and mapping technology. The 150 risk indices portfolio offers organizations a holistic view of their risk exposure at a global scale considering political, economic, human rights, and environmental risk. Other services include Country Risk Monitoring, Responsible Sourcing, Human Rights Due Diligence, Commodity Risk, Disruption Risk, Investment Analysis, among others. 	Yes (on a web-based platform).	Yes	https://www.maplecroft.com/
Fair Wage Database developed for performing IP S-LCIA with a focus on wages	<ul style="list-style-type: none"> Developed in parallel with the S-LCA impact category for Fair wages by Neugebauer et al. (2017). Database includes inventory indicators and characterization factors for calculating Fair wage potentials. Provides information on 217 countries. 	No	No	https://www.see.tu-berlin.de/menue/research/data_tools/fair_wage_equivalents/parameter/en/
Statistical Databases (can be used for both RS and IP S-LCIA assessments)				
Organization for Economic Co-operation and Development (OECD) database	<ul style="list-style-type: none"> Compilation of statistics on economic and social issues for OECD's 34-member states (and for some non-member states (such as Russia, Brazil, and China). Free database includes annual statistics over the last 20 years on the economy, labor market, education, health, social issues, prices, national finances, industry, etc. 	No	Partly free	https://stats.oecd.org/
International Labour Organization (ILO) database	<ul style="list-style-type: none"> Set of databases for different topics: ILO Department of Statistics (ILOSTAT), Key Indicators of the Labour Market (KILM), Labour Force Survey (LFS), Child Labor info. Contains labor statistics for 165 economies, including data on employment by economic sector, wages per hour, weekly working hours, child labor, unemployment, and strikes on an annual basis In some cases, quarterly or monthly data are available too. 	No	No	https://www.ilo.org/global/statistics-and-databases/lang--en/index.htm

Database	Content	Bound to software / specific online platform	Licensed or subscription-based	URL
United Nations (UN)	<ul style="list-style-type: none"> UN provides statistics on a large range of topics on economic and human development for almost all countries. Including education, demography, refugees, asylum, health, external trade, labor market, agriculture, environment, and energy. 	No	No	http://data.un.org/
The World Bank Group (WBG)	<ul style="list-style-type: none"> The WBG's Databank is an analysis and visualization tool that contains collections of time series data on a variety of topics. Includes 55+ databases such as World Development Indicators, Statistical Capacity Indicators, Education Statistics, Gender Statistics, Health Nutrition and Population, Poverty and Equity, Doing Business, etc. 	No	No	https://databank.worldbank.org/home

4.1.7 COLLECTING SITE-SPECIFIC AND PRIMARY DATA

The collection of primary data is carried out by visiting specific or relevant production sites or by working together with respective organizations. Thus, primary data can be gathered through direct contact with organizations and companies (e.g. by means of management systems), through NGOs or comparable organizations (e.g. by means of auditing processes), through observation of business/production processes on-site, or through interviews or surveys with affected stakeholders (e.g. workers or local inhabitants).

The need for primary data can be determined by starting with a first hotspots assessment using generic data and by identifying data gaps. Primary data are especially relevant for prioritized (foreground) processes and if the specific process or product performs better or worse compared to the defined average based on the hotspot assessment. Furthermore, they are very relevant for measuring positive impacts to measure their contribution to the specific product, plant, or company compared to the local condition. It is also necessary to collect primary data to verify the risk and be able to analyze impacts. It is possible that some of the hotspots identified in the generic analysis end up not representing any problem in the production chain. On the other hand, problems can appear where generic analysis did not suspect them.

Sometimes, site-specific data are not primary data. For instance, they could be data from a social audit conducted by another party at the site under investigation. Thus, being secondary data.

Site-specific data are being collected through a range of methods. The data analyze the relationship between an organization (at the location where the unit process of interest is found) and its stakeholders (e.g. national government, community representatives, unions and workers representatives, elected officials, workers, consumers, NGOs). Data collected on site may be generated through document auditing, interviews, questionnaires, participatory evaluation, etc.

There are too many methods available to describe in these Guidelines. In order to choose the appropriate method, you need to consider which data you need and how relevant and meaningful these data are.

Methods differ greatly in terms of effort and expense; the amount of prior knowledge necessary; and the degree of detail, significance and reliability of findings. The figure below shows some of the main methods available and their level of effort vs. reliability.

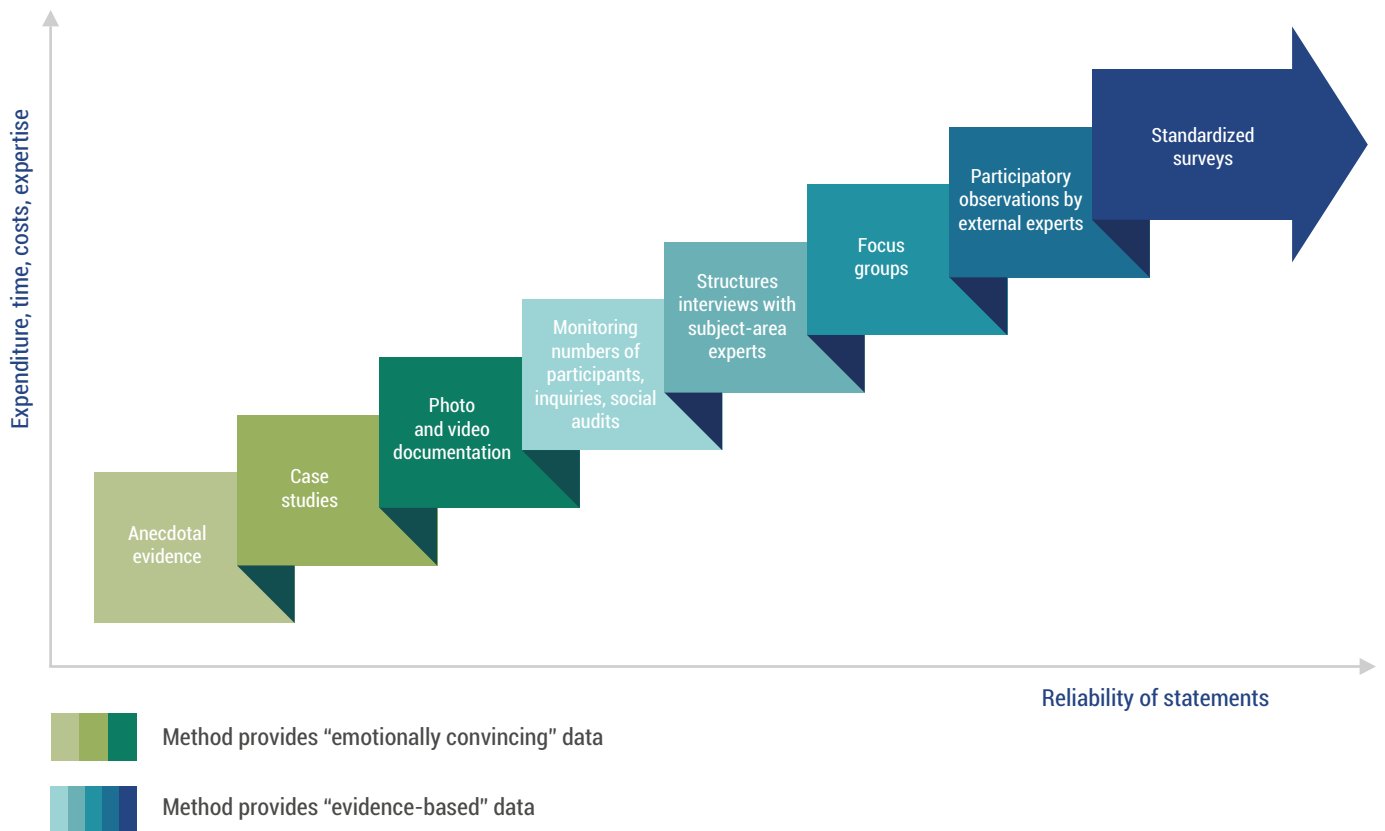


Figure 17: Specific data collection methods (adapted from the Social Impact Navigator (Phineo, 2017)).

4.1.8 REFINING THE DATA COLLECTION STRATEGY

The initial data collection strategy may be revised due to new knowledge, such as:

1. Processes that are important and significant, based on the activity variable (or measures of inputs to the unit process);
2. Significant topics and processes based on the social hotspots;
3. The unavailability of data; and
4. Subsequent sensitivity analyses.

The information on the activity variable and screening of process units may lead to the inclusion or exclusion of specific activities from further data collection. For example, the value chain of a hydroelectric power plant may be too big to be assessed in detail. In that case, research can be prioritized by considering only the suppliers of components requiring a relatively higher number of hours of work to be manufactured (worker-hours as the activity variable with a defined cut-off criterion). This way, the suppliers of minor components (e.g. screws) are only included in the generic data, and the suppliers for major/labor intensive components (e.g. concrete for the dam, or water turbines) are included with specific data.

Unavailability of specific data may lead to the exclusion of unit processes and the refinement of the system boundary. This situation may result in underestimating the potential social impacts. Hence, using other non-specific but acceptable representative data such as proxies should be considered. For example, the amount of child labor in a coal mine is approximated by that of a nearby copper mine. Databases can also be used as a source for proxy data. Both the use of

proxy data and data gaps should be documented and discussed at the stage of interpreting the results.

Lastly, sensitivity analysis on inventory data conducted in the Interpretation step (see Chapter 6) may also lead to the refinement of the system boundary (inclusion or exclusion of activities after the first analysis iteration). The results of this refining process should be documented.

4.2 HANDLING CO-PRODUCTS

There are occasions when a system under study generates multiple co-products or fulfills multiple functions, e.g. the raising of a cow that provides milk, meat, and leather. When assessing the social and socio-economic impacts of only one of these products, it might be necessary to refine the system boundaries or allocate only a share of social effects to this product. However, this is not always needed or straightforward, due to the nature and scope of social data. In some cases, allocation/partitioning in S-LCA is irrelevant. This is, for example, the case when assessing indicators and impacts not measured on product level, e.g. external effects (delocalization of local communities, disrespect of indigenous rights), or organization-wide issues like the workers' right to strike or the degree of discrimination, e.g. gender wage gaps.

Where allocating is of relevance, e.g. for product-specific, quantifiable effects like working hours or wages, the hierarchy described by ISO 14040-14044 2006 should primarily be followed (elaborated here within the context of S-LCA):

1. Basically, allocation should be avoided by subdividing activities and gathering specific data for the production of each of the co-products separately;
2. If subdivision is not possible, or if we assess rather generic systems (e.g. an industry sector like "textiles"), expand the system to include the additional products and activities substituted by the dependent by-products and associated social issues;
3. For combined products where the relative amount produced can be independently varied, relevant risks and impacts can be allocated causally (what ISO calls "in a way that reflects the underlying physical relationships") to the process output. In S-LCA a causal relationship might be established via the activity variable. For example, one could argue that in an agricultural process, more working time is needed to cultivate and harvest asparagus than carrots, hence a higher share of overtime or number of foreign, discriminated workers can be assigned to asparagus cultivation. See Figure 18 for another example;
4. If causal modeling is not possible or desired, i.e. when the Goal and Scope is to trace a specific issue in the value chain, process impacts can be allocated based on the share of revenue coming to the process for each of its product outputs. For example, in cow husbandry, the production of meat generating higher revenue than milk can be associated with a corresponding higher share of quantifiable effects, e.g. the positive effect of fair wage.

A prominent aspect for S-LCA is thus the usage of the activity variable as partitioning/substitution key. Additional solutions can be found in the literature. The choice of which approach to use will depend on the goal of the study. The hierarchy above provides a first set of options. A recent study that provides an overview of additional solutions is that of Majeau-Bettez et al. (2018).

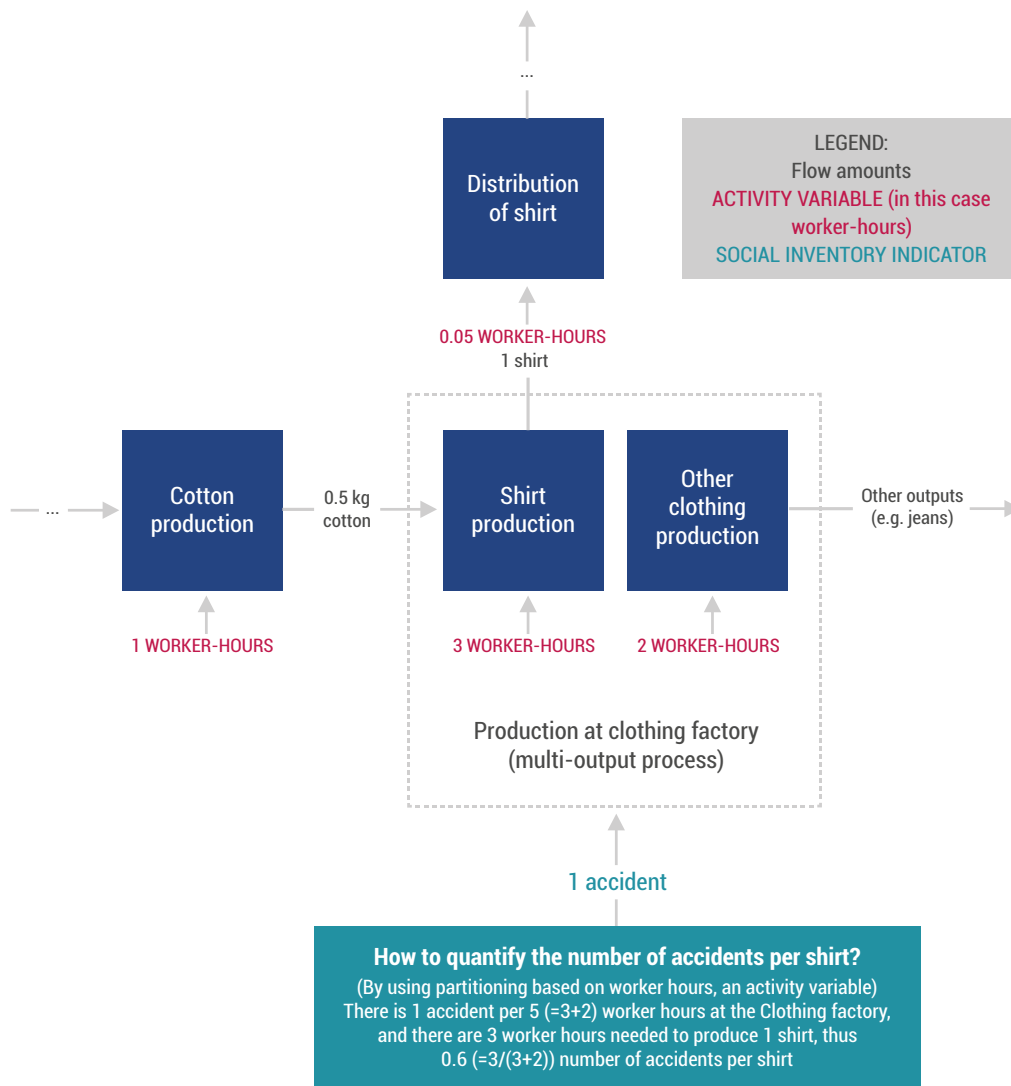


Figure 18: Example of activity variable (worker-hours) and its use as allocation key for number of accidents (at factory level) related to the process of shirt production at the factory, as part of the life cycle of a shirt's social impacts.

4.3 DATA QUALITY

It is important to address the data quality and integrity, as this is fundamental to ensure the reliability and validity of the findings, to reach useful conclusions. Quality is a multi-faceted concept, depending on user perspectives, needs, and priorities. For the time being, there is still no comprehensive guidance document addressing general data quality requirements and management for social and socio-economic data in S-LCA. Against this background, some general considerations and a possible data quality management option are presented. This section refers to ensuring and managing data quality during the entire collection process.

4.3.1 APPROPRIATE INSTRUMENTS, SOURCES AND COLLECTION METHODS

Depending on the type of indicator and data needed (quantitative or qualitative, generic or specific), appropriate measurement methods, sources and instruments must be defined. Both the measuring methods and instruments, but also the indicators themselves should be measured on the following minimum criteria.²¹

1. **Reliability:** The extent to which an instrument produces reliable and consistent results;
2. **Validity:** The extent to which an indicator and instrument are measuring an intended concept (e.g. a social issue or sub-category), based on soundness and empirical analysis (if possible);
3. **Objectivity:** The extent to which an investigator/data source is separated from the object of investigation and without bias.

There are a variety of available procedures and methods.²²

This is explained using the following example. One indicator that can be used to assess discrimination is the share of foreign workers at the factory site. Data can be gathered by various methods and instruments, e.g. published statistics in organization-wide CSR reports, third-party documents from NGOs or auditors, interviews with factory employees, and management or observations.

However, we need to check if the indicator is valid, i.e. whether it really provides meaningful information on the sub-category assessed. In our case, additional indicators should be used to assess discrimination. Using only the share of foreign workers does not provide the information necessary to evaluate the situation regarding discrimination at the factory.

Regarding methods, internal statistics on the percentage of foreign workers in a factory might be valid and reliable, however being company-owned information, data might be biased, hence not objective. Interviews with employees and management might also provide valid data but depending on the number of interviews, the reliability might be limited because the information gathered would only reflect a subjective snapshot of the share of foreign workers on site.

To decide on the “correct” data collection approach, the methods, sources, and instruments should be assessed against the above-mentioned criteria and weighted. The selection should be justified according to these criteria and data requirements, both outlined in the Goal and Scope phase of the S-LCA.

4.3.2 DATA QUALITY MANAGEMENT

To assess the quality of the collected data itself, it is recommended to define additional relevant aspects of data quality, e.g. timeliness, geographical or technical conformance of the datasets with the activity under study etc. For a structured evaluation of the quality of both the measurement methods and collected data, the defined indicators and criteria, i.e. reliability, timeliness, geographical match etc., can be rated by ordinal evaluation rules, e.g. scores from 1 to 5 corresponding to a qualitative assessment of the data.

The indicators and rating scales can be combined in a pedigree matrix, following an idea for uncertainty management by Funtowicz & Ravetz (1990). A refined version was applied in the PSILCA database to assess its process-specific datasets). It combines the reliability of the data source, the timeliness and completeness of data, and their geographi-

21 Adapted from the definitions in *The SAGE Glossary of the Social and Behavioral Sciences* (Sullivan, 2009).

22 For instance, to determine the reliability of a quantitative instrument, usually Cronbach's alpha (Internal consistency measure) is used. Other methods are test-retest, alternate/parallel forms and split-halves. Ensuring the reliability of a qualitative instrument usually requires taking measures to avoid biases in the collection (e.g. Communicate and clearly explain the research objectives, theoretical framework, and research design) and analysis of data (e.g. Cross-check the results by different field researchers to compare results and determine consistency). Further, to ensure validity of data, triangulation should be applied, i.e. the use of different measurement methods, instruments, and sources.

cal and technical conformance with the unit processes (i.e. country-specific sectors), see Section 4.1.6.

Table 13: Pedigree matrix for evaluating the data quality in S-LCA (adapted from Eisfeldt & Ciroth 2017).

Indicator	Scores				
	1	2	3	4	5
Reliability of the source(s)	Statistical study ²³ , or verified data from primary data collection from several sources.	Verified data from primary data collection from one single source or non-verified data from primary sources, or data from recognized secondary sources.	Non-verified data partly based on assumptions or data from non-recognized sources.	Qualified estimate (e.g. by an expert).	Non-qualified estimate or unknown origin.
Completeness conformance	Complete data for country-specific sector/country.	Representative selection of country-specific sector/country.	Non-representative selection, low bias.	Non-representative selection, unknown bias.	Single data point/completeness unknown.
Temporal conformance	Less than 1 year of difference to the time period of the dataset.	Less than 2 years of difference to the time period of the dataset.	Less than 3 years of difference to the time period of the dataset.	Less than 5 years of difference to the time period of the dataset.	Age of data unknown or data with more than 5 years of difference to the time period of the dataset.
Geographical conformance	Data from same geography (country).	Country with similar conditions or average of countries with slightly different conditions.	Average of countries with different conditions, geography under study included, with large share, or country with slightly different conditions.	Average of countries with different conditions, geography under study included, with small share, or not included.	Data from unknown or distinctly different regions.
Further technical conformance	Data from same technology (sector).	Data from similar sector, e.g. within the same sector hierarchy, or average of sectors with similar technology.	Data from slightly different sector, or average of different sectors, sector under study included, with large share.	Average of different sectors, sector under study included, with small share, or not included.	Data with unknown technology/sector or from distinctly different sector.

Pedigree matrices have the benefit of converting qualitative assessment results into quantitative figures. The evaluation is fast to apply, and results may be aggregated over different criteria and aspects to arrive at a more or even fully aggregated data quality score. Practitioners are encouraged to use the proposed pedigree matrix during data collection

²³ As defined in the work of Eisfeldt & Ciroth (2017): "A statistical study is understood as a study where a random sampling is used to obtain data for the analysis, and where the sampled data is treated with measures of statistics to retrieve representative values". It can after all be that there is a high variability in the value.

to document data quality and ensure the information meets required quality criteria. Quality-assessed datasets provide a more transparent picture of the results and could also be used for weighting indicators, datasets, and impacts.

4.3.3 CHALLENGES FOR GENERIC AND SECONDARY DATA

Due to a variety of reasons, e.g. goal(s) of the study, non-availability of site-specific information, lack of time or financial resources to collect primary data, etc., in many studies it is necessary to recur to generic and/or secondary data even when site-specific or primary data would have been preferred. This practice presents several challenges because, usually, these data may have been gathered for a different purpose. Such challenges may include:

1. Data do not relate well to the concept being measured, i.e. is not valid;
2. The study context has changed and the way the data collection was conducted is no longer appropriate, i.e. validity is limited;
3. Parts of the necessary data are not available;
4. The collection agency transforms the data in a way that invalidates or distorts it;
5. The collection agency and data are not reliable because of human errors in collecting the data and/or inconsistency in the collection procedure leading to errors;
6. The collection agency might be biased, i.e. not objective.

However, the credibility of sources is very important because reliability is very much a function of the characteristics of the organizations that produce and publish the data. To address and document such problems of generic data and secondary sources, pedigree matrices (see Table 13) are a suitable instrument because challenges like geographical and technical fitness, as well as the appropriateness of the source can be evaluated at a glance.

In general, triangulation of data is advised. Triangulation implies that different perspectives are brought together when investigating an object or research question. These perspectives can consist of different methods that are applied, in different theoretical approaches that are followed, or more frequently in a combination of different types of data or data collection methods. It also refers to the collection of data from different persons or stakeholders or stakeholder groups which are contrasted. Other validation steps for secondary data include checking for data outliers, cross-checking several data sources, benchmarking against industry averages, and hypothesis checks. The approach to validation may differ for the different subcategories and inventory indicators. For example, quantitative data (e.g. worker hours, wages) can be compared to industry or national averages or references, like living wage. Qualitative data might be validated by bringing together different perspectives on an indicator.

4.3.4 DOCUMENTATION OF DATA QUALITY

Information about the data collection and data quality management should be documented and reported to increase the overall transparency of a study – this is identified as a requirement in the Interpretation phase (see Chapter 6). Moreover, allowing external review of data collection schemes will likely improve the credibility of results. The following list suggests important aspects of data collection that should be documented throughout the study:

1. General description of the data collection process, including objectives, temporal reference, collection design, sample, sources, and instruments used;
2. Information regarding reliability and validity of instruments or measurement methods;
3. General results from data quality management, e.g. using the pedigree matrix;

4. List of personnel responsible for data collection, including qualification requirements;
5. Templates of the instruments or measurement methods used for data collection, if possible.

Description of any deviations from the stated procedures and specifications, e.g. identification and treatment of data gaps, any subjective choices and compromises to the theoretical data requirements, should be reported.

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5. Impact assessment

5.1 WHAT IS LCIA IN S-LCA?

5.1.1 DEFINITION

Social impact assessment is the phase in S-LCA aimed at calculating, understanding and evaluating the magnitude and significance of the potential social impacts of a product system throughout the life cycle of the product (adapted from ISO 14040 section 3.4). It can be applied either to analyze current or past potential social impacts associated with a system or to forecast future potential social impacts of an evolving or presently non-existent system.

It is important to note that S-LCIA mainly focuses on evaluating **potential social impacts** – not social impacts per se. As a reminder, potential social impact is understood as the likely presence of a social impact, resulting from the activities/behaviors of organizations linked to the life cycle of the product or service and from the use of the product itself (for further information see Section 2.3). The term “potential” is important as it conveys relativism. The assessment of potential impacts is supported by a range of hypotheses that, while being rigorous, have their own limitations. For example, the indicators selected to indicate the likely presence of **potential social impacts** bear a variable level of uncertainty, depending on the methods chosen. Moreover, forecasted potential impacts may not materialize due to unforeseen interferences.

As will be further explained in Section 5.2, some impact assessment methods chiefly focus on evaluating **social risks**. These concepts are taken as general indicators for potential social impact.

Important notions in this section are, on the one hand, impact indicators and, on the other hand, impact categories or subcategories. An impact indicator reflects the extent of the social impact and belongs to a certain impact (sub)category. An example is the impact indicator of hours of missed education. The impact (sub)category reflects a type of impact, e.g. child labor. An impact category may have various indicators, e.g. hours of missed education is one of the indicators for the impact category child labor.

See Figure 4 for more examples of such indicators and general outcome types of LCIA.

5.1.2 CHARACTERISTICS OF THE TWO MAIN APPROACHES IN S-LCIA

As described in Section 2.4, there are two main families of impact assessment approaches, the Reference Scale Assessment (formerly Type I or RS S-LCIA) and the Impact Pathway Assessment (formerly Type II or IP S-LCIA), each responding to different practitioner needs:

1. If the aim is to assess social performance or social risk, use the RS S-LCIA approach;
2. If the aim is to assess consequential social impacts through characterizing the cause-effect chain, use the IP S-LCIA approach.

The sections below present the two families of S-LCIA approaches independently, because they are distinct, they did not experience the same history and are not at the same level of development and implementation. While relatively young, reference scale approaches are operational at present and numerous case studies exist. Meanwhile, impact pathway studies chiefly pertain to the field of research, but as will be presented below, several documented pathways are available and readily applicable.

5.2 IMPLEMENTING REFERENCE SCALE APPROACHES

Reference Scale Assessment can be implemented following the steps illustrated below in Figure 19. Some of these steps pertain to the Impact Assessment phase, but others belong to previous steps in the S-LCA process. Steps pertaining to S-LCIA, as well as the step pertaining to Inventory “Establishing reference scales for impact assessment” will be explored below. Other steps are already well covered in the corresponding chapters.

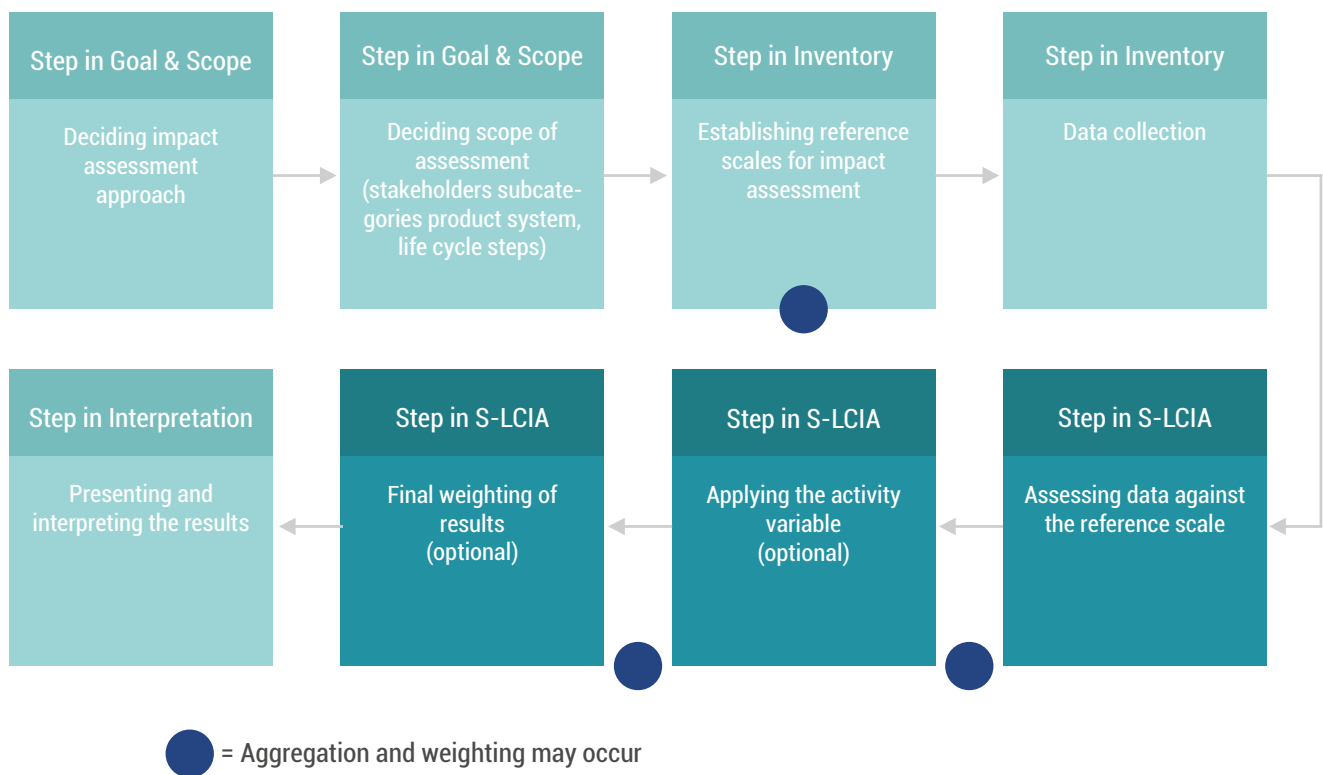


Figure 19: Steps related to the impact assessment process for the Reference scale (Type I) approach.

BOX 10: USE OF S-LCA DATABASES FOR PERFORMING S-LCIA

S-LCA databases such as SHDB and PSILCA may automatize a great number of steps related to the S-LCIA process, using generic data from national and international organizations. The following steps from Figure 19 are all performed during an S-LCA database analysis:

1. Establishing reference scales for impact assessment; the databases have a set of pre-determined reference scales for each impact subcategory in their framework;
2. Data collection; the associated software collects data for the specific case, drawing on generic data from pre-selected databases or other data sources;
3. Assessing data against the reference scale; the databases proceed to assess the data collected against the pre-determined reference scales;
4. Applying an impact assessment method to group by subcategory or impact category and aggregate results over the value chain using an activity variable;
5. Final weighting of results; the databases either apply weighting or give users the opportunity to apply the weighting onto the results;
6. Presenting the results; the databases provide some infographics to present the results. However, some users prefer to use the raw data to develop their own infographics for Interpretation.

For more information on the use of databases in S-LCA, see Chapter 4.

5.2.1 GENERAL GUIDANCE ON DEVELOPING REFERENCE SCALES

Reference scales ought to be developed for each indicator used, and each level of the scale should be defined. Calling upon in-depth knowledge of the industry and geography (including country laws) to be assessed is recommended for optimal development. Building on past studies and existing guidance is also recommended – see end of the chapter for recommended readings.

5.2.1.1 ESTABLISHING REFERENCE SCALES

Reference scales are established during the Inventory phase. It is a crucial preparatory step for organizing inventory data collection and for the implementation of the impact assessment.

Reference scales are ordinal scales, typically comprised of 1 to 5 levels, each of which corresponds to a performance reference point (PRP). PRPs are thresholds, targets, or objectives that set different levels of social performance or social risk, which allow to estimate the magnitude and significance of the potential social impacts associated with organizations in the product system. The PRPs are context-dependent and are often based on international standards, local legislation, or industry best practices – normative reference points – but as will be discussed below, they can also be based upon other points of reference. Comparing relevant inventory indicator data with these levels allows qualifying whether the data collected suggests a negative or a positive performance (of varying degrees in between the two poles).

Reference scales can be ascending – ranging for example from negative performance to positive performance (see Figure 20), but they can also be descending – ranging from very low risk to very high risk of potential negative impacts (see Figure 21). They may or may not cover both negative and positive impacts (refer to Section 2.5 on positive impact).

They may use numbers to identify the levels or just colors. Reference scales with only two scale levels are typically applied to identify the presence or absence of an impact. Reference scales comprised of only 1 performance reference point are only used when the assessment is done using a ratio approach (see Section 5.2.2). Figure 20 and Figure 21 illustrate two generic reference scales.

Scale level	Description
+2	Ideal performance. Best in class
+1	Beyond compliance
0	Compliance with local and international laws and/or basic societal expectations
-1	Slightly below compliance level
-2	Starkly below compliance level

Figure 20: Generic ascending reference scale, for social performance evaluation.

Scale level	Description
Very high risk	Very high risk
High risk	High risk
Medium risk	Medium risk
Low risk	Low risk

Figure 21: Generic descending reference scale, for social risk evaluation.

BOX 11: ARE WE ASSESSING SOCIAL PERFORMANCE OR SOCIAL RISK?

As specified in Section 2.3, **Social performance** refers to the principles, practices, and outcomes of businesses' relationships with people, organizations, institutions, communities, and societies in terms of the deliberate actions of businesses toward these stakeholders as well as the unintended externalities of business activity measured against a known standard (Wood, 2016). **Social risk** is understood as the probability of adverse social effects on stakeholders occurring through a company's activities or business relationships and the consequence of such an occurrence.

From a data perspective, social performance is often measured with company-specific data (or close proxies), and social risk is often measured with generic, sector/country level data. The term 'risk' is thus commonly associated with data that has a lower resolution and therefore does not allow to ascertain social performance, but rather simply point to a general risk level of encountering detrimental and/or positive social impacts. Some studies have both social performance and social risk results, for different portions of the product system. It is generally useful to have both because it will contextualize the performance. For example, having production activities that are "child labor" free is a different accomplishment in countries and sectors where the risk is low than in countries and sectors where the risk is high.

Social risk assessment is a practice supported by databases. For more information on databases see Chapter 4.

BOX 12: HOW TO SET REFERENCE SCALES FOR POSITIVE IMPACTS ASSESSMENT

When assessing positive and negative impacts within the same framework, the question arises as to how the different reference scales used, should be related and aggregated to each other.

For example, when using distinct ascending reference scales (where the top level corresponds to ideal performance) to evaluate positive and negative impacts, how should the value of the scale levels relate to one another? Should the top level in each scale be associated with the same numerical value, if using a scoring system with the scales? This choice has implications if the outcome is intended to be aggregated.

Moreover, the question arises whether the positive and negative impacts should be mirrored on different sides of the zero (assumed neutral), or should both be positive integers. This also has important implications for the aggregation, as in the former case, there is a possibility to arrive at an impact that has the value zero if the impacts on both sides have the same order of magnitude. This may in some cases be misleading, as a negative impact on one issue and a positive on another of the same magnitude, are not necessarily the same as no impact at all. In the work of Ekener et al. (2018), there has been an attempt to try to invert some of the issues in the Guidelines that were considered positive, but expressed in the Guidelines as negatives, so as to align the approach for all positive impacts to be treated in the same way. This approach is also used in S-LCA databases.

5.2.1.2 TYPES OF PERFORMANCE REFERENCE POINTS

There are six main types of performance reference points for reference scales. Points of reference can be:

1. ...based on **specific norms, practices, and best practice**. The reference scales are thus expressed to translate the norms, practices, and best practice to corresponding levels as applicable. Reference values can be qualitative (see Figure 22) or quantitative;
2. ...based on **norms, practices, best practice, and the socio-economic context** of unit processes. This is based on the same logic as above, except that the lower level on the scale is divided in two levels: the highest one corresponds to lower level performance in a favorable socio-economic context, and the lowest one corresponds to lower level performance in an unfavorable socio-economic context;
3. ...kept in their **generic form**, in other words, the scale is not fleshed out – it is kept as in Figure 20. For the assessment, expert knowledge is applied to assess inventory data against the scale. The downside of these scales is that they are less transparent;
4. ...based on **comparisons with the sector average/median or distribution**. In this case, the assessment will focus on how the studied company/sector/country's data are positioned in comparison to a sector/country/worldwide average on median. This can be done for example by dividing an even distribution into quartiles, each of them corresponding to a scale level. The assessment is thus relative to the performance/risk of comparable peers, instead of being normative;
5. ...based on a combination of **specific norms AND positioning on a distribution**. This can be done by assessing the position of the unit process (or its proxy) data in relationship with an even distribution but aligning the compliance level (or cusp between low risk and medium risk) with a baseline norm (e.g. basic World Bank norms for sanitation);
6. ...based on a combination of **expert knowledge AND even portions of a distribution**. This can be done by assessing the position of the unit process (or its proxy) data in relationship with an even distribution but aligning the compliance level (or cusp between low risk and medium risk) with expert knowledge.

The points of reference can be qualitative or quantitative in nature. They can also be an aggregation of reference values/information, as illustrated in Figure 22 below.

Reference scales		Relevant PIs
+2	The company or facility engages in a dialogue with the collective representation of workers and incorporates their views into management decisions.	2-3 and 5-6
+1	The company or facility recognises the collective representation of organized workers in negotiations.	2-3 and 5
0	The company or facility has a system in place to enforce the policy that allows freedom of association and collective bargaining AND no incidents have been discovered that the company or facility prevents workers' freedom of association and collective bargaining.	2-3
-1	Incidents have been discovered that show that the company or facility prevents workers' rights to freedom of association and collective bargaining, but a corrective action plan with a clear timeline for completion has been developed OR the company or facility has a policy that allows freedom of association and collective bargaining but does not have a system in place to enforce the policy.	4 or 1
-2	Incidents have been discovered that show that the company or facility prevents workers' rights to freedom of association and collective bargaining but a corrective action plan with a clear timeline for completion has not been developed.	-

Figure 22: Example of Reference scale with aggregated reference values/information (Goedkoop et al., 2018).

5.2.1.3 REPRESENTING SCALE LEVELS THROUGH SCORING OR NON-SCORING APPROACHES

As reference scales are established, an important aspect to decide is whether or not to assign a numerical value to scale levels and if so, what numerical value to assign to each level. Numerical values enable easier aggregation of results in subsequent steps of the assessment. However, they also have some limitations, as will be discussed below. Essentially, reference scales can be represented in three main ways:

1. In non-numerical terms, such as in color, letters, or checkmarks. Visualization of these types of results can be done through dashboards, heat maps, or narrative descriptions;
2. With linear scores, where each scale level corresponds to one (1) unit point above the preceding level; or
3. With non-linear scores, where each scale level is granted a customized value, according to its judged distance with the other scale levels. Visualizations of the two latter approaches can be done through bar graphs, tree maps, or spider diagrams.

At the moment, the most common approaches are representation through linear and non-linear scores. An example of the latter are the scales in the SHDB risk mapping tool social hotspot index, which grant more unit points to the very high and high-risk level than to lower levels. The value choice underlying this scale – based on systematic review of the database and expert panel deliberations – is to numerically magnify risk levels as the risk level increases, to translate the greater importance of higher levels of risk. Box 13 explains a process for developing customized scoring values based on expert value judgment.

Each of these approaches may be more appropriate for different study goals. For instance, non-linear scores may be the most appropriate for a social hotspot assessment. Systematic approaches are arguably more objective. Proponents for non-linear scoring argue that allotting the same unit value for each scale level is an arbitrary decision, which does not necessarily reflect the actual value of the social performance/risk levels being assessed. They put forward the idea of defining the unit value of each scale level specifically. What is to say that an 'ideal performance', as presented on the generic scale in Figure 20 is really worth 2 points above the compliance level? While those numbers are small, they add up to different results as practitioners' aggregate results – the actual numerical distance between the scales

can therefore affect interpretation²⁴. However, linear scoring allows certain predictability in how results are presented, in a context where there is no consensus on value numbers to attribute to non-linear scoring.

Some practitioners also argue that allotting numerical values to qualitative scale levels is problematic and therefore prefer to represent results in non-numerical terms. However, what that choice implies is that no aggregation of results is possible, thus rendering studies with more complex and voluminous results – but arguably more faithful to what is being assessed. See the work of Arvidsson (2019) for an overview of this debate.

At the moment, there are thus multiple approaches to representing scale levels. It is the practitioners' responsibility to transparently communicate which approach was selected and integrate the inherent limitations of each approach into the limits of their study.

BOX 13: S-LCA EXPERTS' VALUE BASED NON-LINEAR SCORING

To go beyond the simplified assumption of linearity when translating the A to D qualitative levels into a numerical performance score, Do Carmo et al. (2017) proposed an approach based on the value judgment of S-LCA experts. For each impact subcategory indicator, S-LCA experts are asked to place the ordinal classification levels (A, B, C, and D) in a cardinal 0-10 scale, considering the description of the indicators provided. It is possible to adopt other scales for this exercise (for example, [-10; 10]).

As a result, for each impact subcategory indicator, numerical scores are normalized and then an average value representative of the S-LCA expert group is obtained for each of the A-D classification levels. Interpolating the average values, three types of value function shapes to score the qualitative levels are possible: linear, concave, and convex. The first is the shape currently considered in S-LCA studies. For this shape, the distances among the performance levels are assumed to be equal, meaning that the scores of the levels increase linearly. The second is concave: the compliance threshold provides a higher score as compared to the linear shape. Finally, in the convex shape, the compliance threshold provides a lower score as compared to the linear shape. This approach can also be used for considering stakeholders' representatives or decision-makers. The authors remark that scoring obtained by this approach cannot be generalized for all cases and the proposed approach must be adapted for each study.

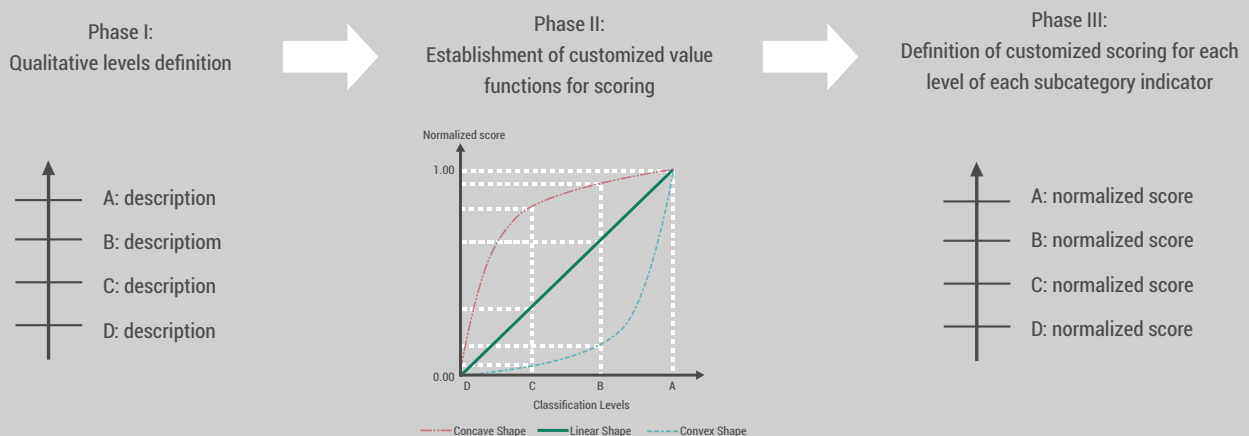


Figure 23: Non-linear scoring approach, in this case based on 4 level approach of Do Carmo et al. (2017).

24 In a way, scoring choice is value-based and will grant more importance to some scored results rather than others.

5.2.2 ESTABLISHING PERFORMANCE INDICATORS TO PREPARE FOR DATA COLLECTION

After having developed the reference scales, it is useful to develop a list of the performance indicators mobilized in each of the scale levels, i.e. a scale level can be based on the outcome of not just one but various performance indicators. Performance indicators (PIs) are quantitative or qualitative markers of performance. They underlie each of the performance reference points comprised in the reference scales (Goedkoop et al, 2018). Clearly establishing a list of the performance indicators associated with a reference scale helps to: 1) improve the precision of a reference scale iteratively; and 2) provides clarity on what type of data needs to be collected for the inventory, in order to be in a position subsequently to compare inventory data with the established reference scales. Figure 24 below shows the PIs associated with the reference scale in Figure 22.

Performance indicators							
1	The company or facility has a policy that allows freedom of association and collective bargaining.						
2	The company or facility has a system in place to enforce the policy that allows freedom of association and collective bargaining.						
3	No evidence indicates that the company or facility/management has taken disciplinary actions against workers organising themselves collectively.						
	<table border="1"> <thead> <tr> <th>Type of data sources</th> <th>Example</th> </tr> </thead> <tbody> <tr> <td>News</td> <td rowspan="3">The management of the facility has taken disciplinary actions against workers organising themselves collectively.</td> </tr> <tr> <td>NGO reports</td> </tr> <tr> <td>Social media</td> </tr> </tbody> </table>	Type of data sources	Example	News	The management of the facility has taken disciplinary actions against workers organising themselves collectively.	NGO reports	Social media
Type of data sources	Example						
News	The management of the facility has taken disciplinary actions against workers organising themselves collectively.						
NGO reports							
Social media							
4	Incidents have been discovered that show that the company or facility prevents workers' rights to freedom of association and collective bargaining, and a corrective action plan with a clear timeline for completion has been developed.						
5	The company or facility recognises the collective representation of organized workers in negotiations.						
6	The company or facility engages in a dialogue with the collective representation of workers and incorporates their views into management decisions.						

Figure 24: Performance indicators associated with reference scale in Figure 22 assessing data against reference scale (Goedkoop et al., 2018).

In this step, the practitioner can assess the inventory data against the reference scales. In this approach, we assign the inventory data to a reference scale level. The ensuing interpretable result is a scale level (e.g. the social risk associated with forced labor is +1 (one level above compliance level));

It entails associating the inventory data with its corresponding reference scale level. It can be applied on qualitative or quantitative reference scales. Below is a simplified illustration of an assessment using this approach.

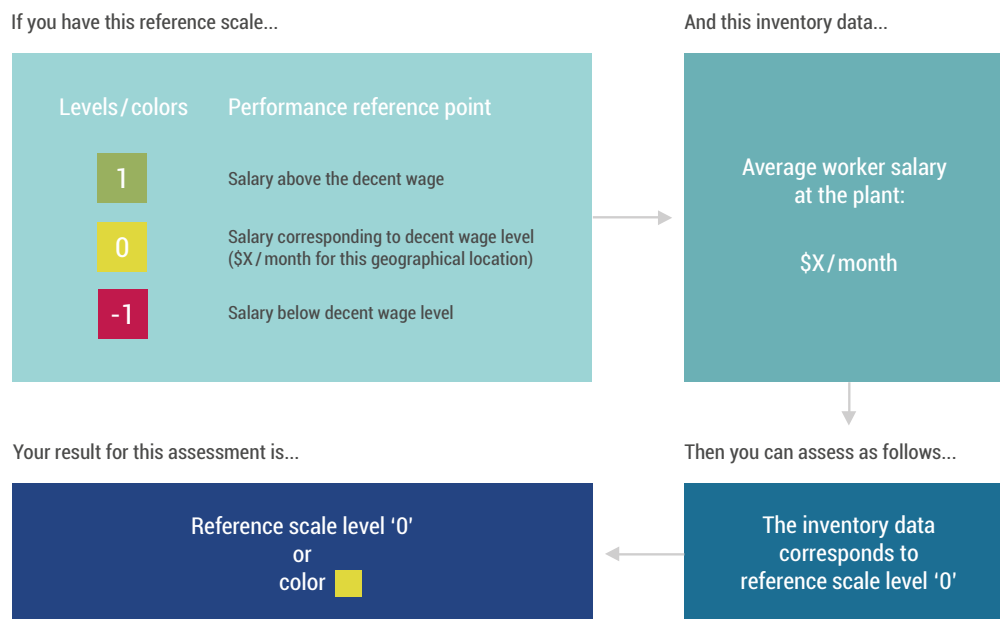


Figure 25: Simplified illustration of assessment using this approach.

Other approaches may be developed to assess data against the reference scale.

5.2.3 AGGREGATION AND WEIGHTING

Aggregation²⁵ and weighting can occur at many points during the impact assessment phase. It is intrinsic to the S-LCA methodology. It can be applied to aggregate indicators into social subcategories but also to produce a set of stakeholders' level performances, aggregate subcategory results into impact categories or to a single overall score. The same techniques described here hold well for all aggregation steps.

In particular in S-LCIA, aggregation is a way of combining various elements and synthesizing complex phenomena in order to achieve a better understanding and for the communication of results. As such, it implies the construction of a single, possibly synthetic, score involving two or more subcomponents. Single indices or scores are a powerful tool to combine and summarize multi-dimensional information.

It is recommended to not aggregate positive and negative impacts because impacts occur on the level of individuals or groups of individuals and, thus, positive impacts do not make up for negative ones. Presenting the results side by side is acceptable. In spite of the previous arguments, aggregated results are needed, the positive and negative impacts shall additionally be shown separately in order to not lose transparency.

Aggregation of results should always be done very carefully to avoid misinterpretation and loss of context. This also applies for aggregating results of stakeholder groups, because the location dependent aspect of the results is important – especially when the supply chain is global. When aggregating results over e.g. workers or communities in one part of the world with workers or communities of other parts of the world (supply chains are often global), the context of the results is lost. In case of aggregating reference scales, aggregating makes the assumption that a score of minus 2 is twice as bad as a score of minus 1, and that plus two is twice as good as plus 1, which is somewhat artificial. This should be kept in mind by assigning adequate weights as explained in the next paragraphs.

Aggregation requires weights in order to display expressions of performance at impact indicator/subcategory level.

²⁵ Note that aggregation is a common procedure in the business decision context because it can be difficult to make a decision based on the complex information provided by the life cycle approach. Ekener-Petersen and Moberg (2013) argue, however, that aggregation implies a loss of detailed information, highlighting the uncertainty associated with the definition of the weighting factors.

Specifically, in S-LCA weights represent the assignment of the relative importance (or contribution) of each indicator to the performance of a specific impact subcategory.²⁶

When weights are not defined or have the same value, all indicators are assumed to have equal relevance.

During the *weighting* step, the practitioner applies weights (values) to inventory, impact subcategory, or stakeholder category results, in order to reflect their relative importance.

BOX 14: WEIGHTING – DEFINITION

During the weighting step, the practitioner applies weights (values) to inventory, impact subcategory, or stakeholder category results, in order to reflect their relative importance. For example, impact subcategories/categories that are deemed more important will have greater weights, so that their associated results show a higher contribution in the final results. There is a range of approaches for deciding upon weighting values in S-LCA. However, all of them – even implicit weighting – rely on value choices and may change over time.

Weighting of results takes place in all S-LCA studies. Even when the step is formally omitted, an implicit form of weighting is still applied, as all contributing indicators are assumed to have equal relevance. The weighting process often happens in conjunction with an aggregation of results.

Weights should always be applied in a transparent manner. If this condition is not met, weighting can be a source of confusion and questioning rather than facilitation of interpretation. As such, information should be provided by answering the following questions:

- Are the weights based on a specific framework?
- Were the weights established by stakeholders affected by the product system or S-LCA experts?
- Which method was used for establishing the weights?

Reference scale results can be aggregated into an impact subcategory or category result through different approaches, each implying a different form of weighting. Below the most common approaches are presented:

²⁶ Note, this only holds true for S-LCA. In other (social impact) assessment methods weights can also be used with different intentions, e.g. for reducing data redundancy.

Table 14: Weighting approaches.

Weighting approach and description	Pros, Cons, 'When to apply', and 'How to apply'
<p>Equal weighting Attributing equal weighting to all indicator results.</p>	<p>Pros: Simple, easy to communicate. Cons: Provides a false sense of neutrality. When to apply: When indicators are deemed as robust and as relevant as one another. How to apply: If numerical results: do nothing. If non-numerical results: determine the average result based on observation of results.</p>
<p>Most robust indicators prioritized Most robust and relevant indicators are granted a higher weight than the others in the aggregation (criteria may include: timeliness, robustness of data source, level of resolution (Beaulieu et al., 2014)).</p>	<p>Pros: Results are based on the most robust and relevant indicators while including a certain level of triangulation. Cons: Some subjectivity may be involved in defining what comprises robustness and relevance, thus adding a certain bias. When to apply: When indicators are not deemed equally robust and relevant. It is important to document clearly how robustness and relevance is determined. How to apply: If numerical results: i) multiply each numerical result by the weight allocated to it (based on robustness or relevance); (do not forget that not applying any weight is equivalent to applying a weight of 1).</p>
<p>Expert or stakeholder values Weights are defined based on existing frameworks (e.g. ILO decent work agenda, corporate code of conduct) or on preferences expressed by stakeholders, product users, or pre-defined stakeholder profile values, through a stakeholder involvement process. *Rarely applied on this type of aggregation.</p>	<p>Pros: Provides opportunity to integrate stakeholder opinions to determine the relative importance of indicators within subcategories. Can boost richness and relevance of results. Cons: Structure and quality of stakeholder involvement process may affect results in a significant way. May be time consuming if using survey, focus group, or delphi panels. When to apply: When it is relevant to present weighted results for the context. How to apply: If numerical results: i) multiply each numerical result by the weight allocated to it through the stakeholder involvement process (do not forget that not applying any weight is equivalent to applying a weight of 1).</p>
<p>Worse performance prioritized A weight of '1' is granted to the worse performing indicator and a weight of '0' is granted to all other indicators. This means that the results for the impact subcategory amount to the worse performance recorded.</p>	<p>Pros: The impact subcategory results do not dilute any documented negative performances/risks among indicators. Cons: May provide a less balanced view on impact subcategory results, given that less triangulation is involved. When to apply: When indicators are deemed as robust and relevant as one another. Relevant when objective of the assessment is to ensure that no negative performance is missed. How to apply: If numerical results: i) a weight of '1' is granted to the worse performing indicator and a weight of '0' is granted to all other indicators; ii) multiply each numerical result by the weight allocated to it through the stakeholder involvement process; iii) apply weighted arithmetic or geometric mean (do not forget that not applying any weight is equivalent to applying a weight of 1).</p>

Before aggregating and applying weighting, it is essential to ensure that all results are expressed in the same unit, in order to avoid the combination of different units. For example, the units can be converted to points.

It is important to remark that the data prior to weighting should remain available in order to ensure the transparency of the study.

Different weight sets may lead to different aggregated results. In the same way, different techniques when aggregating can lead to different conclusions.

The diversity in value judgments from people involved – or not – in a stakeholder involvement process reflects actual differences in values between groups in the society, made visible by a transparent weighting process. When relevant for the Goal and Scope, parallel weightings based on different sets of values may be used to contrast different stakeholder profiles for instance (Ekener et al., 2018).

When dealing with weighting systems, attention must be paid to potential bias introduced by the value solicitation procedures: how the sample was drawn, how PRP scales were defined; the type of scoring used and if/how uncertainty was addressed. A large body of literature on behavioral economics suggests improvements to the survey techniques to control and adjust for the systematic biases caused by the contextual and informational setting of the valuation. One important example is that of the endowment effect, which causes a larger weight that which are framed as losses than to those framed as gains. Another example is the issue of scaling, where large singular instances of impacts (catastrophes) may be systematically over-weighted relative to the same impact over a larger space or time, while empirical studies systematically controlling for this bias show that neither experts nor lay people are particularly catastrophe averse. By making such biases explicit, it is possible to adjust for them.

5.2.4 IMPACT PATHWAY APPROACHES

Another type of approach available for S-LCA practitioners are impact pathway assessments. Typically, Impact Pathway (IP) assessments are based on **social mechanisms** (see Box 15). The impact pathway also belongs to a certain impact (sub)category. Unlike RS assessments, IP assessments do not have a strong focus on stakeholder groups (mostly impacts on workers have been included in studies so far), but they try to give general measures/values for selected social consequences through midpoint and/or endpoint indicators²⁷. Midpoint indicators refer to impacts that are midway through the cause-effect chain, while endpoint indicators represent the impact at the end of the cause-effect chain, as explained in the next section. This requires defining the social mechanisms and related inventory indicators that lead to midpoint and endpoint impacts. In general, negative as well as positive impacts can be regarded, although the first may be more common practice. Even though, there are no specific approaches on how to assess positive social impacts in IP studies some implicitly include them (e.g. Disability-Adjusted Life Year (DALY)). In addition, some impact indicator results can be either positive or negative, depending on their magnitude on a spectrum (e.g. Fair Wage Equivalents – wages can be either very unfair (negative) or totally fair (positive)).

²⁷ A critical reflection on this practice can be named by quoting Dreyer et al., 2006: "Impacts on stakeholders. The stakeholder relations of a company are very specific and can be quite complex, which makes it difficult to make a general people impact model based on them."

BOX 15: SOCIAL MECHANISMS IN S-LCIA – RELATING TO THE E-LCIA APPROACH

To determine the social consequences in an impact pathway assessment, the identification of social mechanisms that describe cause-effect-chains is needed. Social mechanisms may provide information on the relative importance of activities and consequences within social or socio-economic considerations (Vanclay, 2002).

In alignment with ISO 14044 (2006) the social mechanisms in S-LCA shall be represented by **social impact categories**, **impact category indicators**, and **characterization models**¹. To this end, inventory results are connected with impact categories (usually described as midpoint impact categories) and category endpoints (usually described by endpoint impact categories) (JRC, 2010). An outlined example for a full Life Cycle Sustainability Assessment including S-LCA is illustrated in Figure 26.

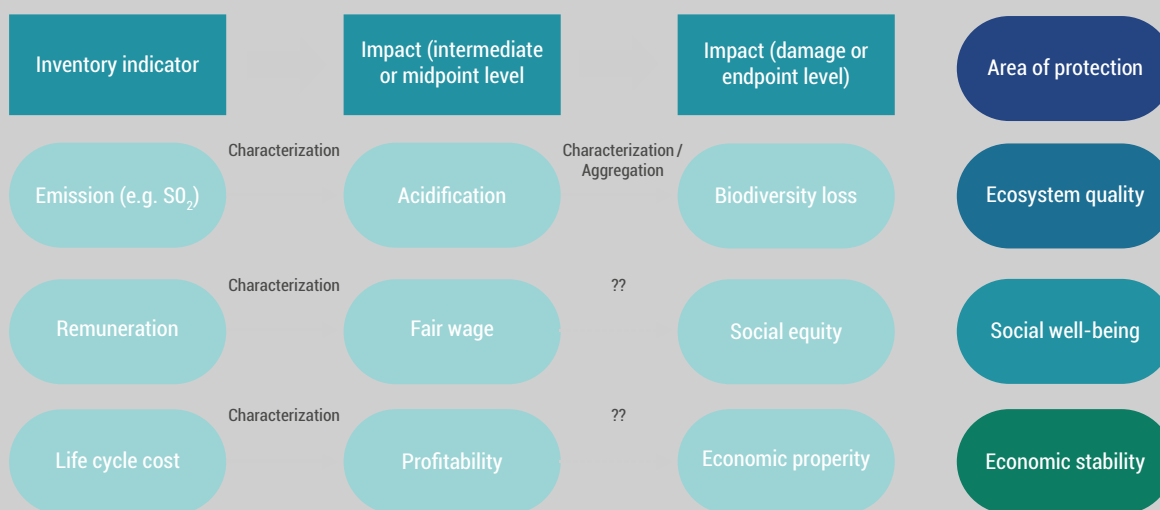


Figure 26: Exemplary impact pathway schemes for LCSA (adapted from Neugebauer 2016).

After classifying inventory results in impact categories (e.g. child labor), characterization is required to translate inventory results into a value for an impact indicator at midpoint (e.g. loss in education) or endpoint level (e.g. loss in well-being) (ISO 14044, 2006). Similar approaches have already been suggested by Hunkeler (2006), Weidema (2006), and other authors. Characterization shall be done based on scientific findings following identifiable mechanisms, reproducible empirical observations or international agreements.

¹ Characterization models are normally understood as a quantitative way to convert inventory indicators into category indicators, i.e. social impacts, reflecting social, environmental, or economic mechanisms (ISO, 2006b; Neugebauer, 2016).

5.2.5 GENERAL STRUCTURE IN IP S-LCIA

Development of an IP S-LCIA method, just as for E-LCIA, usually consists of linking inventory data that undergoes a characterization step, and which results in midpoint and or endpoint impact indicators. In other words, the impact pathway relates the **social activity/stressors** reflected by means of **inventory indicators** (or social causes) with **impact indicators** at (several) intermediate steps along the social impact pathway as well as a **final damage** relating to the **social Area of Protection (AoP)** (consider Figure 27, Box 16, and Box 17). Therefore, the link can be indirect through midpoint indicators but also can sometimes be made directly from the inventory level to the social endpoint.

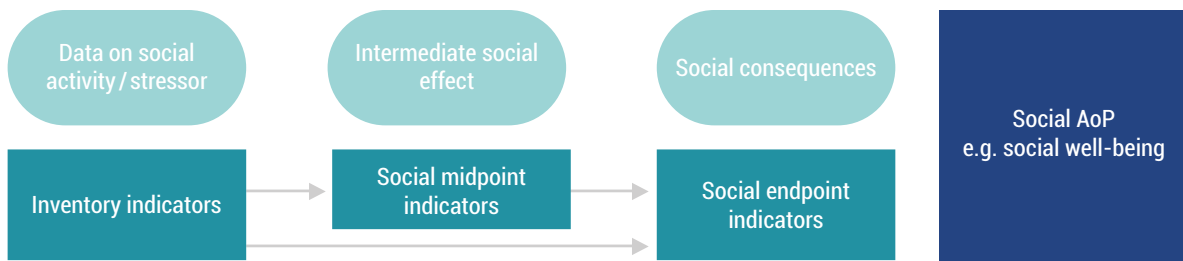


Figure 27: Illustration of the social impact pathway scheme applicable to type II S-LCA. See figure 4 and main text for examples of midpoint and endpoint indicators.

BOX 16: THE LOGIC OF MIDPOINT AND ENDPOINT CATEGORIES FROM E-LCA TO S-LCA (DERIVED FROM NEUGEBAUER, 2016)

Impact categories within life cycle based methods should cover the complete impact pathway by including inventory indicators, midpoint, and endpoint categories (Bare et al., 2000; JRC, 2010). Inventory indicators may be defined as simple variables (e.g. working hours), whereas midpoint impact indicators are seen as parameters in the (social) mechanism network (Bare et al., 2000). Endpoint impact indicators are then understood as measurement endpoints determining damage levels to the Area of Protection (Jolliet et al., 2004).

BOX 17: THE AREA OF PROTECTION (AOP) OF S-LCA AND OVERLAP WITH HUMAN HEALTH IMPACT OF E-LCA)

The AoP of S-LCA is usually considered to be Social or Human Well-Being, i.e. happiness. When human health is also considered this may sum up as Total Social or Human Well-Being, confining both health and happiness. Regarding human health as AoP, there is overlap between S-LCA and E-LCA since the latter also covers it. However, S-LCA focuses mostly on health and safety practices, outcomes, and effects while E-LCA looks at environmental health issues (e.g. pollutants). Although, they can also overlap (e.g. pollutants in workplaces).

Given the recent development of the *Impact Pathway approach*, this section summarizes the current state of the art including guidance on how to perform IP S-LCIA.

When we consider IP S-LCIA, we normally refer to approaches that fulfill the following **four typical characteristics**:

1. Inclusion of **inventory** and **impact** indicators (part of the G&S definition and the S-LCI);
2. Definition and use of **characterization models** leading to impact indicators;
3. Description of **impact pathways** which are then quantified using characterization models;
4. Presence of **correlations** and/or **causal relations** connecting social activities/stressors²⁸ with social impacts, constituting the impact pathways and models.

Below we describe what we understand under an impact pathway (see Section 5.2.6) and classify the underlying methodological choices in four main groups. See also the work of Sureau et al. (2019) for an overview on types of Impact

²⁸ Sometimes it is referred to as social causes, social factors, or social stressors instead – see e.g. the work of Hunkeler (2006).

Pathway approaches. Specific guidance is provided within the next section 'on how to construct the impact pathway', within the following sections 'on how to define (inventory and) impact indicators', and 'on how to develop/use characterization models'.

5.2.6 WHAT IS AN IMPACT PATHWAY?

The main target within the IP S-LCIA is to assess and model relations between the cause (social activities/stressors (that may be resulting from a company's activity)) and their effect. This is usually done by establishing what we call **impact pathways**. Those Impact Pathways in IP S-LCIA can be established qualitatively and quantitatively.

5.2.6.1 QUALITATIVE PATHWAYS

Qualitative pathways cover social topics/categories and support the impact indicators' and characterization models' definition to explain the interrelations of social phenomena towards the defined areas of protection (e.g. social well-being) (see Figure 28).

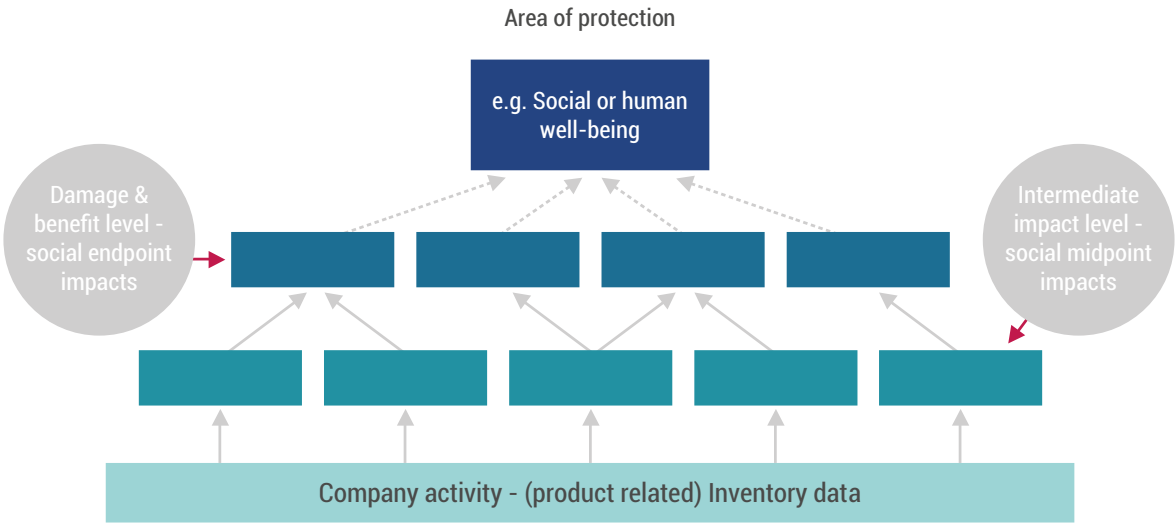


Figure 28: Scheme of qualitative impact pathways connecting the company's activity with social mid- and endpoints (adapted from the work of Dreyer et al., (2006)).

Those qualitative pathways typically identify social topics/categories of interest (e.g. Fair Wages) or of concern (e.g. child labor). The pathways described often combine findings of different disciplines of social and natural sciences²⁹. The pathways enable to link social topics/categories to social activities (or vice versa) and also may link to societal challenges. The findings can contribute to explain underlying social interrelations. While this all may lead to theoretical interrelations, it can still serve as a prerequisite for well-founded impact pathways (see Figure 29).

²⁹ Here we refer to case studies undertaken on specific locations and/or specific topics, such as child labor, targeting the investigation of "real" conditions and circumstances.

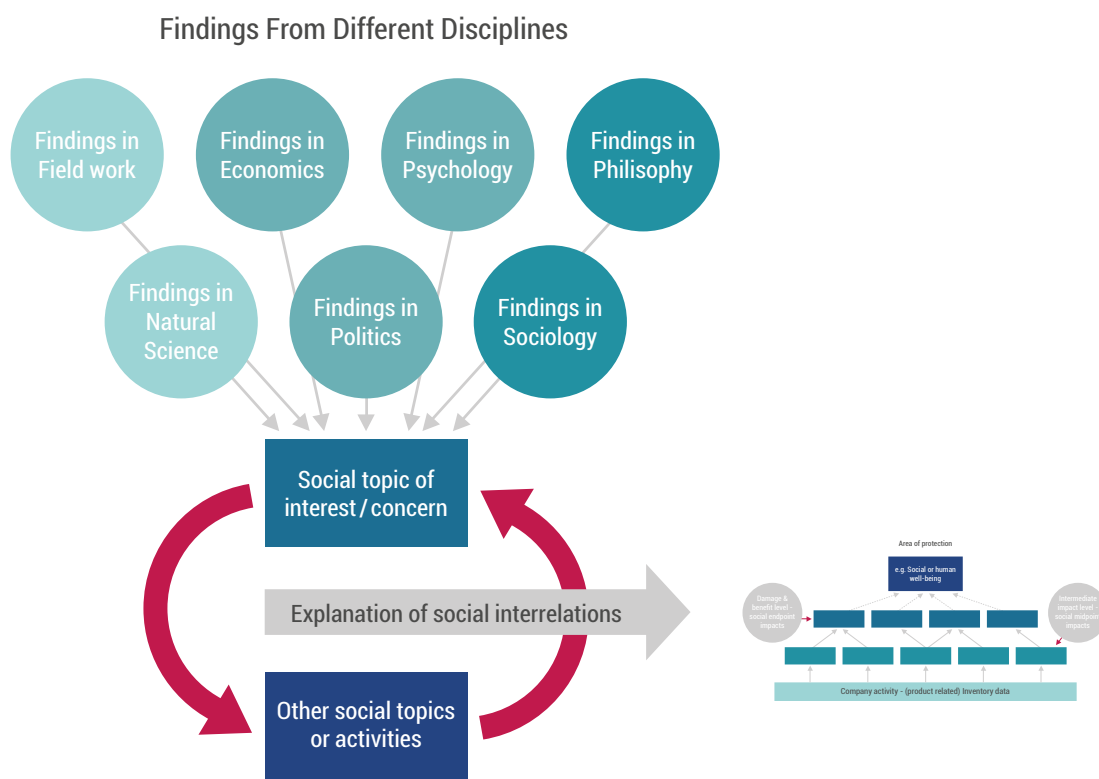


Figure 29: Role of different disciplines for building social impact pathways.

5.2.6.2 GENERAL INDICATOR FRAMEWORKS FOR SELECTED SOCIAL MID- AND/OR ENDPOINT IMPACT CATEGORIES: EXAMPLE OF QUALITATIVE PATHWAYS

An example of qualitative pathways is the development of indicator frameworks. The main purpose is the investigation of broader social interrelations often relating to a specific social topic and/or product life cycle and suggestion of first attempts for calculation/quantification (Dreyer et al., 2006; Jørgensen et al., 2010; Neugebauer et al., 2014; Neugebauer et al., 2017).

Indicator frameworks describing selected social topics of interest or concern (e.g. fair wages or child labor) target the elaboration of interrelations with other social topics, the broader society (also understood as the sink of potential social impacts), and/or the company’s activity (understood as the potential cause of social effects). Therefore, typically social mid- and/or endpoint impact indicators are usually defined. These can be either quantitative, qualitative, or a mixture of both. Findings from social science, economics and socio-economic investigations, sometimes even philosophical or psychological observations assist in establishing the first qualitative cause-effect-relations along an impact pathway (see Section 5.2.6).

Assessments are typically divided in qualitative and quantitative steps and are performed through (also consider Figure 30):³⁰

1. **Selection of a social topic** of interest or concern (e.g. fair wages, education, or child labor) – part of the G&S phase;

³⁰ Note, the parts highlighted in grey are listed here for reasons of completeness but belong to the G&S and/or S-LCI phase of the assessment.

2. **Categorize the social topic to the mid- or endpoint level** (by following common or defining new classifications on impact indicators and/or damage categories (see Box 16) – part of the S-LCI;
3. **Develop the impact pathway** by using observations and findings from various disciplines (see Section 5.2.6) – iterative step in the assessment;
4. **Build the inventory** to follow the defined pathway by also considering the respective life cycle – part of the S-LCI;
5. **Perform the characterization step**, consisting of either:
 - I. newly developed own characterization models³¹;
 - II. existing characterization models (as presented e.g. in the following sections); or
 - III. case-specific characterization models, as e.g. suggested by Neugebauer et al., 2017 (see Box 18);
6. **Calculate the potential social impact**, e.g. Fair wage equivalents (see Box 18).

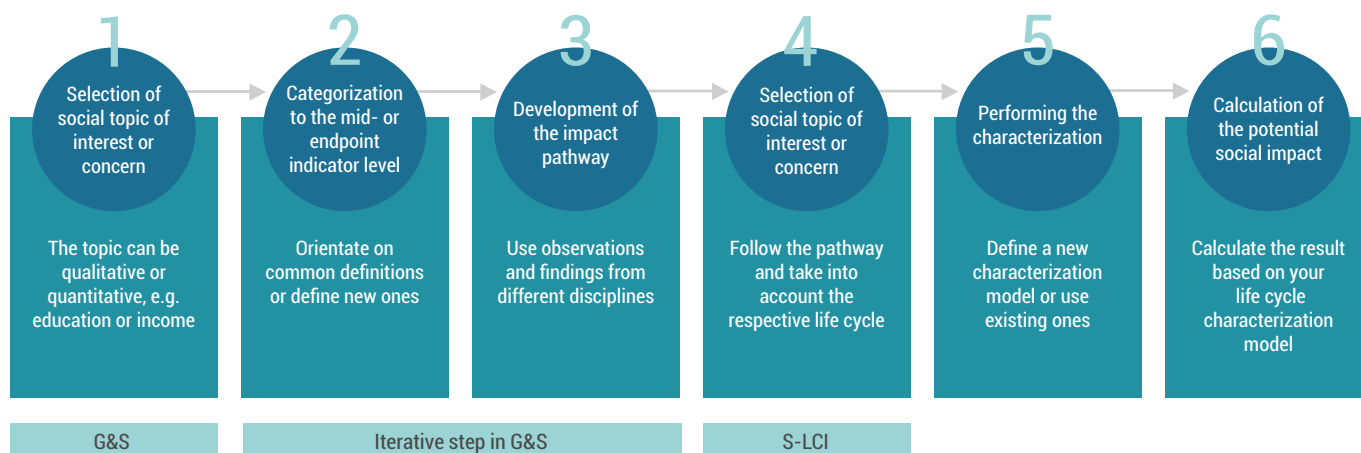


Figure 30: Exemplary procedure when building general indicator frameworks in IP S-LCIA (parts with titles underneath belong to earlier phases of the S-LCA).

31 No one-procedure-fits-all example can be given, but we suggest orientation on existing characterization models. Note that for qualitative assessments no characterization in the IP S-LCIA has been suggested so far.

BOX 18: DISTANCE-TO-TARGET CHARACTERIZATION IN IP S-LCIA AGAINST THE BACKGROUND OF AN IMPACT PATHWAY – THE FAIR WAGE EXAMPLE (FOLLOWING THE APPROACH OF NEUGEBAUER ET AL., (2017))

Determination of fair wages depends on mainly three country/region-specific and/or product-specific parameters: 1) living wages, 2) working time, and 3) income (in-)equality. For developing a characterization model, characterization factors¹ for these parameters have to be operationalized and included in a formalized relationship. This formulates into:

$$CF_{FW,n} = \frac{1}{MLW_n} \times CWT_n \times (1 - IEF_n^2)$$

where $CF_{FW,n}$ is the Fair wage related characterization factor [month/€] for process n representing the country, region, or sector specific conditions;

MLW_n is the Minimum living wages by country, region, or sector [€/month], which have to be paid to the worker to enable an adequate living standard for an individual and/or family in the respective country or region, where process n is performed;

CWT_n is the contracted working time [hours/week] for workers performing process n (including vacation days); and

IEF_n is the (squared) inequality factor [expressed in percentages] of the organization, region, or country where process n is performed.

The impact indicator Fair wage equivalents (given in Fair wage potentials – FWP_n) can then be calculated as follows:

$$FWP_n = \frac{RW_n}{RWT_n} \times CF_{FW,n}$$

where RW_n is the Real (average) wage [€/month calculated over one year], which are paid to the worker employed in process n ; and

RWT_n is the Real working time [hours/week] of workers performing process n (including vacation days and unpaid overtime).

Results give the distance from the announced target of receiving a fair wage ($FWP = 1$). But if a) RW_n is smaller than the MLW_n , the resulting FWP_n will be < 1 , thereby implying: the greater the distance from the (minimum) targeted state, the lower the FWP_n ; and b) if the real working time is equal to the CWT then no effect on the FWP_n occurs, but if c) RWT_n is greater than the CWT_n (which indicates overtime work), the resulting FWP_n will also be < 1 and keeps getting smaller the more overtime the worker does. Hence, the characterization factors function as determinants on how far the distance from the minimum targeted situation is.

1 Characterization factors translate the inventory results into the common unit of the category indicator (ISO 14044, 2006).

LIMITATIONS: The link to the endpoint level and AoP are usually qualitative.

5.2.6.3 QUANTITATIVE PATHWAYS

Quantitative pathways have a focus on measurable numbers and target the explanation of one or more phenomena rather than elaborating about the bigger picture as done in the Qualitative Pathway Approach.

Today, we can distinguish mainly two types of quantitative pathways:

1. Pathways following a mechanistic modelling approach oriented on E-LCIA; and
2. Pathways following a regression-based modelling approach.

5.2.6.4 PATHWAYS FOLLOWING A MECHANISTIC MODELLING APPROACH ORIENTED ON E-LCIA

Those pathways relate to the assessment of human health mostly by means of the DALY approach, which was applied in the context of human health impact in E-LCA³². It is based on measurable causal relations which link emissions and/or social conditions with the probability of persons being affected (see Figure 31).

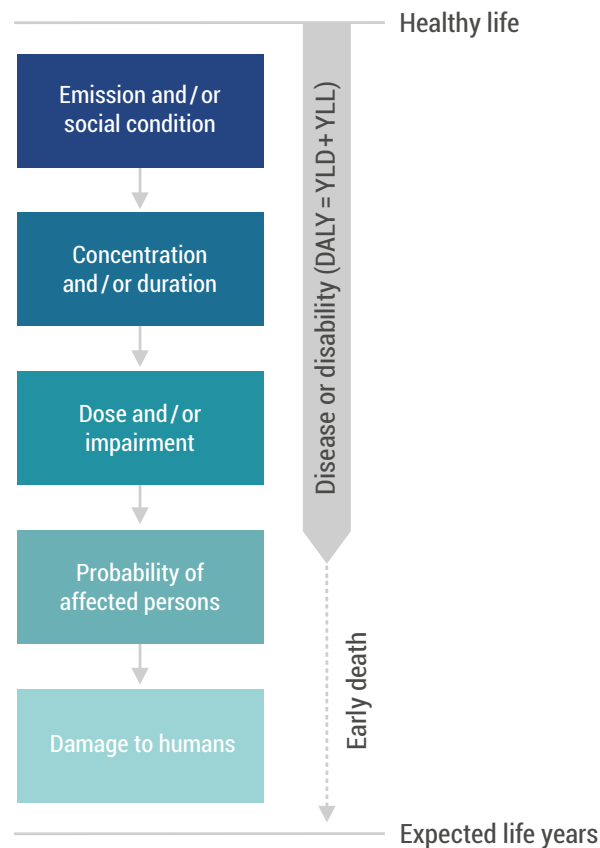


Figure 31: Illustration of a DALY (disability adjusted life years) impact pathway representing the mechanistic modelling approach. YLD = years of life disabled and YLL = years of life lost. Based on figures from Crettaz et al. (2002), Frischknecht et al. (2000) and Golsteijn (N.D).

³² A summary of the DALY approach in the context of E-LCA is presented in: ILCD Handbook – Framework and requirements for LCIA models and indicators (JRC, 2010).

5.2.6.5 CALCULATION OF SINGLE-UNIT HEALTH OR WELL-BEING INDICATORS: FIRST EXAMPLE OF MECHANISTIC MODELLING APPROACH

An example of the mechanistic modelling approach is the single-unit health or well-being indicators. (Arvidsson et al., 2018; Baumann et al., 2013; Weidema, 2006; Schaubroeck and Rugani, 2017)

The main purpose of studies is the expression of positive and/or negative health impacts along the life cycle/value chain of a product or process.

S-LCA studies focusing on **human health impacts** are usually developed against the background of the derived methods from E-LCA. Those are typically linked to existing approaches, such as the **DALY** (disability-adjusted life years) approach suggested by the World Health Organization or the **QALY** (quality-adjusted life years) approach developed in the late 1960s by economists, psychologists, and further researchers (Gold et al., 2002) and further developed in the S-LCA context by Weidema (2006). However, the interpretation of Weidema (2006) consists on well-being as a whole (See Box 20).

Accordingly, for both approaches cause-effect-relations have already been described, which may enable a straightforward implementation in case studies. Unlike the single-unit indicators in the previous section, these human health impacts do not solely focus on workers along value chains, but also focus on other stakeholder groups, e.g. local communities.

Assessments are typically performed through (see also Figure 32):³³

1. An **inventory step** (usually comparable to E-LCA) – parts of the inventory can even be derived from earlier (E-LCA) studies – part of the S-LCI;
2. A **characterization step** including:
 - I. General DALY/QALY characterization by means of existing characterization models and/or software³⁴;
 - II. Specific characterization factors, e.g. representing specific working environments – examples can be taken from Scanlon et al., 2013;
 - III. An allocation step, if applicable, e.g. for differentiating the DALYs/QALYs of specific resource impacts from overall resource industries' impacts – an example is provided by Arvidsson et al. (2018);
3. The **final benefit/damage calculation** (for general calculation of DALYs see Box 19) including positive and negative health impacts.

NOTE: The steps for performing the assessment apply under the premise that the impact pathway has already been developed – if this is not the case see Section 5.2.6.

33 Please note, the parts highlighted in grey are listed here for reasons of completeness but belong to the G&S and/or S-LCI phase of the assessment

34 E.g. ReCiPe (Goedkoop et al., 2009) and/or GaBi, Simapro etc. (Thinkstep, 2015). Please note, if regional characterization factors should be applied, E-LCA models may have limitations. Please also note, if primary data or additional secondary sources are used new characterization factors need to be developed.

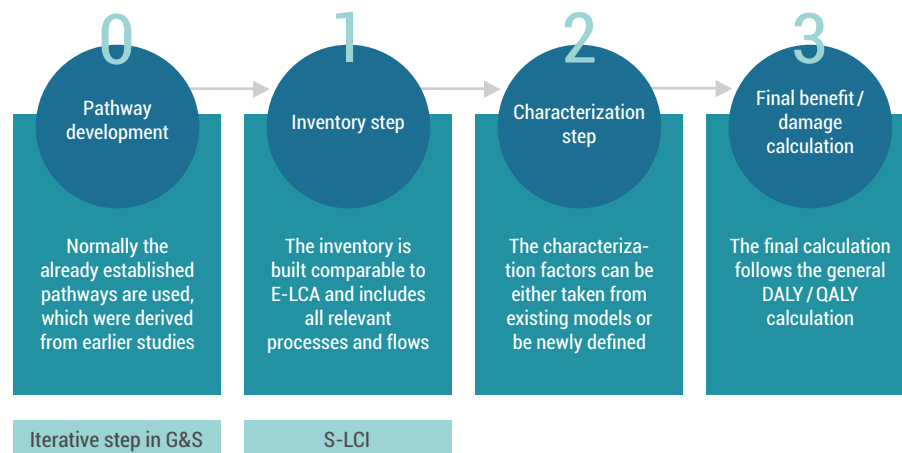


Figure 32: Exemplary procedure when using the single-unit health indicators approach in IP S-LCIA (parts with titles underneath belong to different phases of the S-LCA).

BOX 19: CALCULATION OF DALYS FOLLOWING THE WORLD HEALTH ORGANIZATION'S APPROACH)

$$DALY = YLL + YLD$$

with $YLL = \text{years of life lost}$ and $YLD = \text{years of life disabled}$ (and $DALY = \text{disability-adjusted life years}$)

$$YLL = t_{exp} - t_{death}$$

with $t_{exp} = \text{expected age in population}$ and $t_{death} = \text{actual age at death}$

$$YLD = w \times D$$

where w is a severity factor between 0 (complete health) and 1 (complete disability), and D is the time duration of the disability.

Arvidsson et al. (2018) suggest a **generic human health impact assessment method**:

$$DALY_x = \sum_i DALY_i + \sum_j DALY_j$$

where x is the product of study; i constitutes the negative health impacts expressed in DALYs and j represents the positive health impacts expressed in negative DALY values.

Thus, health savers and health takers may be identifiable.

BOX 20: BEYOND COVERING HEALTH WITH DALY; COVERING WELL-BEING THROUGH QALY OR WELBY

Source: (Schaubroeck and Rugani, 2017)

DALY is strictly focused on human health. QALY has originally been developed several decades ago in the field of health sciences to quantify only health (not well-being as a whole) and the effect of medical treatments on it, even though the interpretation of Weidema (2006) covers well-being as a whole. Following the interpretation of Weidema (2006), QALY consists of the product of a period of human life (in years) and a factor that represents the extent of well-being on a scale between 0 and 1, where 0 is equal to death. In fact, in general, the difference between health and well-being is not clear, and different interpretations of QALY exist. As a result, the well-being adjusted life years (WELBY) metric has been introduced, which is the same as a QALY measure, except the descriptive system is clearly concerned with well-being rather than just health-related quality of life, in line with the interpretation of Weidema (2006). Future research in S-LCIA could focus on characterizing impact through the latter WELBY indicator, covering not only health but well-being as a whole, as already considered by Weidema (2006).

NOTE: Human health is a crucial part of social investigations. Therefore, the single-unit health indicators approach may always be useful when performing S-LCA. It may represent also further stakeholder groups beyond workers, such as local communities.

LIMITATIONS: It however fails in representing a worst case scenario and may not include those who are worse off (Gold et al., 2002). This may be better represented by RS S-LCIA approaches (see Section 5.2).

5.2.6.6 CALCULATION OF WORKER SINGLE-UNIT INDICATORS: SECOND EXAMPLE OF MECHANISTIC MODELLING APPROACH

Another example of the mechanistic modelling approach is the worker single-unit indicators (Hunkeler, 2006; Labuschagne and Brent, 2006).

The main purpose of studies is to provide a first reflection of social impacts/aspects often together with an E-LCA study performed in parallel. (Hunkeler, 2006; Labuschagne and Brent, 2006)

Several authors proposed approaches using single-unit indicators. Coming from E-LCA and using a similar (but extended) life cycle inventory, this kind of approach may be applied, when aiming at a first inclusion/reflection of social impacts within environmental assessments.

The calculation of single-unit indicators can basically be done in two ways (see also) – part of the S-LCI:³⁵

1. **Break-down of social aspect into one social midpoint indicator** by use of an activity variable (e.g. labor hours);
or
2. **Summary of defined social impacts into one single-score** (e.g. Social Impact Indicator)³⁶.

Assessments are typically performed through:

1. An **inventory step**, which is mostly comparable to E-LCA and thus regards all processes and flows, which are

35 Note, the parts highlighted in grey are listed here for reasons of completeness but belong to the S-LCI phase of the assessment.

36 Note, that this approach may have overlaps with what we described in section 5.2 and may not be described as the classical IP approach described in this section; however, it still contains specific characteristics such as a characterization step that allows for classification within this section.

necessary to describe the product system in relation to the social aspects/impacts considered – part of the S-LCI;

2. A translation of the inventory data by means of an **activity variable** (if applicable), e.g. labor hours – part of the S-LCI;
3. A **characterization step** by using regional and/or impact related characterization factors;
 - I. which can be taken from existing characterization models (as presented e.g. in the previous and following sections); or
 - II. which can be newly defined;
4. A **summary into one single-unit impact indicator** (if applicable by using also normalization, ranking and/or weighting approaches).

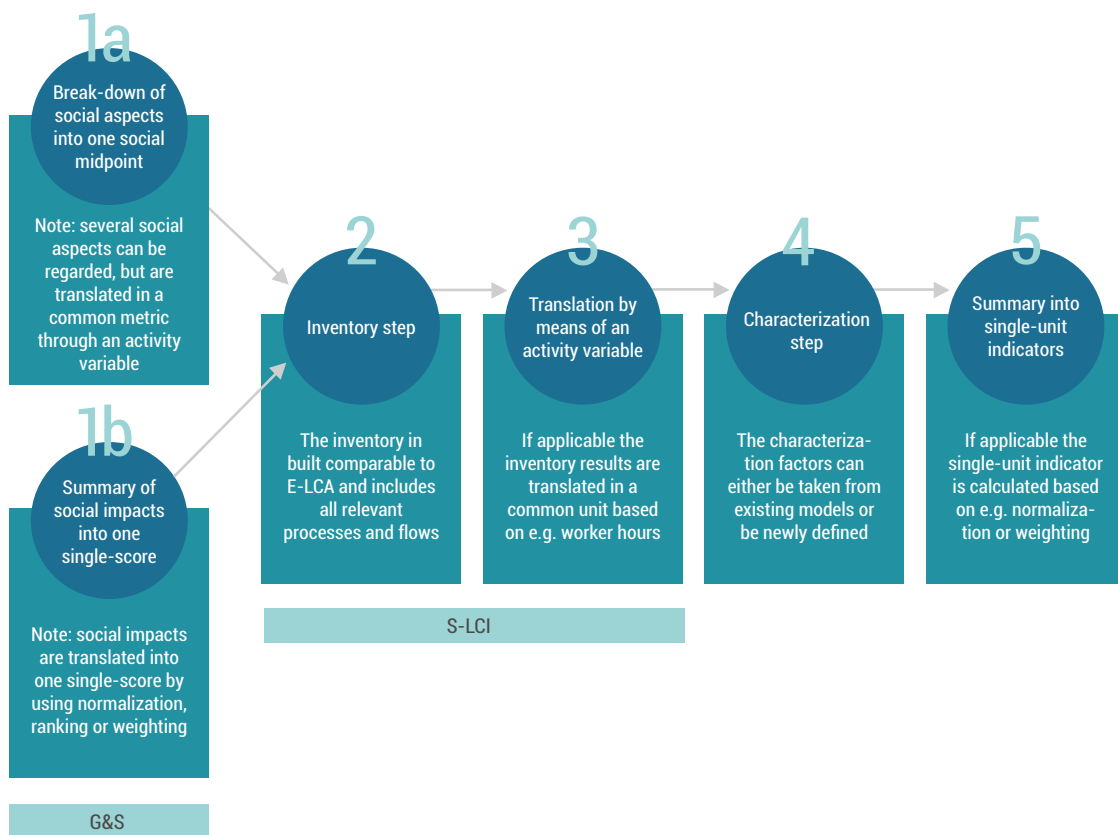


Figure 33: Exemplary procedure when using the single-unit indicators approach in IP S-LCIA (parts with titles underneath belong to earlier phases of the S-LCA).

NOTE: The described single-unit indicators approach may be useful to describe impacts on workers but may provide limitations with regard to other stakeholder groups. It shall thus serve as a first proxy for social impacts but rather not for providing a complete social impact assessment. The approach described under 1b may also have overlaps with the approaches described under Section 5.2.

LIMITATIONS: The approach is NOT primarily designed to describe an impact pathway, but focuses more on the definition and characterization of (simplified) social impact indicators. Hence, in related studies it is not clearly described on how to establish/create the pathway – for further guidance see Section 5.2.6.

5.2.7 PATHWAYS FOLLOWING THE REGRESSION-BASED MODELLING APPROACH

Those pathways build correlations on the basis of economic regression modelling (for instance linking data on income with health impacts on a societal level, (see Figure 34).



Figure 34: Example for a quantitative impact pathway following the regression-based modelling approach adapted from the work of Bocoum et al. (2015).

The main purpose of studies is the determination of positive and/or negative social impacts, linking the product level with macro-scale indicators (Bocoum et al., 2015; Feschet et al., 2013; Hutchins and Sutherland, 2008; Norris, 2006.)

Within regression-based modelling approaches, social impacts of product systems are determined by measuring the change in social conditions and social impacts.

Therefore, the analysis is typically being done in three steps:

1. **An empirical correlation between two parameters of interest is established** (e.g. between income inequality and human health) through a simplified economic calculation;
 - I. By using (simplified) economic predictions, such as the Preston curve or the Wilkinson pathway – iterative step;
2. **A potential social impact is predicted** for a product’s life cycle (microeconomic level);
 - I. By measuring indicators on a societal level resulting from the functionality of the product system under consideration, such as income inequality;
3. **An effect on the social condition at the national indicator is calculated** relevant in the context of social sustainability (such as human health or social equity) based on the earlier determined empirical correlation;
 - I. By choosing macro-economic indicators, which reflect the macro-scale situation resulting from the change in the product system, such as health (e.g. infant mortality rate) or income status of the population (e.g. GDP).

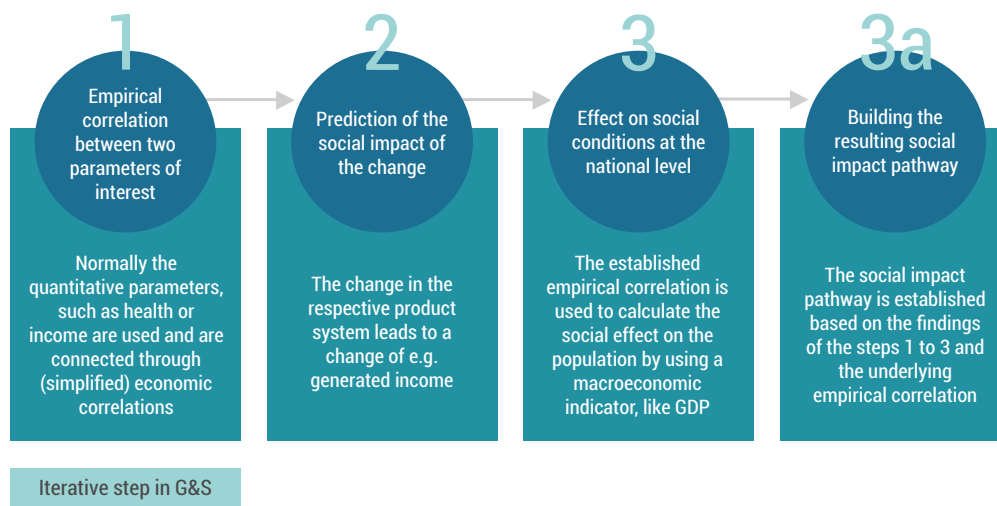


Figure 35: Exemplary procedure when using the non-marginal regression-based modelling approach in IP S-LCIA (parts with titles underneath belong to different phases of the S-LCA).

NOTE: Established correlations through the regression-based modelling approach can very well serve for further pathway developments and the hunt after cause-effect-relations in S-LCA or for quantitatively describing social mechanisms (this was described by Wu et al., 2015).

LIMITATIONS: The correlations are typically case-specific and usually assess scenarios and changes instead of the status of product systems. Furthermore, the assessments are only valid, if certain conditions are met. Feschet et al. (2013) specify it as follows:

- (1) the activity is set within countries where the GDP per capita in purchasing power parity is less than \$10,000 at the start of the period;
- (2) the assessed activity accounts for a significant part of the annual GDP and/or demonstrates obvious signs that it represents a huge stake in the country's economy;
- (3) the duration of the assessed activity is regular and long enough; and
- (4) the added value created by the activity is shared within the country."

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6. Interpretation

Social Life Cycle Interpretation is the final phase of an S-LCA in which all the previous phases are reviewed. When the study's iterative process is concluded, the results of the S-LCIA phase are checked and discussed in depth. This discussion forms a basis for conclusions, recommendations, and decision-making in accordance with the Goal and Scope definition.

In order to be interpreted, results are not only discussed and summarized, but also analyzed at different levels. Information and data might be aggregated and/or broken down at the level of life cycle phases, impact categories, impact subcategories, stakeholder categories, or also at process level for extracting insights. It is a key phase of an S-LCA study, as it affects the capability of displaying the final results and suggestions, and related improvement potentials, by the direct users and other stakeholders of the study.

6.1 HOW TO CONDUCT INTERPRETATION

The Interpretation phase is built upon the requirements of ISO 14044 (2006), and it consists of the following steps (Figure 36):

- Completeness check;
- Consistency check;
- Sensitivity and data quality check;
- Materiality assessment;
- Conclusions, limitations, and recommendations.

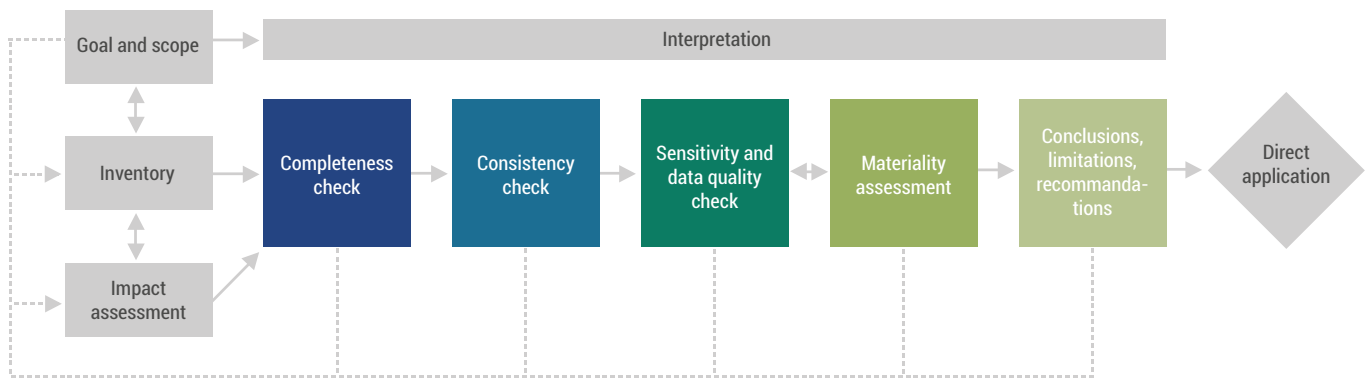


Figure 36: Illustration of the elements of the interpretation phase in S-LCA and their relation with the other life cycle phases (Source: adapted from the works of Hauschild et al. (2018) and Laurent et al. (2019)). The dashed arrows highlight the iterative nature of the different steps within the interpretation and with other phases.

Interpreting the results is an iterative approach: the outcomes of this phase might require revising the Goal and Scope of the S-LCA study, as well as the data collected and the impact assessment.

The steps can be carried out with the support of several methods, most of which are qualitative in nature. In order to ease their application, a check list of guiding questions has been defined for each step of the Interpretation.

6.1.1 COMPLETENESS CHECK

The completeness check aims at reviewing each assessment phase to ensure that all the relevant issues, outlined in the Goal and Scope, have been satisfactorily addressed or integrated in the inventory and impact assessment, i.e. that all pertinent data and information have been gathered and processed in relation to the relevant stakeholders, the results have met the objective(s) of the study, and that the insights gained allow to draw conclusions from the life cycle evaluation.

In parallel, the completeness check highlights if some questions remain unsolved, and for what reasons: it provides the information necessary to review the previous steps. The process can therefore be iterated until gaps are filled and missing information is found.

If gaps cannot be filled by iteration, the Goal and Scope should be revised to accommodate the lack of completeness. This circumstance should be taken into account when drawing conclusions.

The completeness check is carried out in a narrative way. The following checklist of guiding questions (Table 15) supports the practitioner in carrying out the completeness check.

Table 15: Example of guiding questions to conduct the completeness check.

Assessment phase	Guiding questions	ITERATIVE PROCESS
GOAL AND SCOPE	<ul style="list-style-type: none"> • Are the Goal and Scope clearly defined? • Have all the relevant stakeholders been considered? If some stakeholders have been excluded, which criteria were used to justify it? • Have all the relevant life cycle phases and processes been taken into account? If cut-offs and omission have been applied, are they duly justified according to e.g. social significance, empirical motivations, identical elements, and decision relevancy? 	
INVENTORY	<ul style="list-style-type: none"> • Are the data collected sufficient for evaluating the identified relevant social aspects? 	
IMPACT ASSESSMENT	<ul style="list-style-type: none"> • Are the selected impact categories, subcategories, and indicators sufficient for addressing the performances/impacts of the study? • Are the social impact pathways sufficient for addressing the identified impacts (if applicable)? 	
INTERPRETATION	<ul style="list-style-type: none"> • Are the results answering the research/evaluation questions? Are there unsolved questions or information gaps? • Are value choices properly detailed when drawing conclusions? 	

The reasons and modes of stakeholders' involvement should be checked and explained: which stakeholders have been involved, how and for which purposes (e.g. information, consultation, collaboration, empowerment; data provision/gathering, scoring, weighting, interpretation)

6.1.2 CONSISTENCY CHECK

The consistency check aims at ensuring that the methods applied in the inventory and impact assessment steps, and the data used, are consistently applied throughout the study and are in accordance with the Goal and Scope of the study. Ensuring consistency means ensuring that the applied procedures are not contradicting the choice of indicators (and, as a consequence, of data), the impact assessment method chosen to process them, and the typology of results.

The consistency check is carried out in a narrative way, through a set of guiding questions that support the practitioner during this evaluation step (see Table 16):

Table 16: Example of guiding questions to conduct the consistency check.

Assessment phase	Guiding questions	ITERATIVE PROCESS
GOAL AND SCOPE	<ul style="list-style-type: none"> • Has the terminology in the study been used consistently, i.e. risk vs. performance vs. impact? • Does the procedure defined for measuring the social aspects or impacts reflect the epistemological underpinnings of the study, i.e. are the values underlining the study explicitly declared where relevant? • Is the methodology applied coherently according to the decision that the study intends to support and the goal it aims to achieve? • Is the functional unit defined in a way to ensure that all the relevant properties of the product have been captured where relevant? 	
INVENTORY	<ul style="list-style-type: none"> • Are the typologies of data coherent with the epistemological stances of the study? • Are there differences in the quality of data, i.e. qualitative vs. quantitative vs. semi-quantitative, primary vs. secondary, site-specific vs. generic? If so, are they coherent with the Goal and Scope of the study? • Have allocation rules and system boundaries been consistently applied and defined? When the S-LCA entails the comparison among two product systems, was it considered if any cut-off has been applied that may bias the comparison? 	
IMPACT ASSESSMENT	<ul style="list-style-type: none"> • Is the impact assessment method (risk vs. performance vs. impact) coherent with the stated goal(s) of the study? • Are the aggregations performed and the weighting consistent with the Goal and Scope of the study? • When implementing the reference scale approach, are performance reference points defined consistently within the study, for the different social aspects, and are the points of reference duly documented? 	
INTERPRETATION	<ul style="list-style-type: none"> • Have the results taken into account the context of the study, i.e. the cultural, normative, geographic, socio-economic surrounding in which the system is embedded? • Have the results been aggregated in a way that allow to interpret the results in line with the stated goal(s) of the study? 	

The consistency check is mainly a qualitative step in the interpretation of results, which forces the practitioners to re-consider the robustness of the choices made during the study, and transparently report them. The results of this step can be a recommendation to revise the conclusions, in order to limit any potential misinterpretation.

6.1.3 UNCERTAINTY, SENSITIVITY AND DATA QUALITY CHECK

Uncertainty analysis can be conducted either quantitatively or qualitatively, depending on the available data and information. It should be carried out if two products are compared. Specifically, in the case of S-LCA, quantitative analysis can be applied to assess the uncertainty of scoring factors and impact subcategory indicator aggregation into stakeholder type. The resulting output of uncertainty ranges can help to pinpoint whether two studied systems are statistically different.

When a quantitative uncertainty analysis cannot be applied, qualitative methods can be used. They consist of qualitatively evaluating the uncertainties of the modelling and data, and how these in turn affect the results of the study, as described in Section 4.3.2.

The sensitivity check aims at determining whether and to what extent the conclusions of the S-LCA study may be affected by the assumptions made during the previous steps. Assumptions may be related to data, value judgments, activity variable, calculation of the social performance and social impacts, aggregation, and weighting.

While the evaluation of the sensitivity check's results is part of the Interpretation phase, its planning and execution are part of the inventory and/or impact assessment phase.

Several methods and tools that can support conducting a sensitivity check have been defined and are available for E-LCA studies. To some extent these can be applied to S-LCA studies too.

Scenario analysis is also a valuable method that can be used to verify whether the assumptions made are valid and relevant under different conditions. With scenario analysis, practitioners might investigate *What is likely to happen*, *What can happen*, or *How can a well-defined target be reached*. While these questions contribute towards the evaluation of the robustness of the results under the influence of external factors, they have to be part of the Goal and Scope definition.

Sensitivity analysis is the procedure in which the influence of choices and assumptions on the final results is evaluated. Key issues on which a sensitivity analysis should be conducted are the following:

- Choice of the activity variable (e.g. working hour vs. value added);
- Referencing system;
- Aggregation criteria applied during the social impact S-LCIA phase;
- Weighting criteria;
- Allocation methods;
- Assumptions on data;
- Scenario analysis.

The sensitivity analysis should be carried out by means of varying the identified variable/assumption/choice in the S-LCA model (either in scope definition, inventory, and/or impact assessment), running the assessment, critically analyzing, and documenting the changes (if any) in the results.

The sensitivity analysis should be carried out only after an uncertainty analysis. However, the sensitivity of some key issues might require redoing the full assessment. If limitations in resources for the study exist, the quantification of the effect of the changes might not be feasible; however, also in this case, the effects of the choices should always be discussed at least qualitatively when relevant.

When a sensitivity analysis on data is carried out, the assumptions on data should be discussed regarding data quality and integrity, in line with the data quality management defined for the study (see Section 4.3). This requires to transparently document and report any information related to data, for properly evaluating their reliability. For good practices on uncertainty and sensitivity analysis in the field of LCA, see the work of Igos et al. (2018).

6.1.4 MATERIALITY PRINCIPLE

The results should be further interpreted to determine the significance of the selected issues. This step of the Interpretation phase aims at identifying significant social performances or impacts, risks, stakeholders' categories, life cycle phases of processes, in accordance with the Goal and Scope of the study. In the context of S-LCA, the significance is related to the concept of materiality. A social matter (information, data, performance, impact, stakeholder) is material if it is of such relevance and importance that it could substantially influence the conclusions of the study, and the decisions and actions based on those conclusions. Materiality is thus independent from the level of influence that an organization plays on the different phases of the product system under study.

The materiality assessment can be carried out with the support of the contribution analysis; it consists of determining the share of social performances/impacts assigned to life cycle phases, processes, and/or stakeholders. The contribution can be expressed either in terms of percentage contribution or qualitative ranking.

When an input-output-based S-LCA is carried out (see Box 5), the understanding of the structure of the system analyzed and the identification of the value chains that contribute most to the results, can be carried out with a process contribution (social hotspots) analysis.

Another method is the influence analysis: it consists in examining the resulting social issues in relation to the level of control that the organization has on them, and/or on the capability to address them, using a ranking approach. This should not replace the materiality principle but add a perspective.

As a support to the findings of the materiality assessment, case studies, reviews, and grey literature by government report can provide a benchmark for the evaluation and comparison of the results. Practitioners have to be careful to ensure that the benchmark studies share similar goals, are related to the same application or sector, and share consistent modelling choices.

6.1.5 AGGREGATION

Aggregation may occur in several parts of S-LCIA, when for example indicators are aggregated within subcategories. It entails the definition of weighting criteria, i.e. values that reflect the relative importance of one e.g. impact subcategory or stakeholder category result. As a general rule, all the aggregation steps up to the weighting of the results to get a single score are part of the S-LCIA phase. See Section 5.2.3 in LCIA on indicator aggregation.

The aggregation carried out in the Interpretation phase aims at displaying the results in a way that supports a better understanding of the results. The choice on how to aggregate the result should be in line with the Goal and Scope of the study, and made considering the target audience of the study.

Given that the aggregation is by definition a step that hides details and it is subject to personal views and values, the results of the study should always be complemented with the disaggregated data. In addition, practitioners should always transparently report and justify the criteria adopted for the aggregation, to avoid misinterpreting the results.

6.2 CRITICAL REVIEW

An independent, critical review can enhance the quality and credibility of an S-LCA, as has been found for E-LCA. Another benefit of critical reviews is to promote learning and development on the part of life cycle practitioners. Thus, it is highly encouraged to plan a critical review process when planning an S-LCA. The ISO standards for LCA state that an independent critical review is required for studies that will be used as the basis of a "comparative assertion," namely a claim about the life cycle superiority of one product over another. The critical review process described in ISO 14044 is an adequate process for S-LCA. With accumulation of further experience in S-LCA, adjustments and refinements to the

critical review guidelines that are specific to S-LCA may be developed.

As stated by ISO (ISO 14044, 2018), the critical review process shall ensure that:

- The methods used to carry out the LCA are scientifically and technically valid;
- The data used are appropriate and reasonable in relation to the goal of the study;
- The interpretations reflect the limitations identified and the goal of the study; and the report resulting from the study is transparent and consistent.

ISO 14044 also states that “the scope and type of critical review desired shall be defined in the scope phase of an LCA, and the decision on the type of critical review shall be recorded.”

Two types of critical review are described by the ISO standards for LCA, as quoted directly (ISO 14044, 2018) below:

- 1) Critical review being carried by an internal or external expert.

In this case, an independent expert of LCA shall perform the review. The review statement, comments of the practitioner, and any response to recommendations made by the reviewer shall be included in the LCA report.

- 2) Critical review being carried by interested parties.

In such a case, an external independent expert should be selected by the original study commissioner to act as chairperson of a review panel of at least three members. Based on the Goal and Scope of the study, the chairperson should select other independent qualified reviewers. This panel may include other interested parties affected by the conclusions drawn from the LCA, such as government agencies, non-governmental groups, competitors, and affected industries.

For LCIA, the expertise of reviewers in the scientific disciplines relevant to the important impact categories of the study, in addition to other expertise and interest, shall be considered.

The review statement and review panel report, as well as comments of the expert and any responses to recommendations made by the reviewer or by the panel, shall be included in the LCA report.

- 3) General criteria for selection of a peer review panel.

As noted for environmental LCA and quoted above, ISO recommends that the expertise of reviewers be relevant to the impacts addressed by the study. In this spirit, it is recommended that the expertise of critical reviewers for S-LCAs bring background and experience relevant to assessing social impacts and working with relevant data.

6.3 CONCLUSIONS, LIMITATIONS, RECOMMENDATIONS

When the results have been thoroughly analyzed in relation to their completeness and consistency, and the material aspects of the study have been identified, conclusions can be drawn. This includes highlighting limitations and giving of recommendations for improvement actions provided to the decision maker. Limitations might refer to the type and quality of the data used, the referencing system adopted, the scoring system applied, or the weighting criteria adopted (e.g. needed for aggregating the reference scale results into an impact subcategory result). It could be important to involve the stakeholders in this last step, extending the representativeness to those who might be affected by the decision of the study. This is where main questions raised during Goal and Scope result in answers.

Finally, S-LCA studies can be combined with/integrated to other evaluation methodologies, such as other life cycle

methods (e.g. E-LCA, LCC), evaluation methods, and multi-criteria methods. When such a combined study is carried out, either as a life cycle sustainability assessment or part of it, consistency has to be ensured in system boundaries definition, function of the system, decision making context, and interpretation of the results. In this regard, the guidelines on life cycle sustainability assessment, among other relevant scientific articles, developed by the UNEP/SETAC Life Cycle Initiative "Towards a Life Cycle Sustainability Assessment" provide additional information and details.

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ISO 14044:2006: <https://www.iso.org/standard/38498.html>



7. Social organizational life cycle assessment (SO-LCA)

SO-LCA³⁷ is understood as the social complement to O-LCA. It also shares a lot of common features with S-LCA. SO-LCA is defined accordingly as:

“SO-LCA is a compilation and evaluation of the social and socio-economic aspects and the positive and negative impacts of the activities associated with the organization as a whole or a portion thereof adopting a life cycle perspective.”

SO-LCA therefore measures social indicators or impacts on the organizational level in order to assess the organization’s social performance and therefore may complement S-LCA by going beyond the product perspective, but considering the organization as a whole.³⁸ By doing so it may also address some challenges of S-LCA, such as the difficulty to link social indicators and impacts to the product level by means of the functional unit.³⁹ In addition, SO-LCA can support improving an organization’s social performance as many relevant decisions, e.g. the selection and development of suppliers, are usually not made at a product but at a company level.

7.1 HOW DOES SO-LCA RELATE TO S-LCA?

SO-LCA and S-LCA are conceptually based on the same grounds, considering the ISO 14040 and the S-LCA framework, with regard to stakeholder categories etc. The main difference between the S-LCA and the SO-LCA methods lies in the scope of the analysis (product vs. organization). Specific differences can be taken from Table 17. With regard to the Impact Assessment and Interpretation phase, no core difference exists for both methods, and the same challenges apply equally.

37 The conceptual framework of SO-LCA was developed by Martínez-Blanco et al. (2015a) based on S-LCA (UNEP/SETAC, 2009) and O-LCA (ISO, 2014; UNEP, 2015). By combining the two methodological schemes first requirements and recommendations could be derived for SO-LCA.

38 Note, the benefit of SO-LCA may not be as obvious, when considering only parts of the organization and even less when focusing only on one branch of an organization’s activities.

39 Note: The relation to the functional unit in S-LCA is a broadly discussed challenge including the aspect, if this is really needed or not. However, common S-LCA indicators are linked to organization’s behavior and implicitly also to products’ life cycles.

Table 17: Overview on differences between S-LCA and SO-LCA & challenges.

Phase	S-LCA	SO-LCA
Goal and scope	<p>Goal:</p> <ul style="list-style-type: none"> Assessing social impacts of products. <p>Scope:</p> <ul style="list-style-type: none"> Products & services. Definition of functional unit. 	<p>Goal:</p> <ul style="list-style-type: none"> Assessing social impacts of organizations. <p>Scope:</p> <ul style="list-style-type: none"> Organizations or parts of organizations Definition of reference unit – the reporting organization – instead of a functional unit.
Inventory	<p>Data needed:</p> <ul style="list-style-type: none"> Product specific (for different kinds of data used in S-LCA see Section 4.1). <p>Challenge:</p> <ul style="list-style-type: none"> Data on product level may be difficult to obtain. 	<p>Data needed:</p> <ul style="list-style-type: none"> Organization specific. <p>Challenge:</p> <ul style="list-style-type: none"> Data from organizations still leave challenges on data for stakeholder groups beyond workers.

7.2 CONCEPTUAL FRAMEWORK

In the following subsections the key steps to perform a SO-LCA study are presented – structured according to the four phases: Goal and Scope, Life Cycle Inventory Analysis, Life Cycle Impact Assessment, and Life Cycle Interpretation in accordance to E-LCA (ISO 14040, 2006), S-LCA and O-LCA. Most explanations provided in the Chapters 3 to 6 are valid for SO-LCA as well and, thus, not repeated here. The focus of this section is on key differences to S-LCA.⁴⁰

7.2.1 GOAL AND SCOPE

The overall goal of SO-LCA is to analyze the behavior of an organization in order to contribute to improved living conditions of stakeholders (workers, local communities, etc.) along the value chain. The results of a SO-LCA study are not intended to be used in comparative assertions to be disclosed to the public. This is in contrast to S-LCA but in line with the O-LCA method, claiming that

“the comparability step is neither meaningful nor robust at this point in time, due to the lack of a consistent basis for comparison between organizations, [...as] different organizations have vastly variable product portfolios” (UNEP, 2015)

⁴⁰ A complete, schematic, analysis for almost all the steps and elements of SO-LCA and the corresponding proposals can be found in the work of Martínez-Blanco et al. (2015b).

Table 18: Goal and scope of SO-LCA and relation to the S-LCA approach.

	SO-LCA	Relation to S-LCA
General goal	<ul style="list-style-type: none"> Promote improvement of social conditions and of the overall socio-economic performance of an organization and its value chain for all its stakeholders. Limitations: The results are not intended to be used in comparative assertions disclosed to the public. 	<ul style="list-style-type: none"> Promote improvement of social conditions and of the overall socio-economic performance along product’s life cycle including all relevant stakeholders. In S-LCA, the results may be used in comparative assertions intended to be disclosed to the public.
Unit of analysis	<p>Reporting unit is the reporting organization or parts thereof (e.g. business divisions, brands) and is defined by the reporting flow.</p> <ul style="list-style-type: none"> Reporting organization: the organization and its portfolio. Reporting flow: Ideally the quantification of the organization’s product portfolio, which should be expressed in non-physical terms. Reference period: Semi-quantitative and qualitative indicators may not be expressible quantitatively per reference period, but need to be expressed as valid for the reference period. 	<p>Functional unit and reference flow (see Section 3.2).</p> <ul style="list-style-type: none"> As social impacts of products are assessed, changes in the product portfolio may also affect social impacts of the organization.
System boundary	<p>The system boundary defines which unit processes are included in the system assessed.</p> <ul style="list-style-type: none"> Like in S-LCA, a cradle-to-grave approach is preferred as specified in Section 3.2.4 including the cut-off criteria setting described in Section 3.2.6. However, there are differences in terminology and the inclusion of certain life cycle stages (e.g. capital equipment) as described in the next section. 	<p>The system boundary defines which unit processes are included in the system assessed (for more info see Section 3.2.4).</p>

7.2.2 LIFE CYCLE INVENTORY

The life cycle inventory needed for SO-LCA is, for the most part, comparable to S-LCA. The differences are summarized in Table 19 and mainly relate to:

1. The needed data and data collection process; and
2. The relation of data to the reporting unit.

The processes and activities along the value chain are used in S-LCA as well as in SO-LCA to identify the organizations involved, the production locations, and the stakeholders related to the steps of the value chain. In general, for SO-LCA (as in S-LCA), the location of the facilities, the suppliers, and other partners of the value chain are of high importance to assess the potential social impacts and should be included. The main elements for the inventory phase of SO-LCA are summarized in Table 19 and explained below.

One main difference of SO-LCA and S-LCA is the terminology used to describe the product system and the inclusion of

certain processes. While speaking about “life cycles,” “production,” “use,” and “end of life” phases in S-LCA, the terms “value chain” as well as “direct and indirect activities” are used in SO-LCA. While direct activities relate to activities from sites that are owned or controlled by the reporting organization, indirect activities are a consequence of the operations of the reporting organization, but occur at sites owned or controlled by other organizations (upstream or downstream). Indirect activities and processes like capital equipment, leased assets, or business trips are considered but are typically neglected at a product level since they are difficult to allocate to individual products and due to applied cut-off criteria (Martínez-Blanco et al.,2015c).

Table 19: Methodological framework for life cycle inventory of SO-LCA and relation to S-LCA.

Elements	SO-LCA	Relation to product S-LCA
Needed data	<ul style="list-style-type: none"> Inputs and outputs of the processes and activities that relate to the involved organizations, locations and stakeholders including indirect activities (often purchasing/expenditure data are used e.g. spend analysis). Inputs and outputs of supporting activities (e.g. business travel, cleaning services). 	<ul style="list-style-type: none"> As in SO-LCA, but some indirect activities, such as capital equipment, leased assets, etc., are often not included in S-LCA. <p>NOTE: Supporting activities may in practice not be considered in S-LCA.</p>
Data collection	<ul style="list-style-type: none"> Specific data should be used for direct activities, at least for the identified hotspots (based on generic data). The use of generic or extrapolated data may be used for indirect activities. 	For Guidance on the data collection in S-LCA see Chapter 4.
Relating data to the unit of analysis	<ul style="list-style-type: none"> In most cases, social aspects relate to the reporting unit thus the organization. 	<ul style="list-style-type: none"> The unit of analysis is a broadly discussed topic in S-LCA – for more information see Section 3.2.1.

7.2.3 IMPACT ASSESSMENT

The different types of S-LCA impact assessment approaches also apply to SO-LCA. Therefore, the impact assessment step in SO-LCA is strongly affected by the existing limitations and challenges of S-LCA impact assessment approaches (for more information see Chapter 5).

7.2.4 INTERPRETATION

The elements to consider during Interpretation are the same for S-LCA and SO-LCA. If the organizational perspective may ease the understanding of the results, it will be investigated further during the Piloting phase. However, comparative assertions intended to be disclosed to the public are not part of SO-LCA.

7.3 LIMITATIONS & FURTHER RESEARCH NEEDS

SO-LCA can represent a step towards a broader sustainability assessment at the organizational level. Some of the challenges of S-LCA (e.g. the difficulty to link social indicators and impacts to products) might be partly resolved by SO-LCA due to the organizational approach. However, inherent limitations of S-LCA and also O-LCA apply as well to SO-LCA (e.g. lack of generic databases for background processes or missing social impact pathways).

Specific SO-LCA challenges include:

1. The distribution of impacts;
2. Complex organizations; and
3. Social performance tracking.

They represent key priorities for the further development of the approach.

7.3.1 DISTRIBUTION OF IMPACTS

In cases, where only parts of an organization are considered for SO-LCA, challenges may arise from the fact, that social attributes may be occurring only for some parts of the organization but not the whole system. Thus, by only focusing on parts of the respective organization, social attributes may be neglected or overestimated. When considering an incident approach, the latter can be solved, as it would be no longer important where and with what intensity the social impact occurs, but rather that it occurs at all – e.g. either you have child labor in the immediate tiers of your value chain or you do not. However, in specific cases more detailed data should be used, e.g. if specific segments tend to be socially impacting relating e.g. to facilities of the organization in a certain country. This of course is also a matter of generic and specific data.

In any case, it would however be useful if SO-LCA results show that different parts of an organization (e.g. different sections producing different products) differ in their social performance. By this means positive examples and good practices can serve as role models for other segments of the same organization not performing as good at the same time.

7.3.2 COMPLEX ORGANIZATIONS

SO-LCA's implementation may provide challenges for complex organizations with large product portfolios, as those organizations involve a variety of suppliers, use-phases, and end-of-life scenarios. Although big organizations may on the other hand possess the resources to perform SO-LCA including the related data collection, their complexity will complicate the assessment. However, S-LCA databases can be used for SO-LCA, providing a way forward to ease data collection. Especially, as the definition of clusters and proxy products/sites that was proposed for O-LCA, may not be possible for SO-LCA. The variability of results for social impacts is expected to be much higher than for most environmental impacts, as it is the behavior of the organization and the geographical context rather than the nature of the process that induces the impacts. Next to this, keeping track of locations in big and complex systems is particularly challenging. As noted earlier, knowing the location of all relevant sites of the organization and the partners along the value chain is of high importance to identify the involved stakeholders and thus social impacts in the context of the specific geographical location.

7.3.3 SOCIAL PERFORMANCE TRACKING

As performance tracking provides a general challenge for all kinds of assessment, it does so for SO-LCA as well. SO-LCA results may be different from one year to another, due to changes in the suppliers' network or the managerial behavior of the organizations involved. Further, if we change the number of products, it is difficult to tell the effects on social impacts, as social impacts mainly result from the organization's behavior (and its suppliers), instead of being linked to the organization's product output. However, more products could demand more workers and could serve more consumers, thus an increased number of people would be affected.

If we instead change the type or nature of the products in the portfolio, two possible situations are foreseen:

1. When these changes in the portfolio do not involve a variation in the network of suppliers (and their associated

managerial behavior), social impacts are likely to be the same; or

2. In case the changes involve different suppliers and activities, different social impacts can be expected.

Therefore, defining the changes in the network of suppliers and other partners involved is more important than identifying the changes in the product portfolio. It should be noted that a few social indicators, and thus impacts, do relate to the production process and thus to the product. This means that a change in the type of product may indeed affect those social indicators. For example, the indicator *total number of accidents of non-compliance with regulations concerning health and safety* may be higher for certain sectors and activities.

As SO-LCA is a young concept, performance tracking may be even more difficult, also considering the challenges in the collection of social data. The issue may however resolve over time, as with time databases and experience evolve.⁴¹

A solution approach may be to only update activity data⁴² on a yearly base. Furthermore, although the results refer to one year of operation, the organization may define longer periods of time between the updates. This could be reasonable as only longer time frames will reveal the improvement of social conditions. A compromise solution can be the annual update of only certain hotspots or activity data followed by an overall update every 3 or 5 years.

7.4 REFERENCES

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41 Note that even for the environmental dimension, most of the organizations are only able to report life cycle data for climate change on a yearly basis, but not for other indicators.

42 Activity data are understood as data relevant for certain activities relating to sectors and/or countries implying high social risks and including an activity variable.



8. Communication

As comprehensively described in the previous sections, S-LCA allows for analyzing social impacts in various categories along the value chains of products and organizations. In this way it can support stakeholders in improving their social performance and decision-making. In order to put this potential into practice, the communication of S-LCA results is key – but challenging. Different means of communication are available which address different target groups (B2B (business-to-business), B2C (business-to-consumer), workers, shareholders, science, policy, etc.). In the following section, general principles for the communication of S-LCA results are presented (see Section 8.1) before individual means of communication are discussed. Internal communication (e.g. to workers and shareholders) is considered before external audiences are communicated (see Section 8.2). With regards to external audiences, means supporting business to business (B2B) and business to consumer (B2C) communications will be discussed separately considering the different information needs of business and consumers for making purchasing decisions (see Sections 8.3 and 8.4). Typically, there is a gradual implementation starting with internal communications of S-LCA results. Once open issues have been resolved, external communications are considered.

8.1 PRINCIPLES FOR COMMUNICATING SOCIAL IMPACTS

Positive impacts that go beyond the organization's activities (or handprints) and negative impacts (footprints) resulting from an S-LCA must be reported separately to allow a transparent presentation of positive and negative impacts.

Ensuring that communications of social impacts of products and organization are reliable, trustworthy, and substantiated is relevant and even reflected in the SDGs (Target 12.8).

In order to support this, the UN Environment/ITC 'Guidelines for Providing Product Sustainability Information' proposes 10 high-level principles (UN Environment & ITC, 2017). These are structured into fundamental ('must be met') and aspirational ('should be met') principles shown in Figure 37.

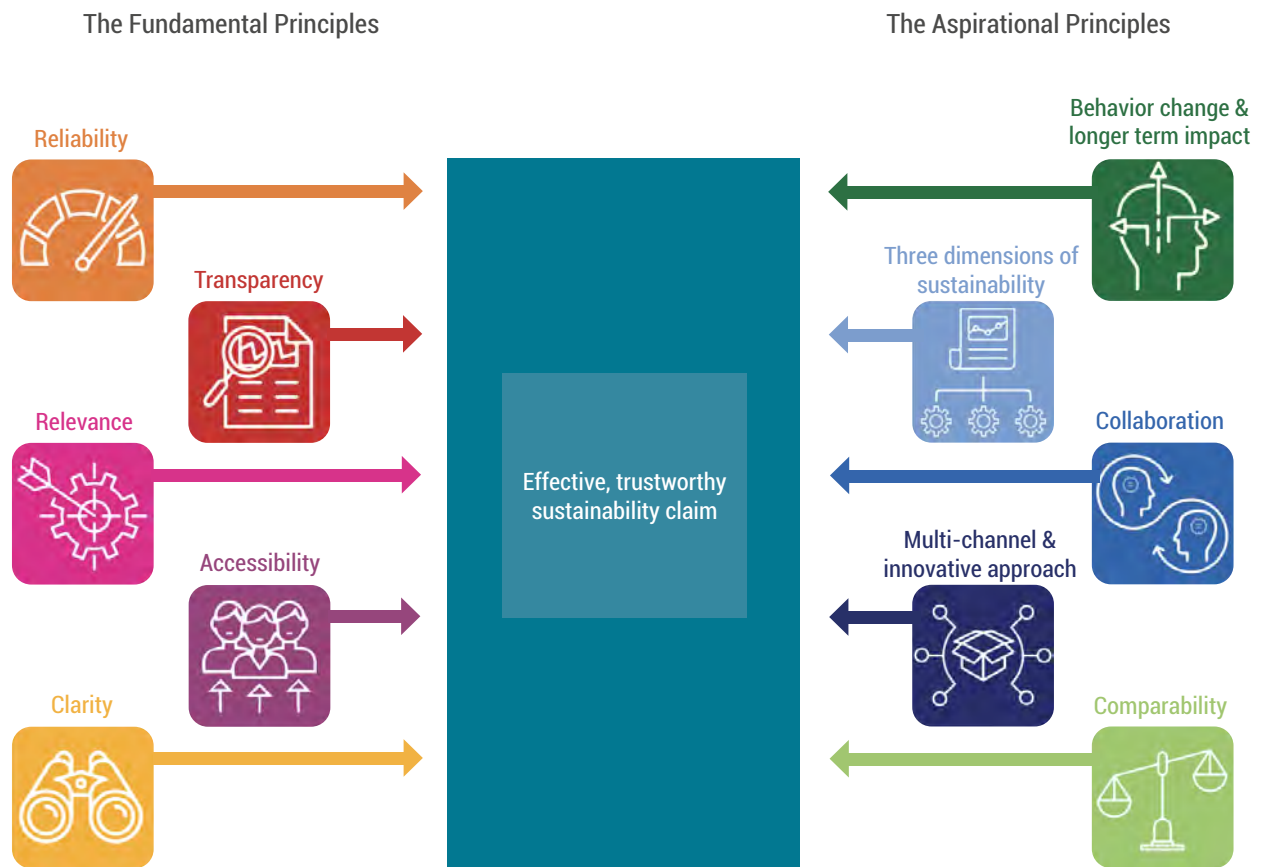


Figure 37: Fundamental and aspirational principles for sustainability claims (UN Environment / ITC, 2017).

In the following the fundamental principles and their relation to S-LCA is discussed. Accordingly, social impact claims must be:

Reliable, thus accurate and scientifically robust and consistent, and based on substantiated data and assumptions: Gaining third party verification of the claim is not a requirement but considered the most reliable option. S- LCA provides a thorough frame on which to base a claim. For comparative assertions a critical review following the peer-reviewed methodology from this publication is encouraged;

Relevant, thus highlighting major impacts in areas that matter: S-LCA helps with the identification of social LCA hotspots and defines their metrics for communicating them as part of the overall social sustainability performance made by the claim. While single-issue claims can be an entry point, multi-issue claims are encouraged;

Clear, thus explicit and easy to understand, while ensuring an exclusive and direct link between the claim and the product and stating the limits of the claim clearly: this might be more challenging for information providers deriving their claims from an S-LCA as it might involve communicating in non-technical language and on limited space. Given the comprehensiveness of an S-LCA assessment by identifying key issues, communication e.g. via claims should focus on the main social issues in order to avoid overloading consumers with less relevant information;

Transparent, thus allowing traceability of how the claim was generated, including methods, data sources, and stakeholders involved, with confidential information being accessible to competent bodies. Communication should not be misleading with regards to trade-offs between S-LCA categories, life cycle stages, and products or materials;

Accessible, thus clearly visible and readily accessible at the time and location the consumer needs it: after conducting an S-LCA, a decision needs to be made about which information is required when. For instance, information on issues

concerning the consumer's health according to certain use behavior might be best placed on the product itself, whereas QR codes or websites can provide additional information on e.g. how the claim was generated for those who seek this level of details.

More specifically a document for "communicating product's social impacts" (UNEP 2018) was released which complements the high-level principles developed and supports social impacts communications by providing examples.

In general, it can be said that the holistic approach and thorough methodology provided by S-LCA is a robust basis from which product and organization level social impact communication can be derived.

8.2 INTERNAL COMMUNICATION

Communicating to internal stakeholders such as: CEOs, workers, and shareholders about the social impacts along the life cycle of the products concerned aims to:

- Identify potential areas and actions for improvements;
- Support internal decision makers;
- Reaffirm within the organization the commitment towards sustainability;
- Demonstrate a holistic approach and maintain consistency with the developments concerning other sustainability dimensions (e.g. on environmental aspects);
- Recognize achievements (e.g. in case of improvements compared to previous period, or in case of positive impacts identified);
- Provide the background information needed in seeking for active participation in order to develop improvement measures;
- Support monitoring efforts towards improvement.

Effective internal communications are specific to each organization and could be supported through regular workers' meetings, announcements boards at the facility, internal newsletters, technical workshops, etc.

8.3 EXTERNAL COMMUNICATION: B2B

In B2B communications, potential customers typically require detailed and well thought-out content which can be lengthy and contain industry jargon and technical knowledge. This differentiates from the B2C communications.

Social impacts determined by means of S-LCA can be communicated between companies in different ways including S-LCA reports, scientific publications, companies' sustainability reports, and more recently through social media. While labels could be the entry point for attracting the attention of companies, this does not suffice the information needs of potential customers to make a decision. A further means of communication could be "type III labels" (ISO 14025), which originally convey environmental information derived from an (environmental) LCA that has been conducted according to specific product category rules (PCR). In principle, such PCR could also be defined for S-LCA and define methodological aspects (functional unit, system boundaries, data sources, stakeholder categories, social LCIA approaches, etc.). As an equivalent to environmental product declarations (EPD), "social product declarations" (SPD) could be determined and convey relevant social information of products.

8.4 EXTERNAL COMMUNICATION: B2C

For B2C, average consumers prefer short, simple, and less detailed messages –e.g. avoiding industry jargon. Considering the complexity of S-LCA, communication to consumers is challenging. Self-declared claims (also called marketing claims or green claims) and labels (backed or not through a third-party based verification leading to a certification) are the primary mediums used by companies to communicate social impacts and performances to consumers. Rather than providing comprehensive information, labels and claims are intended to communicate to the consumers that the product that they buy doesn't contribute to sweatshop conditions and violations of human rights. Assurance can only happen through third-party based verification.

Today more than 450 environmental and sustainability labels are available according to the ecolabel index (<http://www.ecolabelindex.com>). It is not easy for a consumer to understand the exact meaning and scope or the levels of transparency and robustness. The "label jungle" and the increased awareness of consumers in the social performance of products also bear a risk for "social greenwashing" or "white washing" of companies via labels. For this reason, the principles for communicating social impacts (Section 8.1) are of particular relevance. Examples of current social labels are shown in Table 20 below. The UN ITC Standards Map provide a useful tool to compare standards and labels on environmental and social criteria and also learn about their governance (<https://www.sustainabilitymap.org>).

S-LCA and social labels and claims can benefit from each other in different ways. On one hand, S-LCA can assist companies in qualifying for social labels and claims as relevant social impacts along the supply chain of products have already been analyzed. On the other hand, social labels and claims can be a starting point for S-LCA as companies have considered different social aspects along the supply chain of products. This consideration can be extended to a comprehensive S-LCA by adding other relevant social aspects and life cycle phases.

In the current form, social labels and claims communicate certain social aspects - which might have been determined by means of S-LCA. While S-LCA is currently not a prerequisite for social labels and claims, they do have the potential of communicating S-LCA results: new third-party verified labels and claims or modified existing ones could make use of S-LCA in their rewarding criteria. That is, the existence of an S-LCA study and/or the attainment of certain S-LCA could be a requirement to qualify for the social label or claim. Such third-party verified label or claim could be considered a new "type IV" label (Minkov et al., 2019), which combined the characteristics of a "type I" label (third-party verified, multiple criteria, on products) but is awarded based on a "social product declaration (SPD)" derived from S-LCA (type III label). If this is the path, SPDs must be based on sound social product category rules (social PCRs) and harmonized with existing environmental PCRs.

Table 20: Examples of social labels.

Label	Description	Main Aspects
	<p>The Fairtrade logo – The Fairtrade System or logo is one of the most known product certifications referring to human rights issue for farmers in food and organic supply chain. It also contains many of the elements expected of fair trade programs, including requiring transparency about future sourcing needs as a show of good faith of long-term commitment, support of the general assembly as the highest authority of a farmer association, and strong requirements for gender equity.</p>	<p>Third party verified and certified. Focus on small farmers.</p>
	<p>Rainforest Alliance certification is a comprehensive process that promotes and guarantees improvements in agriculture and forestry. To earn the seal, foresters, and farmers have to ensure that their production meets criteria of sustainability under the aspects of protection of the environment, decent working conditions, and respect of local communities.</p>	<p>Third party verified and certified. Focus on farmers, forest communities, and indigenous people.</p>
	<p>The GoodWeave label means that no child, forced or bonded labor was used in the making of a certified product, and support programs that educate children and ensure decent work for adults.</p>	<p>Second party verified. Dedicated to ending child labor, forced labor, and bonded labor in global supply chains.</p>
	<p>Fairmined is an assurance label that certifies gold from empowered responsible artisanal and small-scale mining organizations. It transforms mining into an active force for good, ensuring social development, and environmental protection, providing everyone with a source of gold to be proud of. Main considered aspects are: No link to conflict situations, no child labor, creating safer and more stable jobs, promoting gender equality, promoting well-being in the community.</p>	<p>Third party verified and certified.</p>

8.5 COMMUNICATION ON SOCIAL PERFORMANCE – A POSSIBLE PATHWAY

According to the main principles described in the Section 8.1, further characteristics that external communications on Social Impact of a product and/or an organization must meet are:

1. Transparency – once the impacts/performances are presented, a consistent set of life cycle inventory data should be published as well to make the results transparent and reproducible. This is also consistent with the ISO 14040 standard on environmental life cycle assessment;
2. Fairness – a mix of positive and negative impacts should be communicated in the report. In the unlikely event that only positive impact/performance occurs, full comprehensive inventory and impact assessment data should be published. As an alternative, if those data are sensitive, a critical review or a third party certification of the results must be obtained;
3. Critical review – according to ISO 14040 for environmental LCA which also apply here, before the publication of social life cycle assessment results, the report should be verified by a critical reviewer against the S-LCA guidelines or the ISO standard;
4. Critical review panel – if the goal of the S-LCA is a comparison assertion between two products, the report, before it is communicated, should be reviewed by a critical review panel consisting of at least three experts;
5. Transparency on the positive impacts – a social hotspot analysis must be presented and communicated together with the S-LCA results applied to a product and/or an organization when the focus is on presenting the positive impacts.

8.6 REFERENCES

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9. Next: Outlook for the future

Ten years have passed since the publication of the first Guidelines for Social Life Cycle Assessment by the UNEP/SETAC Life Cycle Initiative. During that time, researchers as well as practitioners have implemented, gained experience with, and evaluated the guidance given in the document, both from a scientific and a practical standpoint. The results of this experimentation and analysis are reflected in this document, an updated version of the Guidelines which has the ambition to capture the lessons learned from a decade of work. We hope that the scientific foundation of the new Guidelines is enhanced and that the guidance on S-LCA practical application is deepened.

In the coming 10 years, we are looking forward to ongoing improvement and specifications of the guidance, but most of all we are looking forward to an increased application of the S-LCA methodology in society. With the Agenda 2030 and the Sustainable Development Goals, adopted by the UN in 2015, the importance of considering social sustainability issues in order to move towards sustainable development has been strongly highlighted. A majority of the goals have a direct or indirect relevance for the well-being of current and future generations. Furthermore, one specific goal – SDG 12 on Responsible Consumption and Production – underscores the importance of addressing the sustainability impacts from products and services, in a life cycle perspective, as an integral part of the actions needed to achieve the SDGs and the 2030 Agenda.

During the work to revise the Guidelines, we have identified several issues that should be addressed in the further development of the methodology. These are, among others:

1. How to address the differences between social performance and social impact, in order to make sure that we are adequately assessing human well-being?
2. What is the appropriate scope and the minimum data quality required to properly assess the impacts in a life cycle perspective?
3. How to assess social impacts and risks in the use phase?
4. How to ensure that the assessment results are relevant in the local context and for the affected stakeholders?
5. How to communicate the evaluation of abstract and stakeholder-dependent concepts such as product utility and benefits?

6. What are the considerations for the integration of S-LCA results in a life cycle sustainability assessment?
7. How can S-LCA contribute to a sustainable circular economy?
8. How can S-LCA be considered for decision-making at the policy and industry sectors level?
9. Should S-LCA performances or impacts be valued/monetized, and how?
10. How could the root causes of social impacts/performances be identified and addressed?

Considering these issues, we are aware that these Guidelines reflect the current state of the art, and that the development process for S-LCA is ongoing. We invite all and every one of you to keep contributing to the further development and refinement of the method, by applying it, demonstrating its feasibility, sharing findings, and further developing it through research.

Annex – Glossary

Term	Explanation / Definition
Activity variable	An activity variable is a measure of process activity or scale which can be related to process output. Activity variables, scaled by the output of each relevant process, are used to reflect the share of a given activity associated with each unit process. A relevant activity variable is worker-hours. Process-specific coefficients of worker-hours per unit of process output are used to estimate the share of total life cycle worker-hours associated with each unit process. Figure 18 presents an example. The activity variable is useful to represent the product system in a way that gives an idea of the relative significance of each unit process in the whole system.
Aggregation	<p>The action of summing or bringing together information (e.g. data, indicator results, etc.) from a smaller scope into a larger scope, e.g. from inventory indicator to subcategory. In S-LCA, aggregation of data may be done at the life cycle inventory or impact assessment phase of the study and should not be done in a way that leads to loss of information about the location of the unit processes.</p> <p>In particular in S-LCIA, aggregation is a way of combining various elements and synthesizing complex phenomena in order to achieve a better understanding and for the communication of results. As such, it may involve the construction of a single, possibly synthetic, score with two or more subcomponents. Single indices or scores are a powerful way to combine and summarize multi-dimensional information.</p>
Area of protection [The term “Damage category” can be used as a synonym]	A state that is desired to be sustained or protected which is of recognizable value to society, in the specific context of sustainability assessment. In the field of S-LCA, one area of protection has been defined and is referred to as human well-being (health and happiness) or simply social well-being. See also Box 17. For environmental LCA areas of protection include human health, natural resources, natural environment, and man-made environment.
Attributes [see “Life cycle attribute assessment”]	Properties or characteristics of a process, which are of interest to stakeholders. These are different from conventional quantitative input/output flows of processes but are of a qualitative nature, e.g. gender discrimination or safety as a whole, and thus also coincide with qualitative parameters of social issues in the context of S-LCA.
Subcategory / Impact subcategory	It is a constituent of an impact category that is assigned to a stakeholder group, for example “Health and Safety” for the stakeholder group “Workers”. Multiple subcategories, possibly across various stakeholder groups, may be part of an overarching impact category.
Characterization	In S-LCIA, the characterization models are the formalized, and - not always - “mathematical” operationalization of the social and socio-economic mechanisms. They may be a basic aggregation step, bringing text or qualitative inventory information together into a single summary, or summing quantitative social and economic inventory data within a category. Characterization models may also be more complex, involving the use of additional information such as performance reference points.
Characterization factor	Factor, derived from a characterization model, that is applied to convert an assigned Life Cycle Inventory Analysis result to the common unit of the category and/or subcategory indicator. ISO 14040 (2006).
Classification	The classification step is the step where the Inventory results are assigned to a specific Stakeholder Category and/or Impact (sub)Category.

Term	Explanation / Definition
Cut-off criteria	Specification of the amount of material or energy flow or the level of significance associated with unit processes or product system to be excluded from a study. Adapted from ISO 14040 (2006).
Developing economies	Developing and emerging economies include all countries that are not classified as advanced economies. IMF provides a classification that is revised each year in its World Economic Outlook.
Due diligence	The process through which organizations identify, consider, and address the potential environmental and social impacts related to their activities and the ones of their business relationships, as an integral part of their decision-making and risk management system. (OECD, 2016)
E-LCA	Environmental Life Cycle Assessment (E-LCA) is a methodology for assessing environmental impacts associated with all the stages of the life cycle of a product, service or organization.
Endpoint impact / Endpoint (impact) indicator	Impact at the end of the cause-effect chain for a (social) issue, which can be represented by an endpoint indicator. It captures the impact on an area of protection. For example, impact on health, represented by the DALY indicator.
Elementary flow	Material or energy entering the system being studied that has been drawn from the environment without previous human transformation, or material or energy leaving the system being studied that is released into the environment without subsequent human transformation. ISO 14040 (2006)
Environmental aspect	Element of an organization's activities, products, or services that can interact with the environment. ISO 14040 (2006). The counterpart in S-LCA are social issues.
Focus group	A focus group is a type of group interview organized to acquire a portrait of combined local perspective on a specific set of issues. What distinguishes the focus group technique from the wider range of group interviews is the explicit use of the group interaction to produce data and insights that would be less accessible without the interaction found in a group. Focus groups with a range of actors can be used to identify relevant stakeholder groups and indicators. Finally, focus groups can also be used in impact assessment when defining the relative importance (weight) of each impact (sub)category.
Functional unit	Quantified performance of a product system for use as a reference unit in a life cycle assessment study, and also valid for an S-LCA. ISO 14040 (2006)
Generic data	Refers to data that has not been collected for the specific process concerned. It can be data collected from other manufacturers of the same kind of product or in the same country. In other words, it is data with a lower resolution than site-specific data.
Goal and scope	The first phase of an LCA or S-LCA; establishing the aim of the intended study, the functional unit, the reference flow, the product system(s) under study and the breadth and depth of the study in relation to this aim. For S-LCA, a unique aspect in practice is the specification of the stakeholder group(s) of interest and the type of assessment (type I or type II).
Human rights due diligence	An ongoing risk management process in order to identify, prevent, mitigate, and account for how [a company] addresses its adverse human rights impacts. It includes four key steps: assessing actual and potential human rights impacts; integrating and acting on the findings; tracking responses; and communicating about how impacts are addressed. (This is brought forward in the "UN Guiding Principles Reporting Framework")

Term	Explanation / Definition
Impact category	A social impact category is a class that covers certain social issues of interest to stakeholders and decision makers. In practice, impact categories are logical groupings of S-LCA (subcategory) results.
Impact indicator / Impact (sub)category indicator	An indicator that represents a (social) impact, linked to a particular impact category, and in that context, can be called an "impact (sub)category indicator".
Impact pathway approach / Type II approach / Impact pathway (IP) S-LCIA approach	Impact pathway S-LCIA assesses potential or actual social impacts by using causal or correlation/regression-based directional relationships between the product system/organizations' activities and the resulting potential social impacts – a process called "characterization". Here, the analysis focuses on identifying and tracking the consequences of activities possibly to longer-term implications along an impact pathway.
Indicator	An indicator is a measurement or value which gives you an idea of what something is like.
Input	Product, material, or energy flow that enters a unit process. ISO 14040 (2006)
Inventory indicator	An inventory indicator is a type of impact indicator that directly relates to the product life cycle, e.g. hours at risk of child labor. An inventory indicator provides the most direct evidence of the condition or result that is measured. They are specific definitions of the data sought. Inventory indicators have characteristics such as type (e.g. qualitative or quantitative) and unit of measurement.
Life cycle attribute assessment [See "attribute"]	A method that enables to express the percentage of a supply chain that possesses (or lacks) an attribute of interest. Norris (2006)
Life cycle costing / Environmental life cycle costing	Life cycle costing, or LCC, or more specifically environmental life cycle costing, is a compilation and assessment of all costs related to a product, over its entire life cycle, from production to use, maintenance, and disposal.
Life cycle inventory / Social life cycle inventory (S-LCI)	Phase of an S-LCA where data are collected, the systems are modeled, and the LCI results are obtained.
Life cycle impact assessment / Social life cycle impact assessment (S-LCIA)	Phase of an S-LCA that aims at understanding and evaluating the magnitude and significance of the impacts for a product system throughout the life cycle of the product. Adapted from ISO 14040 (2006)
Life cycle thinking	Going beyond the traditional focus on production site and manufacturing processes so to include the environmental, social, and economic impact of a product over its entire life cycle. UNEP-DTIE-Life Cycle Management, a Business Guide to Sustainability.
Environmental mechanism / Social mechanism	System of physical, chemical, and biological or socio-economic processes for a given impact category, linking the Life Cycle Inventory Analysis results to impact (sub)category indicators and to category endpoints.
Materiality principle	Materiality (principle) constitutes social matter (information, data, performance, impact, stakeholder) that is of such relevance and importance that it could substantially influence the conclusions of the study, and the decisions and actions based on those conclusions. In the Interpretation section, we follow this definition.
Materiality assessment	Materiality assessment is a process to select topics that are more important because of their impact on stakeholders and/or on the business. The Global Reporting Initiative consider material issues to be the ones that reflect the organization's significant social impacts; or that substantially influence the assessments and decisions of stakeholders. This is also recommended by ISO 26000.

Term	Explanation / Definition
Method	Specific procedure within a technique.
Methodology	Coherent set of methods.
Midpoint impact / Midpoint (impact) indicator	Impact midway the cause-effect chain of a social issue, which can be represented by a midpoint indicator. It does not imply a fixed point halfway through the cause-effect chain.
Organization	Company, corporation, firm, enterprise, authority, or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration. ISO 14001 (2004)
Output	Product, material, or energy flow that leaves a unit process. ISO 14040 (2006)
Performance reference point (PRP)	Performance reference points (PRPs) are thresholds, targets, or objectives that set different levels of social performance or social risk. PRPs allow to estimate the magnitude and significance of the potential social impacts associated with organizations in the product system. The PRPs are context-dependent and are often based on international standards, local legislation, or industry best practices – Comparing inventory indicator data with PRPs allows to qualify performance on a scale.
Primary data	Refers to data that has been directly collected by the practitioner, via interview, survey, or participant observation for instance.
Product	Any good or service offered to members of the public either by sales or otherwise. ISO 26000–WD4.2 (2008)
Product utility	Product utility refers to the perception of the consumer in regard to what the product provides, besides its function (the capacity of a good to satisfy a need). This appreciation is linked with his/her cultural and social values, as well as his/her desires and satisfaction. Product utility can be identified in technical terms (quality, functionality etc.) or in social terms (convenience, prestige, etc.).
Qualitative indicator	Qualitative indicators are nominative; they provide information on a particular issue using words. For instance, text describing the measures taken by an enterprise to manage stress.
Quantitative indicator	A quantitative indicator is a description of the issue assessed using numbers, e.g. number of accidents by unit process.
Reference flow	A reference flow is a quantified amount of product(s), including product parts, necessary for a specific product system to deliver the performance described by the functional unit.
Reference scale	Reference scales are ordinal scales, typically comprised of 1 to 5 levels, each of which corresponds to a performance reference point (PRP).
Reference scale approach / Type I approach / Reference scale (RS) S-LCIA	Reference scale S-LCIA assesses the social performance in the product system. More specifically, it assesses the social performance of activities of organizations in the product system (e.g. the practices implemented to manage social impacts) based on specific reference points of expected activity (called performance reference points - PRPs).
Salient social risks / impacts	Social impact subcategories that account for a greater share of the overall risk/impact. The UN Guiding Principles consider salient risks/impacts to be the ones that affect the most vulnerable stakeholders and that cause irreparable damages.

Term	Explanation / Definition
Scope of the study	The scope is defined in the first phase of the study. It encompasses issues of depth and breadth of the study. It defines the limits placed on the product life-cycle (that can be infinite) and on the detail of information to be collected and analyzed. It defines where the data will be coming from, how up-to-date the study will be, how information will be handled, and where the results will be applicable.
Scoring system	Scoring may use quantitative, semi-quantitative, or qualitative scales, according to the availability of information and the impact (sub)category or impact category under consideration. Scoring systems usually seek to standardize the scores for purpose of comparison.
Semi-quantitative indicator	Semi-quantitative indicators are indicators that have results expressed into a yes/no form or a scale (scoring system): for example, presence of a stress management program (yes-no). Qualitative and quantitative indicator results may be translated into a semi-quantitative form.
Secondary data	Refers to data that has been initially collected and manipulated by another person/institution than the practitioner or collected for another purpose than the one being currently considered or, often a mix of the two. For example, a publication, third party audit, or a database.
Sensitivity analysis	Systematic procedures for estimating the effects of the choices made regarding methods and data on the outcome of a study.
Social impact assessment (SIA)	Social Impact Assessment (SIA) is the process of identifying the social consequences or impacts that are likely to follow specific policy actions or project development, to assess the significance of these impacts and to identify measures that may help to avoid or minimize adverse effects.
S-LCA	A social and socio-economic Life Cycle Assessment (S-LCA) is a social impact (actual and potential impacts) assessment technique that aims to assess the social and socio-economic aspects of products and their positive and negative impacts along their life cycle encompassing extraction and processing of raw materials, manufacturing, distribution, use, re-use, maintenance, recycling, and final disposal.
Social capital	The social conditions, such as institutions, rule of law, trust, and human networks, that are prerequisites or catalysts for production, but do not enter into the production themselves.
Social endpoint / Social category endpoint	A social attribute or aspect identifying an issue giving cause for concern Adapted from ISO 14040 (2006). It is thus an aspect of an area of protection, e.g. the payment for workers relating to their well-being. They are closely related to endpoint impact categories.
Social handprint	Social handprints are the results of changes to business as usual that create positive outcome or impacts. They can be changes reducing the social footprint, or changes that create additional/unrelated positive social impacts. Those changes can apply to the product or organization value chain or they may be beyond its scope.
Social hotspots [The term "Bottleneck" can be used as a synonym for negative hotspots]	A social hotspot is a location and/or activity in the life cycle where a social issue (as impact) and/or social risk is likely to occur. It is usually linked to life cycle stages or processes. It needs to contribute significantly to the impact (overall, by impact category or subcategory). In other words, social hotspots are unit processes located in a region where a problem, a risk, or an opportunity may occur in relation to a social issue that is considered to be threatening social well-being or that may contribute to its further development.
Social impacts	Social impacts are consequences of positive or negative pressures on social endpoints of area of protection (i.e. well-being of stakeholders).

Term	Explanation / Definition
Social impact pathway [The term "Social mechanism" can be used as a synonym]	An impact pathway that covers the propagation of the cause-effect chain from social LCI results to impact, and is specified per social impact (sub)category.
Social indicators	Social indicators are evidence, subjective or objective, qualitative, quantitative, or semi-quantitative being collected in order to facilitate concise, comprehensive and balanced judgements about the condition of specific social aspects with respect to a set of values and goals. In LCA social indicators are indicators of a social LCI result (inventory indicators) or represent impact per social impact (sub)category.
Social performance	Social performance refers to the principles, practices, and outcomes of businesses' relationships with people, organizations, institutions, communities, and societies in terms of the deliberate actions of businesses toward these stakeholders as well as the unintended externalities of business activity measured against a known standard (Wood, 2016). Commonly, social performance is measured at the inventory indicator level.
Social significance / significant	Social significance is a judgment on the degree to which a situation or impacts are important. It is highly dependent on context, based on criteria, normative, contingent on values, and entails considering trade-offs.
Social footprint	A social footprint refers to the end result of an S-LCA study, in term of adverse effects, overall or by impact category/subcategory (e.g. The total medium risk hours equivalent for labor rights and decent work by purchase category supply chain).
Socio-economic	Which involves a combination of social and economic factors or conditions.
Stakeholder	Individual or group that has an interest in any activities or decisions of an organization. (ISO 26000, 2008)
Stakeholder category / Stakeholder group	Cluster of stakeholders that are expected to have similar interests due to their similar relationship to the investigated product system.
Supply chain	A supply chain, or logistics network, is the system of organizations, people, technology, activities, information, and resources involved in moving a product or service from supplier to customer. Supply chain activities transform natural resources, raw materials, and components into a finished product that is delivered to the end customer. In sophisticated supply chain systems used products may re-enter the supply chain at any point where residual value is recyclable. Supply chains link value chains. Nagurney (2006)
System scope / System boundary	System scope = system boundary: set of criteria specifying which unit processes are part of a product system. ISO 14040 (2006)
Technique	Systematic set of procedures to perform a task.
Social themes / Social issues	Social themes or issues are considered as threatening social well-being or that may contribute to its further development. Social themes of interest include but are not restricted to: human rights, work conditions, cultural heritage, poverty, disease, political conflict, indigenous rights, etc.
Tool	Instrument used to perform a procedure.

Term	Explanation / Definition
Triangulation	Triangulation implies that different perspectives are brought together when investigating an object or research question. These perspectives can consist of different methods that are applied, in different theoretical approaches that are followed or more frequently in a combination of different types of data or data collection methods. It also refers to the collection of data from different persons or stakeholders or stakeholder groups which are contrasted.
Uncertainty	Uncertainty refers to the lack of certainty e.g. in the prediction of a certain outcome, in a measurement, or in an assessment's results. It is a general term used to cover any distribution of data caused by either random variation or bias. In LCA and S-LCA, evaluation or measurement of uncertainty is an on-going process and relates to all the elements of data quality as well the aggregation model used and to the general aims of the study as set in the Goal and Scope.
Unit process	Smallest portion of a product system for which data are collected when performing a life cycle assessment. ISO14040 (2006)
Weighting	Converting and possibly aggregating indicator results across impact categories using numerical factors based on value-choices; data prior to weighting should remain available. ISO 14040 (2006)

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