Methodologies for Social Life-Cycle Assessment under the *Impact Assessment Act*

Synthesis report presented to
the Impact Assessment Agency of Canada (IAAC)

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Executive Summary

Our research aims to inform the development of methods and tools to support the assessment of social effects in impact assessments and guide agency practitioners on how Social LCA may be used under the Impact Assessment Act.

Social LCA is a novel method to assess potential social impacts throughout a product or organization life cycle from raw material extraction to end of life. This report introduces Social LCA, differentiates it from SIA and describes how it could bring value to the Impact Assessment Act process and requirements including the sustainability framework and Gender Based Analysis plus.

Social LCA follows the ISO 14040 standard developed for environmental LCA and include the phases of goal and scope, inventory, impact assessment and interpretation.

We have identified five key areas where S-LCA can add value to the impact statement and assessment phases that are presented in Table 1 below.

Most relevant IA process phase (s)		**Key areas**
Impact statement	→	Expansion of the system by the description of a function and use of a functional unit when relevant.
Impact statement, Sustainability framework	→	Application of life cycle thinking.
Impact statement, GBA+	→	Ensure that all relevant social effects are being considered for all phases of the project life cycle (and perhaps its value chain), including the VCs but going beyond if necessary, for better concordance with human rights under UNGP.
Impact statement, Impact assessment, Sustainability framework	→	Identification and description of impact pathways using qualitative and quantitative methods.
Impact statement and Impact assessment	→	Application of a reference scale approach for impact assessment.
Impact statement, Sustainability framework	→	Use of a pedigree matrix for uncertainty and data quality documentation.
Impact assessment, Sustainability framework	→	Use the concept of footprint and handprint to refer to the adverse impacts and the positive impacts of change where relevant.
Impact assessment, Sustainability framework	→	Plan for and implement monitoring of social impacts throughout the life of the project.

Table 1. Key areas related to the most relevant IA process phase (s)

Introduction

This report explores making use of methodologies for Social Life Cycle Assessment (S-LCA) under the *Impact Assessment Act*. Social Life Cycle Assessment is a tool to assess the social impacts related to product and organization value chain and life cycle. The life cycle is understood to include all the production activities necessary to deliver the product or outputs of the organization from raw material extraction to final disposal. Social Impact Assessment (SIA) serves as a process to identify and manage the social impacts of industrial projects, infrastructures, policies, plans, and programs.

Social LCA and SIA are two methods that were developed as an extension of environmental tools, respectively, Environmental LCA and Environmental Impact assessment. While they originate from distinct epistemic communities, these tools share many similarities. However, they vary in scope and purpose.

Social LCA and SIA can be positioned as tools of the Corporate Social Responsibility arsenal. Corporate Social Responsibility has been defined as the appropriation and implementation of the logic and principles of sustainable development which applies primarily to states and governments to the business domain (Capron and Quairel-Lanoizelée, 2004; Yedder and Farhoud, 2009). They also figure as enablers of the social license to operate. The social license to operate refers to the ongoing acceptance of a company or industry's standard business practices and operating procedures by its employees, stakeholders, and the general public (Investopedia, 2020).

The adoption of the United Nations Guiding Principles on Business and Human Rights and the broad applications of these Guiding Principles worldwide means that the private sector respect for human rights in its development projects, product life cycles, and value chains is now a fundamental responsibility.

Both SIA and Social LCA can help companies to reduce their risks and enable them to comply with international standards and best practices as they evolve. Ideally, these tools would capture all significant human rights issues and help make plans to address them.

SIAs are often embedded in national regulations. Regularly being incorporated as elements of an Environmental Impact Assessment (McCullough, 2016). However, SIA requirements widely differ between countries and guidance is often lacking. (Wilson, 2017).

Wilson reports that in Canada, until recently, social issues have been historically incorporated into an EIA rather than by carrying out a distinct SIA (Papillon and Rodon, 2017).

The Canadian government recently enacted the *Impact Assessment Act* and repealed the *Canadian Environmental Assessment Act, 2012*. Among other things, the *Impact Assessment Act* provides for a process for assessing the environmental, health, social, and economic effects of designated projects to prevent certain adverse effects and foster sustainability (Canada bill C69, Royal assent). The bill came into force in August of 2019. Whereas CEAA 2012 focused on physical changes to the environment and the social and economic effects that result from those physical changes, the IAA includes a broader list of changes to be considered in the impact assessment, including many which strengthen the consideration of social effects (Fasken, 2018):

- Changes to the environment and health and social, economic conditions must be considered, together with the consequences of those changes, cumulative effects and any interaction between the effects;
- The impact that the project may have on any Indigenous group and any adverse impact the project may have on the rights of the Indigenous peoples of Canada recognized and affirmed by section 35 of the *Constitution Act, 1982* must be assessed;
- Traditional knowledge of the Indigenous peoples of Canada must be considered;
- The extent to which the project contributes to sustainability must be considered.

Because of these critical changes and the imperative of integrating social effects fully to the impact assessment process, the question arose whether the novel method of Social LCA could be recommended for some part of the process. Our research aims to inform the development of methods and tools to support the assessment of social effects in impact assessments and guide agency practitioners on how Social LCA may be used under the IAA.

In particular, the research will support the agency to consider:

- Would S-LCA be an effective tool to use when conducting an impact assessment under the IAA?
- At what stages would S-LCA be applicable, and most effective, in IA?
- What data challenges may exist when conducting an S-LCA under IAA?

What is S-LCA

Social Life Cycle Assessment is a method to assess the potential social impacts of products or organizations over their life cycle from raw material extraction to final disposal. It was developed as an extension of Environmental Life Cycle Assessment (E-LCA). E-LCA provides information on the environmental effects related to product or organization life cycles from cradle to grave. It quantifies all inputs and outputs of material flows and assesses how these material flows affect the environment. This information is then used to improve processes, support policy, and provide a sound basis for informed decisions. Some of the impacts covered by E-LCAs are climate change, resource depletion, human health, and Ecosystem quality.

Social LCA offers a systematic assessment process that enables to identify the potential social impacts related to stakeholder groups including workers, local communities, consumers, value chain actors (suppliers), children and society. It classifies social impacts by impact subcategories ranging from fair salary to community engagement. Positive and negative impacts can be assessed with a Social LCA.

Social Life Cycle Assessment and Environmental Life Cycle Assessment are two of the methods considered in a Life Cycle Sustainability Assessment. Life Cycle Sustainability Assessment is often represented as the addition of Environmental LCA with Social LCA and Life Cycle Costing to provide a complete picture of the three dimensions of sustainability (people, planet, prosperity) (Klöpffer, 2008).

The Guidelines for Social LCA (UNEP-SETAC, 2009) asserts that the first mentions of the integration of social impacts in LCAs were made in the early 1990s. A first journal article was published on the subject in 1996 (O'Brien and al., 1996), and it is in 2004 that a first international task force was created within the Life Cycle Initiative to actively explore 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 over a decade. They were complemented by the publication of *Methodological Sheets for Social Life Cycle Assessment* in 2013 (Benoit et al. 2013). These methodological sheets present each impact subcategory (social topics of interest), provide their definition, discuss the policy context, and provide examples of generic and specific indicators as well as potential data sources. Since the publication of the 2009 Guidelines, a great and increasing number of studies have been published, leading to the creation of a revision process by the Social LCA Alliance, which was adopted as one of the Life Cycle Initiative flagship projects in 2018. After several stakeholder workshops, surveys, working group drafts, and two first completed versions, the revised Guidelines are now ongoing public consultation, and the final document is planned to be published in 2020.

Table 2 presents the stakeholder groups and impact subcategories recommended for consideration when conducting a Social LCA.

Table 2. Social LCA impact subcategories (from revised S-LCA Guidelines 2020)

Stakeholder categories	Worker	Local community	Value Chain Actors	Consumers	Society	Children
Subcategories	Freedom of Association and Collective Bargaining Child Labor Fair Salary Working Hours Forced Labor Equal opportunities/ Discrimination Health and Safety Social Benefits/Social Security Employment relationship Sexual Harassment	Access to material resources Access to immaterial resources Delocalization and Migration Cultural Heritage Safe & healthy living conditions Respect of indigenous rights Community engagement Local employment Secure living conditions	Fair competition Promoting Social Responsibility Supplier relationships Respect of intellectual property rights	Health & Safety Feedback Mechanism Consumer Privacy Transparency End-of-Life Responsibility	Public commitments to sustainability issues Contribution to economic development Prevention & mitigation of armed conflicts Technology development Corruption Wealth distribution Ethical treatment of animals	Education provided in the local community Health issues for children as consumers Gender issues for children as consumers

Social LCA is an iterative method that follows ISO standard 14040, the ISO standard for Environmental Life Cycle Assessment (Weidema, 2006). The phases of an LCA are the Goal and Scope, Life Cycle Inventory, Life Cycle Impact Assessment, and Interpretation.

One of the main characteristics of LCA consists of the use of a functional unit. Functional units enable us to quantify the impacts and compare product systems together. To determine a functional unit, information about the product, its uses, and its attributes are necessary. One typical example used to explain functional units is diapers. To be able to compare different diaper types, we need to describe the product utility, its function. In the diaper case, it is to keep an infant dry and comfortable for some time, let say two hours. Then you can obtain data about how many diapers of which type are necessary to fulfill the function, maybe one paper diaper and two cloth diapers. This allows comparison on the same ground.

The main objective of a Social LCA is to assess the social impacts of the product or organization in order to improve the social conditions of the stakeholders that are involved in the lifecycle. In other words, to inform decision making on an array of topics such as design, sourcing, investments, mitigations and others.

S-LCA may be embedded in organizational processes to:
i) support companies in building a strategy for the development of social policies and programs;
ii) support decision-making processes that involve a variety of stakeholders with different knowledge and background;
iii) manage social risks thanks to the identification of production activities that are at higher risk (social hotspots);
iv) Support process to identify most salient human rights impacts (human rights due diligence)
v) Provide structure, credibility, and consistency to the identification of supply chain's impacts that are the most important to stakeholders and the business (materiality assessment)
vi) Support the disclosure of non-financial information and communication of social performance
vii) Predict social impacts for policymaking

Social LCA can be used to calculate the social footprint of an organization or product (the total negative impacts related to a product or organization value chain). It can also be used to measure the social handprints or the positive impacts created by changes inside or outside the product system compared to business as usual.

S-LCA as a tool consists of the addition of methods, models and data that are used together to offer insights on the social impacts of an identified product or organization system (Benoit Norris et al., 2014, Zamagni et al. 2018):

Methods
Methods are needed to enable the assessment of risks and performances throughout the value chain in a comprehensive, consistent, but manageable way. Methods can be found in the Guidelines for Social LCA (Benoit & Mazjin, 2009) and the draft revised Social LCA guidelines (2020) expected to be published as a final version in 2020, Methodological sheets for Social LCA (Benoit Norris et al., 2013) Handbook for product social impact assessment (Roundtable for social metrics, 2018) and relevant journals.

Models
Models are needed to inform about the supply chain activities, linkages, and location. While a large number of companies still have minimal information on their direct suppliers, let alone second or third tiers suppliers, S-LCA models enable to by-pass this information gap by using trade or process models as described in table 3 below. While databases exist for process-based models and Economic Input-Output approaches, a more involved approach is necessary for value chain mapping and using technology. Traceability is still in its infancy but there is high customer demands to track the supply chain of high-risk commodities including minerals from mining to the finished product.

Process-based	Economic Input-Output (Global IO or Multi-Regional IO)	Value Chain	Traceability
Descriptive	Comprehensive	Qualitative	Precise
Engineering type model using a unit process as a basis	Trade-based model of economic exchanges	A descriptive model developed through stakeholder interviews	Use of technology to map suppliers and their location involved in supply chain

Table 3. Models used in LCA (Benoit Norris & Norris, 2018)

Two modeling approaches are applied in LCA. They are called respectively attributional and consequential. Attributional models explain "how things are made," while "consequential" modeling describes "how decisions affect the World (Benoit and Mazjin, 2009). Thus, attributional models are rooted in the past and describe the product system as it was using the most recent data available. Consequential modeling only describes the impact of a change in a product system and doesn't include the production activities that are not affected by it.

Data
Data are needed to support assessments by providing generic and site-specific information that will allow identifying hotspots and assessing performances. S-LCA requires its own data addressing relevant social issues. The UNEP/SETAC Guidelines on S-LCA include a flexible list of impact subcategories that cover issues mandated by most international instruments/ standards such as the ILO fundamental conventions.

Generic refers to data that has not been collected for the specific process or processes 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. Generic data are often secondary data that have been initially collected and manipulated by another person/institution than the practitioner or collected for another purpose than the one being currently considered. (Draft revised S-LCA Guidelines, 2020)

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. (Draft revised S-LCA Guidelines, 2020)

S-LCA databases are available that provides social risks information/ generic data from secondary sources such as the Social Hotspots Database (Benoit Norris et al., 2013), and the Product Social Impact Life Cycle Assessment (PSILCA) database.

In addition, Social LCA also uses secondary sources such as census data, government or intergovernmental organization publications, statistical databases, reputation data, NGO reports

and academic literature and primary sources such as surveys, questionnaires, key informant interviews, focus groups or other primary research methods.

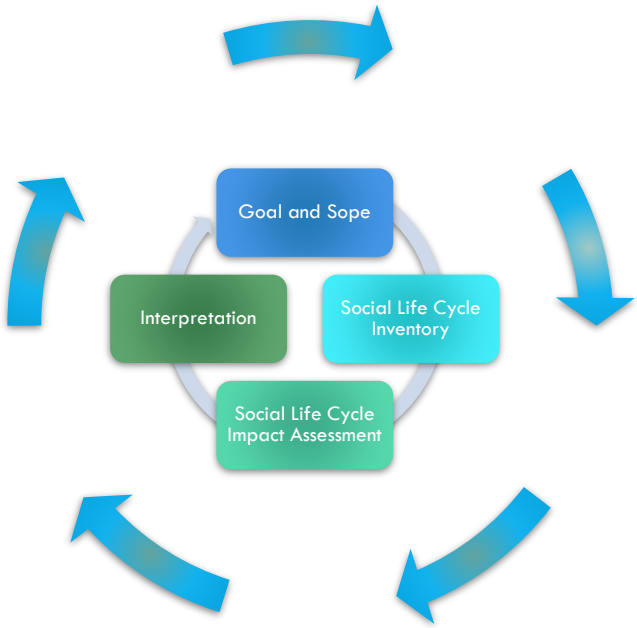

Figure 1: The Four iterative Phases of S-LCA (adapted from Benoit Norris, 2012)

We say that Social LCA is an iterative method because you can and should make adjustments in your goal and scope and data collection plan as you find out more about your product or organization system.

The goal and scope phase is when decisions about what will be studied take place. That is also when the plans for the life cycle inventory, impact assessment and interpretation phases are being made.

Key questions addressed in the goal and scope phase include:

- Is it a product or organization that will be studied?
- Will the study cover the whole life cycle? Or will the study focus on the processes from raw material extractions to end manufacturing?
- Will the study include activities like infrastructure construction or end of life (final disposal or recycling)?
- Will the study use a Social LCA database or generic data, or will it rely only on site-specific data?
- What kind of models to describe the value chain will be used?
- What stakeholder groups and impact subcategories will be included?
- What impact assessment method will be applied? Will the results be communicated with the public?

Figure 2 summarize the Social LCA process and indicate what decisions need to be made at what phase of the study. Because it is an iterative process, when generic data are used and a high risk identified the next step may be to collect site-specific data.

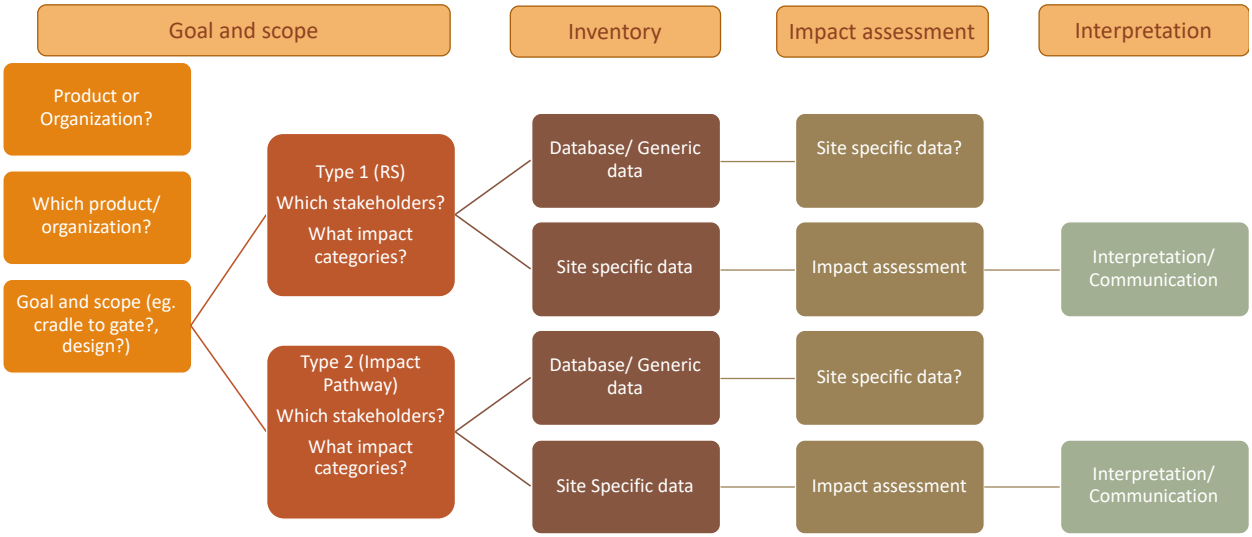

Figure 2. Social LCA decision tree (Revised Social LCA guidelines original from Benoit Norris 2019)

The next phase, Life Cycle Inventory is when data are being collected for the study. It includes data for building the product system model (value chain) also known as additive data (Kruse et al., 2009), data on the social risks or potential social impacts (for each of the impact subcategories selected) or descriptive data (Kruse et al., 2009) and data for the impact assessment method if required.

Social LCA can use a top-down or bottom-up approach to life cycle inventory. Practitioners can choose to start with the list of subcategories, read the methodological sheets to identify indicators or develop them based on other resources and collect data for these indicators from generic or site-specific sources (top-down). Practitioners could also opt to start with stakeholders and identify subcategories with them that are more relevant for the study (bottom-up). Studies can add or subtract subcategories from their assessment based on the scope, relevance, and resources for the study.

A specificity of Social LCA is its uses of a method Life Cycle Attribute Assessment or LCAA (Norris, 2006). Life Cycle Attribute assessment consists of calculating the percentage of a supply chain activity variable that possesses an attribute of interest. Common activity variables in Social LCA are worker hours and value-added, but mostly worker hours are used. The use of LCAA conveys potential impact results without losing the supply chain scope. The activity variable worker hours identify the production activities and countries in the supply chain where people (workers) are most active. Even if it is not an indicator directly related to stakeholder categories other than workers and value chain actors, it is still deemed relevant to convey the supply chain scope. Figure 3 illustrates how Life Cycle Attribute Assessment can be applied to capture the scope of a supply

chain where there is a high risk for low wages to be paid or that are known to be free of forced labor.

50% of worker hours at risk of low wages
90% of worker hours free of forced labor

Figure 3. Life Cycle Attribute Assessment

Social Life Cycle Impact Assessment is the phase where methods are being used to assess the impacts of the product system for which data was collected.

There are two main types of impact assessment methods in Social LCA: the reference scale approach (type 1) and the impact pathway approach (type 2).

Reference scale S-LCIA enables to assess the potential social impacts and social performance of product or organization life cycles. The approach uses performance reference points – PRPs, which classifies the company's behaviors on a scale determined by best practices and standards. Standards and norms are derived primarily from international instruments such as conventions and the local laws. Best practices can be derived from sustainability reports, a literature review, and stakeholder surveys.

Six leading evaluation models are used in reference scale S-LCIA. Assessments based on norms and best practice are most widely used. They are typically performed using a binary or a four- to five-level scale, which correspond to a certain level of compliance with international, national, or sectoral norms or best practices for social responsibility. Certain studies connect multiple issues in one scale (Russo Garrido, 2017).

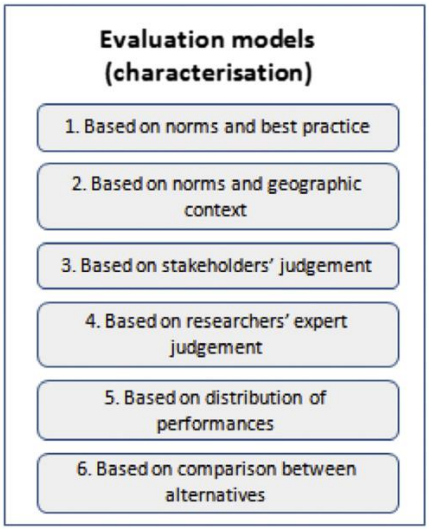

Figure 4. Type I SLCA's main evaluation models. From Russo Garrido et al. (2016)

Reference Scale Assessments focus on the activities of companies in the product system and their immediate effects. As such, Reference Scale approaches do not establish a link between the activity and longer-term impacts. Rather, based on available information, they assess the social performance and *estimate* the likely magnitude and significance of potential social impacts.

The following figure presents an example from a study conducted by Quantis and CIRAIG for the Dairy Farmers of Canada. The red line shows for each impact subcategory (eg. work overload, protection, hourly wage, etc.) what is the level of compliance (risky, compliant, proactive or committed).

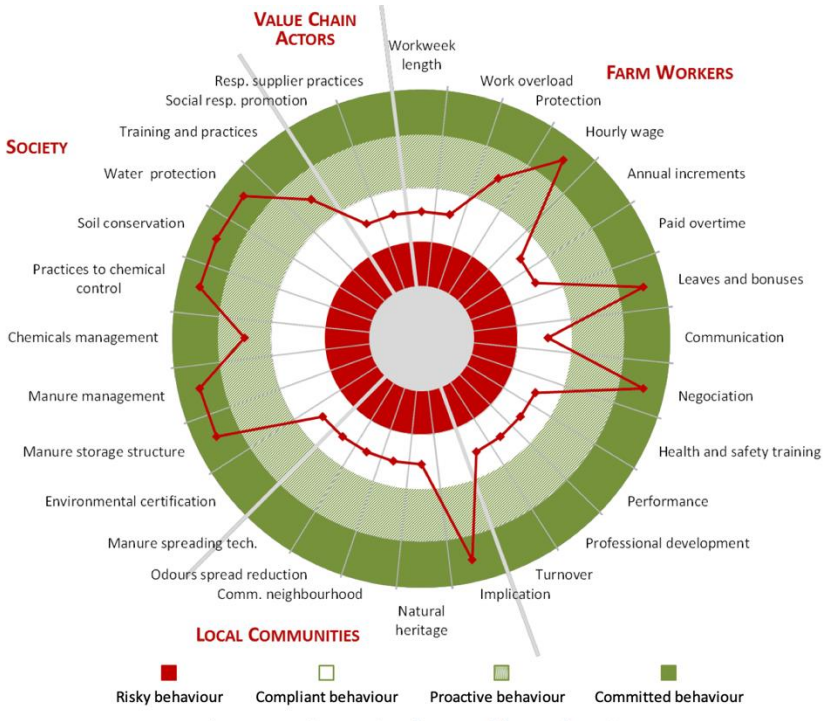

Figure 5. Example of Social LCA results: Socioeconomic performance of the Canadian Dairy Farms (Quantis, 2012)

Impact pathway S-LCIA (Type 2) analyses potential or actual social impacts by using causal or correlation/regression-based models that establish a link between the product system/organizations' activities and the resulting potential social impacts. An *Impact Pathway describes the underlying* social mechanisms concerning social aspects or impacts. Impact pathways S-LCIA focuses on identifying and tracking the consequences of activities all the way to longer-term implications along an impact pathway. This approach is similar to E-LCA impact assessment, where inputs (inventory or collected data, e.g., CO_2 emissions) are linked with environmental problems (midpoint impacts, e.g., global warming potential) and endpoint impacts on areas of protection, e.g., impact on human health.

By far, the reference scale impact assessment approach is the most developed and used (Garrido Russo et al. 2016). An excellent example of the reference scale approach is the Handbook for product social impact assessment published by the Social Roundtable (2018). This Handbook outlines an aligned method for social life cycle impact assessment at the product level. The system enables the evaluation of overall performance by including social topics and performance indicators that reflect the positive and negative impacts of the product on three stakeholder groups: workers, consumers, and local communities. Twenty-four social issues are proposed, together with their performance indicators, including detailed definitions.

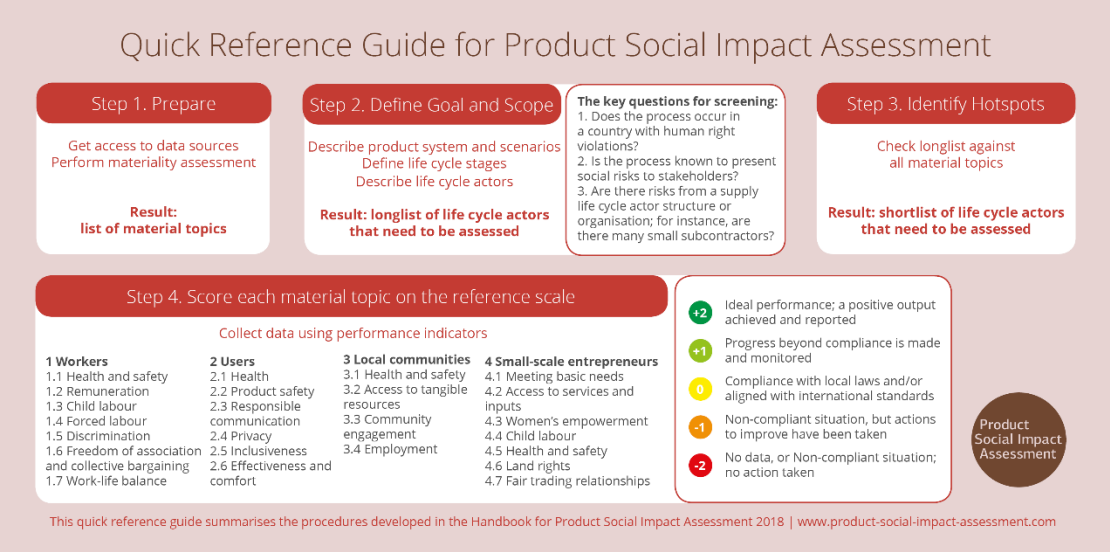

Figure 6. The Social Roundtable PSIA method

Interpretation is the phase where all the previous phases results are reviewed. When the iterative study process concludes, the results of the S-LCIA phase are explored and discussed in depth. This discussion forms a basis for conclusions, recommendations, and decision-making per the goal and scope definition.

Social Life Cycle Assessment has dramatically evolved over the past decade. As more data and more detailed impact assessment methods have become available, its use has grown. However, it

is not currently mandated by legislation and not standardized. Not yet well known, Social LCA should be considered as a leading tool to support human rights due diligence. The European Union has expressed its intent to integrate Social LCA requirements in its product policies[1], and ISO has signalled that it would consider the development of a standard in the near future[2].

What is SIA

Social impact assessment is the method commonly used to evaluate the impact of projects. This section will summarize the main characteristics of SIA so that we can compare it with Social LCA.

Environmental impact assessment (EIA) and social impact assessment (SIA) are tools that focus on specific sites and assess the compatibility of projects concerning environmental conditions, social practices, and standards considering local circumstances. They serve as an impact prediction mechanism. Also, in many jurisdictions, such assessments are part of a project approval process and are conducted to comply with regulatory requirements. Positioned as equally important, is the role of SIA in contributing to the ongoing management of social issues throughout the whole project development cycle, from conception to post-closure (Vanclay et al., 2015).

As such, social impact assessment is the process of identifying and managing the social impacts of industrial projects. It can also be applied to policies, plans, and programmes. SIAs are used to predict and mitigate negative impacts and identify opportunities to intensify benefits for local communities and the broader society. At the core of the principles and practice of SIA is the involvement of affected communities and additional stakeholders in the process. SIA is designed to inform decision-making by government and companies from the early stages of a project.

Of equal importance is the role of SIA in the ongoing management of social issues throughout the whole project cycle until decommissioning and closure. As such, the social management plan that derives from an SIA is essential.

Because development projects related to minerals, energy and beyond, often encroach on the lands and waters that indigenous peoples depend on for their traditional livelihood activities, SIAs play a critical role in assessing the social, economic, and cultural impacts of these industrial activities on indigenous communities. SIA is an essential foundation for community agreements, and in processes of free, prior and informed consent (FPIC) conducted with indigenous communities before the start of industrial development projects (Wilson, 2017).

SIA emerged in the 1970s as an extension of EIA. For several years, it was conducted in a way to be as similar to EIA as possible until the manifestation of a growing consensus from the expert community that social issues differed in fundamentals ways from biophysical ones (Vanclay et al. 2015). In 1994, the Inter-Organisational Committee on Guidelines and Principles for SIA developed the Guidelines and Principles for Social Impact Assessment (1994 & 2003 update) to guide the implementation of the National Environmental Policy Act in the US (Esteves et al., 2012). In consultation with practitioners and other experts, The International Principles for Social Impact Assessment (Vanclay, 2003) were produced in 2003. Building on the 2003 International Principles, the IAIA produced a comprehensive guidance document in 2015, Social Impact

[1] http://agenda.euractiv.com/events/workshop-social-life-cycle-assessment-188359?qt-ea_social_media_agenda=1&page=3
[2] https://product-social-impact-assessment.com/initiating-an-iso-standard-for-social-lca/

Assessment: Guidance for assessing and managing the social impacts of projects (Vanclay et al., 2015). These documents represent the main references for SIA.

One of the key differences between SIA and EIA is the increased attention to enhancing the benefits of projects to impacted communities. The International Association for Impact Assessment guidance on SIA (2015) argues that only minimizing/mitigating adverse impacts is not enough for schemes to gain their license to operate. It does not promote the acceptability of the projects to stakeholders. Enhancing benefits, they say, covers a range of issues, including:

- To modify project infrastructure to ensure it can also serve local community needs;
- To provide social investment funding to support local social sustainable development and community visioning processes to establish strategic community development plans;
- To make a genuine commitment to maximizing opportunities for local content (i.e., jobs for local people and local procurement)
- To remove barriers to entry to make it possible for local enterprises to supply goods and services;
- And to provide training and support to local people.

However, one must not confuse SIA with public participation/consultation only. It is an organized process and method to assess the social impacts and derive a management plan that includes stakeholder involvement, public consultation, and participation.

Social Impacts are defined in SIA as any topic related to a project, and that could be a concern, effect, or impact concerning any stakeholder group. This definition is broad on purpose; the SIA Guidance considers that (2015) almost anything can potentially be a social impact so long as it is valued by or is vital to any specific group of people. For instance, the loss of cultural heritage, important habitats, or biodiversity can also be social impacts because people involved in an SIA value these.

A convenient way of conceptualizing social impacts is as changes to one or more of the following (IAIA, 2015):

- "people's way of life – that is, how they live, work, play and interact with one another on a day-to-day basis;
- their culture – that is, their shared beliefs, customs, values and language or dialect;
- their community – its cohesion, stability, character, services, and facilities;
- their political systems – the extent to which people can participate in decisions that affect their lives, the level of democratization that is taking place, and the resources provided for this purpose;
- their environment – the quality of the air and water people use; the availability and quality of the food they eat; the level of hazard or risk, dust, and the noise they are exposed to; the adequacy of sanitation, their physical safety, and their access to and control over resources;
- their health and well-being – health is a state of complete physical, mental, social and spiritual well-being and not merely the absence of disease or infirmity;
- their personal and property rights – particularly whether people are economically affected, or experience personal disadvantage which may include a violation of their civil liberties;

- their fears and aspirations – their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children."

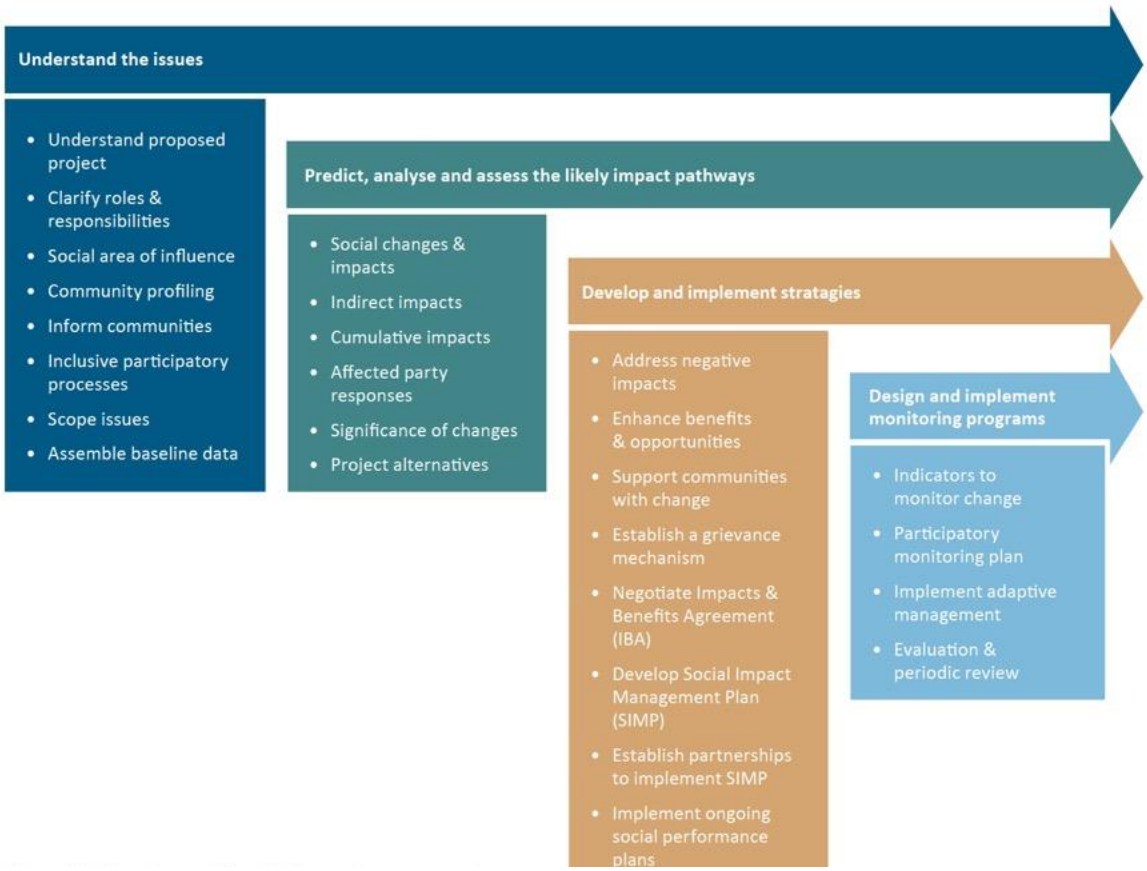

Figure 7: The phases of social impact assessment (Vanclay et al., 2015)

The SIA process, as presented in the IAIA SIA Guidance (Vanclay et al., 2015), has four phases and 26 tasks. In the context of our project, the first two phases are the most relevant. They both involve data collection and analysis.

Regarding the first phase, the community profile, the scoping of the issues, and the collection of baseline data are steps that will be relevant to examine from a Social LCA point of view. In SIA, the community profile is a detailed, qualitative description of the affected communities, including a discussion of trends and issues while the baseline is a carefully selected set of social indicators (social variables) with accompanying quantitative data for the specified communities (Vanclay et al., 2015).

The baseline data covers all of the issues (captured by social indicators) and is meant to offer a point of comparison about the affected communities that will be used as the reference data

against which to measure the impacts of the project as it develops and to determine the adequacy or otherwise of existing facilities.

In addition to the direct impacts, the indirect, second and higher-order impacts also need to be considered and analyzed in an SIA. Since the assessment is prospective, it requires to compare with experiences elsewhere through scenario analysis or other strategies. Mindmapping may help to identify some of the pathways, but then these pathways would need to be refined during the impact assessment.

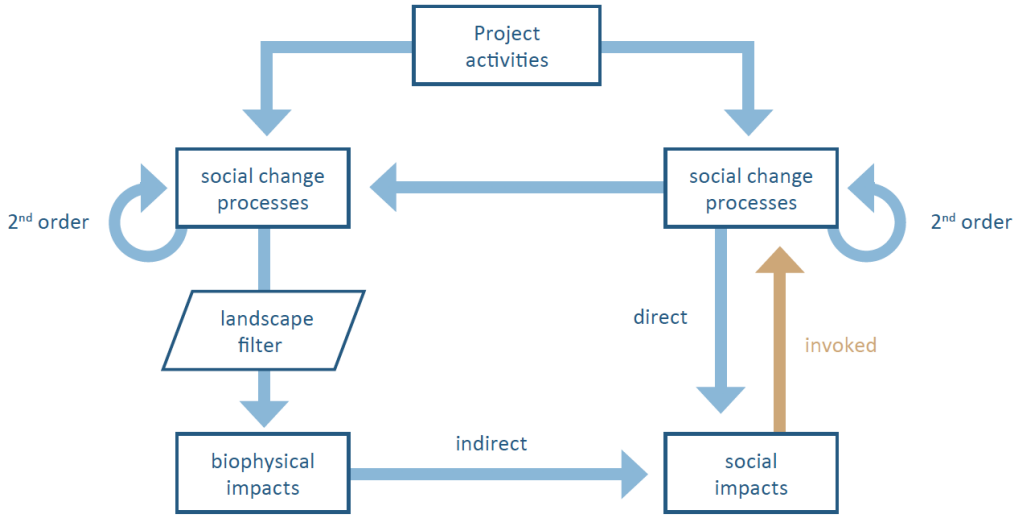

Figure 8. Model for thinking about indirect impacts and impact pathways (Vanclay, 2015)

The second phase is about the prediction and analysis of likely impacts. The quality and transparency of methods and data, and the ability to share this information for critical review are essential aspects. Several methods are used to predict social impacts.

Here are some of the methods used in SIA for analyzing and predicting social impacts as compiled by the Center for Good Governance and adapted from Taylor et al., 1998 and Impact Assessment and Project Appraisal, 2003:

"***Comparative method:*** *This method examines how an affected community has responded to change in the past or the impact on other communities that have undergone a similar action. The present is compared to the future with the proposed action. Based on past research and experiences in similar cases, determination of significance is made based on the comparative data presented.*

Straight-line trend projection: *This method takes an existing trend and simply projecting the same rate of change into the future; we assume that what happened in the past is likely to happen in the future. For example, visitations for recreation increase each year at about the same rate they did in the past.*

Population multiplier methods: *In this method, each specified increase in population implies designated multiples of other variables, such as jobs, housing units and other infrastructure needs.*

Statistical significance means: *It involves calculations to determine probabilistic differences between with and without the proposed action. A social assessor could employ comparative statistical methods to determine statistical significance for appropriate SIA variables.*

Scenarios: *These refer to logical-imaginations based on construction of hypothetical futures through a process of mentally modeling the assumptions about the SIA variables in question. Scenarios include exercises to develop the likely, alternative or preferred future of a community or society. Scenarios can be used to compare different outcomes (e.g., best versus worst case).*

Consulting experts: *Use of expert knowledge such as researchers, professional consultants, local authorities, or knowledgeable citizens. Such persons familiar with the study area could be asked to present scenarios and assess the significant implications for the proposed action.*

Calculation of 'futures forgone': *a number of methods have been formulated to determine what options would be given up irrevocably as a result of a plan or project, for instance, river recreation and agricultural land use after the building of a dam. The wetlands mitigation strategy is such an example."*
(Center for good governance, 2006)

A risk assessment framework may be used to visualize the consequence level on some social variables for different options.

		Consequence Level				
		1	2	3	4	5
Likelihood Level	Descriptor	Insignificant	Minor	Moderate	Major	Catastrophic
A	Almost certain	A1	A2	A3	A4	A5
B	Likely	B1	B2	B3	B4	B5
C	Possible	C1	C2	C3	C4	C5
D	Unlikely	D1	D2	D3	D4	D5
E	Rare	E1	E2	E3	E4	E5

Risk Rating Low Moderate High Extreme

Figure 9. Risk assessment framework (Vanclay et al. 2015)

As we discussed in the introduction, SIA, as a method to predict social impacts, is often included in regulations in some form. The Canadian Impact Assessment Act doesn't mentioned directly SIA but the law mandates the consideration of social effects.

Summary of social impacts under the IAA

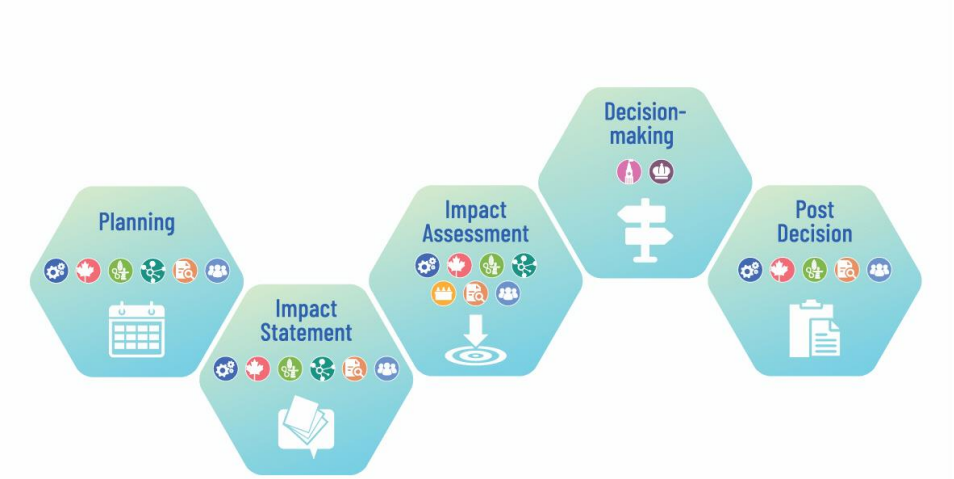

Figure 10. Impact Assessment Process Overview (IAAC, 2019)

There are five phases of the impact assessment process described in the Impact Assessment Act (IAA). These phases are Planning, Impact Statement, Impact Assessment, Decision-making, and Post-decision.

The impact assessment aims to examine the potential changes that may be brought on by the designated project to the environment, health, social, and economic valued components (VCs) and the consideration of mitigation measures.

Planning: The planning consists of inviting the public and Indigenous peoples to provide information and contribute to the assessment. As part of the planning phase, the temporal boundaries for the assessment will be set. Long-term effects must be examined to assess a project's contribution to sustainability.

Defining the scope of an assessment is a central part of the planning phase of an impact assessment. It includes defining VCs: elements of the human and natural environment that are perceived as important by participants in an impact assessment process, and that should be carried forward into the assessment. One of the results of the planning phase is the Tailored Impact Statement Guidelines that present clear requirements for the impact assessment from the Impact Assessment Agency of Canada (IAAC).

Impact Statement: An Impact Statement is a detailed technical document prepared by the Proponent of the project as per the requirements set out in the Tailored Impact Statement Guidelines. The purpose of the Impact Statement is to identify and assess the impacts of the project and the measures proposed to mitigate those effects. Sound science and Indigenous knowledge inform the Impact Statement.

The Impact Statement must describe in detail the project's potential adverse and positive effects in relation to each phase of the designated project (construction, operation, maintenance, suspension, decommissioning, and abandonment). While the guidance is still in development, the environmental, health, social or economic effects will likely need to be described in terms of the context, magnitude, geographic extent, ecological context timing, duration and frequency, and whether effects are reversible or irreversible. Effects mean unless the context requires otherwise, changes to the environment or health, social or economic conditions, and the positive and negative consequences of these changes (IAA, 2019).

In the Impact Statement, the assessment of the effects is based on comparing the baseline situation with the predicted future conditions, both with and without the project. This description of the effects can be qualitative or quantitative, but the criteria must take into account important contextual factors. The information regarding the assumptions and how they were tested need to be transparently available. Table 2 describes the data and model transparency requirements for making predictions.

Type of model	Quantitative	Qualitative
Requirements	Assumptions, parameters, the quality of the data, and the degree of certainty of the predictions obtained or the nature of the effects, directionality, causation, and probability.	Parameters measured, sources and quality of data

Table 4. Data and model transparency requirements for predictions

The Impact Statement should also take into account how effects may impact communities, Indigenous groups, and stakeholders in different ways.

Some of the tools mentioned in recent impact statement guidelines and that can assist with predictions include multi-criteria analysis, risk assessment, modeling, in addition to seeking out expert and stakeholder input. (Marten Falls road impact statement guidelines IAAC, 2019).

Impact assessment: The agency (IAAC) prepares the impact assessment report, which considers the potential positive and negative environmental, health, social, and economic impacts of the proposed project. The potential impacts on Aboriginal treaty rights are also assessed and consulted on.

Decision making: The law states that the decision must be based on the assessment report and whether the adverse effects of a designated project within the federal jurisdiction are in the "public interest." In making the public interest determination, the Minister (or Governor in Council) must have regard to the following:

- the extent to which the designated project contributes to sustainability;
- the extent to which the effects of the project are adverse;
- whether the implementation of the mitigation measures is considered appropriate;
- the impact of a project on Indigenous groups and Indigenous rights; and

- the extent to which the effects of a project hinder or contribute to Canada's ability to meet environmental obligations and commitments on climate change.

If yes, the Minister must establish conditions for the Proponent. Decision statements set out the rationale for the decision, providing transparency and accountability.

Post decision: The Agency's role is to verify compliance with the Decision Statements actively and to correct any non-compliance. Transparency around follow-up programs, access to crucial documentation, as well as opportunities for Indigenous and community participation in follow-up and monitoring programs are all part of this phase.

Since the law took effect in late August 2019, only a limited number of projects are currently going through the process, and obviously, none of them have completed all phases.

Comparison of S-LCA with SIA in the context of IAA

For both Social Life Cycle Assessment and Social Impact Assessment, the social dimension was added at a later time to existing decision making tools primarily designed to assess environmental impacts. Because of the policy context, there was an imperative for these tools' communities of practice to expand their scope to social impacts in order to be considered as capturing broader "sustainability" impacts (Revéret, 2012).

While the first environmental LCAs dates back from the late1960s, Social LCA development only started to take place in the late 1990s. However, the same debate regarding whether social impacts should be studied the same way as environmental impacts have taken place.

Since SIA development and application dates from the 1970s, there is more experience and literature available on its use and best practices. The context has changed significantly since the early days of application, though, and there are growing expectations that SIAs deliver critical information for human rights due diligence assessment and address human rights concerns in line with the UN Guiding Principles on Business and Human Rights (2011). Those expectations also fall on Social LCA, but without the same need for adjustments since Social LCA is largely based on human rights instruments and CSR.

Due to the site-specific nature of traditional EIA and SIA, the scope and boundaries are restricted to impacts on the local environment and society only. In contrast, environmental and social implications in other parts of the value chain, which could be of critical importance, are usually not considered (Econsense, 2016).

Table 3. contrasts Social LCA and SIA characteristics regarding their respective scope, geographical scope, goal, perspective, purpose, data collection, methods, stakeholder engagement and social issues.

Tool	S-LCA	SIA
Scope	Product or organization supply chain or life cycle	Project
Geographical scope	Usually span the globe	Usually one site
Goal	Assess the potential social impacts related to product or organization life cycle	Predict the potential social impacts of projects (typically large energy, mining, transportation, infrastructure sites) ahead of implementation
Perspective	Usually considers existing product or organization value chains (looking back)	Considers industrial project that may take place in the future (prediction)

Purpose	To support decision making, comply with human rights due diligence requirements, improve and communicate about product/organization supply chain social performance	To assess projects social acceptability, identify mitigation measures and to comply with regulatory requirements
Data collection	Generic, site specific when possible and relevant	Generic, site-specific necessary*
Methods	Reference scale and qualitative or quantitative impact pathways	Qualitative or quantitative impact pathways
Stakeholder engagement	Recommended when relevant	Required
Social issues	The UN Environment S-LCA Guidelines recommend a list of social subcategories to consider	Stakeholders identify social issues for each project

Table 5. Comparison between SIA and Social LCA

While Social LCAs are sometimes applied to make predictions about the potential social impacts of product value chains, they usually look at existing products or organization value chains to suggest improvements. However, the ability to predict is necessary for more strategic use of Social LCA in making value chain decisions. On the other hand, predicting potential social impacts is at the core of what has to be delivered by an SIA.

The purpose of both tools is in line with the perspective that they bring. They are both decision-making tools, but the type of decisions that they inform is different because of their respective scope. That also explains why S-LCAs sometimes only needs generic data while SIAs always need site-specific data. Arguably, establishing a baseline is important for both.

In contrast to Social LCA, in SIAs, social impacts are defined broadly, and there is no specific list of categories or subcategories that are used. The International Principles for Social Impact Assessment considers that social impacts include all the issues associated with a planned intervention (i.e. a project) that affect or concern people, whether directly or indirectly.

The product system or value chains considered in Social LCA are often complex and span the globe, while SIA's usually consider one site. Figure 9 and 10 illustrates the difference in the system considered in Social LCA and SIA, respectively.

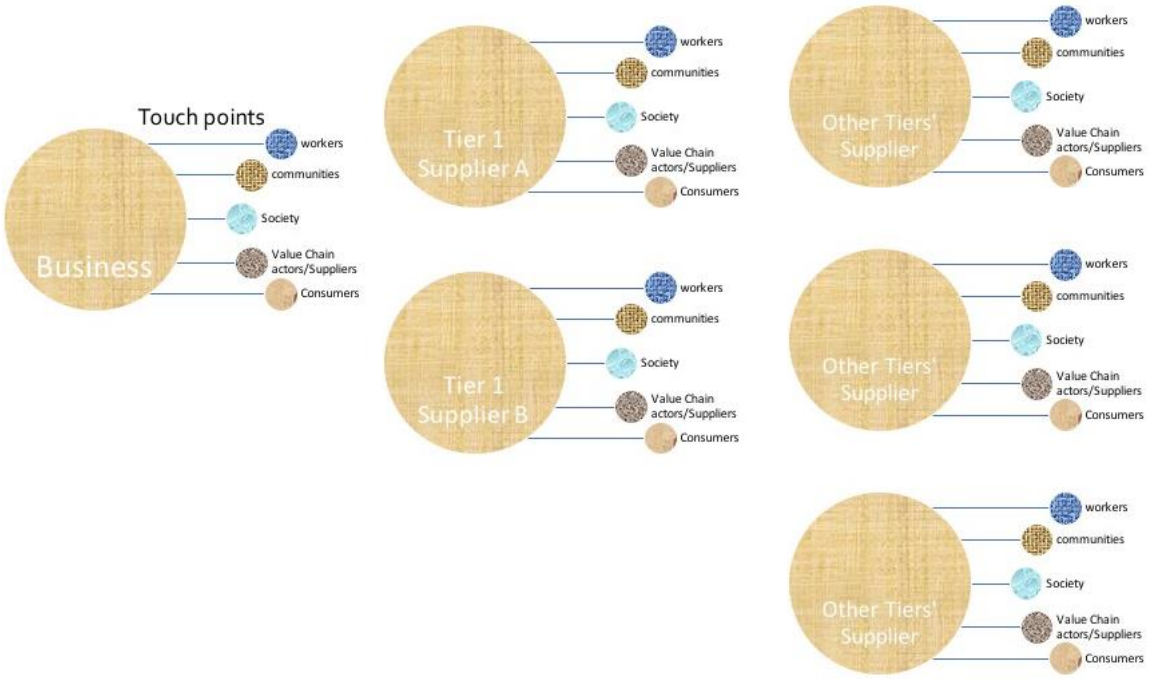

Figure 11. The consideration of supply chains in Social LCA (Benoit Norris and Norris, 2018)

While the entire value chain is included in the scope of a Social LCA, stakeholder groups are not necessarily refined or broken down in different subgroups as it is often the case in SIA where questions of vulnerabilities, power relations and gender are raised and examined.

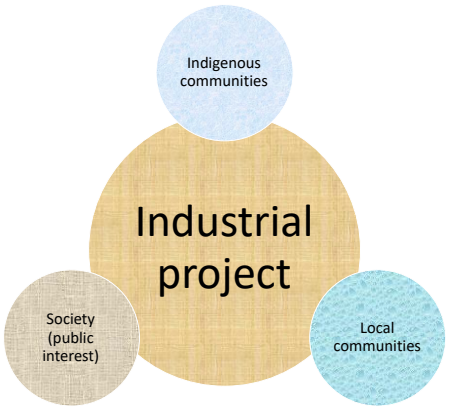

Figure 12. Scope of the assessment in SIA (original)

Participatory methods are often used in SIA to gather the perspective of community members. These methods can also be used for Social LCA.

We will discuss more in detail in the following sections how Social LCA could bring value to the IAA process and phases

S-LCA and IAA Sustainability framework

Under the Impact Assessment Act, one of the factors that must be considered in impact assessments is "the extent to which a designated project contributes to sustainability" (IAA, 2019). The Impact Assessment Act defines ***sustainability*** as "the ability to protect the environment, contribute to the social and economic well-being of the people of Canada and preserve their health in a manner that benefits present and future generations." (IAA, 2019)

The IAA expressed goal of applying this sustainability perspective to the assessment of environmental, health, social and economic effects is to allow practitioners to gather the information that wouldn't otherwise be analyzed and consider long-term effects on future generations, the interaction of effects, and additional mitigation measures. It also aims to include what is valued by communities, indigenous groups, and others in the assessment by the use of a Valued Components approach.

In the IAA, sustainability is contextual, tied to human-ecological systems and project dependent. Because of this, Indigenous groups or communities involved in an assessment may bring their perspectives or values to be taken into account in the process of assessing the project's contribution to sustainability.

The Value Components – VCs, "are the elements of the human and natural environment that are perceived as important by participants in an impact assessment process" (IAA, 2019). The sustainability contribution evaluation occurs after practitioners have conducted their assessment of effects. However, VCs are defined in the planning phase, and practitioners are invited to focus on those VCs that participants characterize as important. The IAA recognizes that different views may be expressed, and the goal is not to seek consensus but rather to document and understand the views expressed. The Proponent's Impact Statement Report will describe the extent to which a project contributes to sustainability applying the VC lens.

"*Without knowing what is valued, it is not possible to analyze the right issues and the sustainability of these elements.*" *(IAA Sustainability framework)*

To conduct the sustainability lens analysis, it is recommended by the IAA that practitioners analyze the potential effects of a project through the application of sustainability principles. These principles have been developed based on the definitions and concepts in the Impact Assessment Act and are informed by best practices, past environmental assessments, and sustainability literature (IAA, 2019). There are four sustainability principles:

Principle 1
Consider the interconnectedness and interdependence of human-ecological systems

A systems approach, examining the relationships among the environmental, health, social , and economic VCs is recommended. Practitioners are required to describe system-level interactions in the Impact Statement with enough details to understand the direct and indirect relationships of a system.

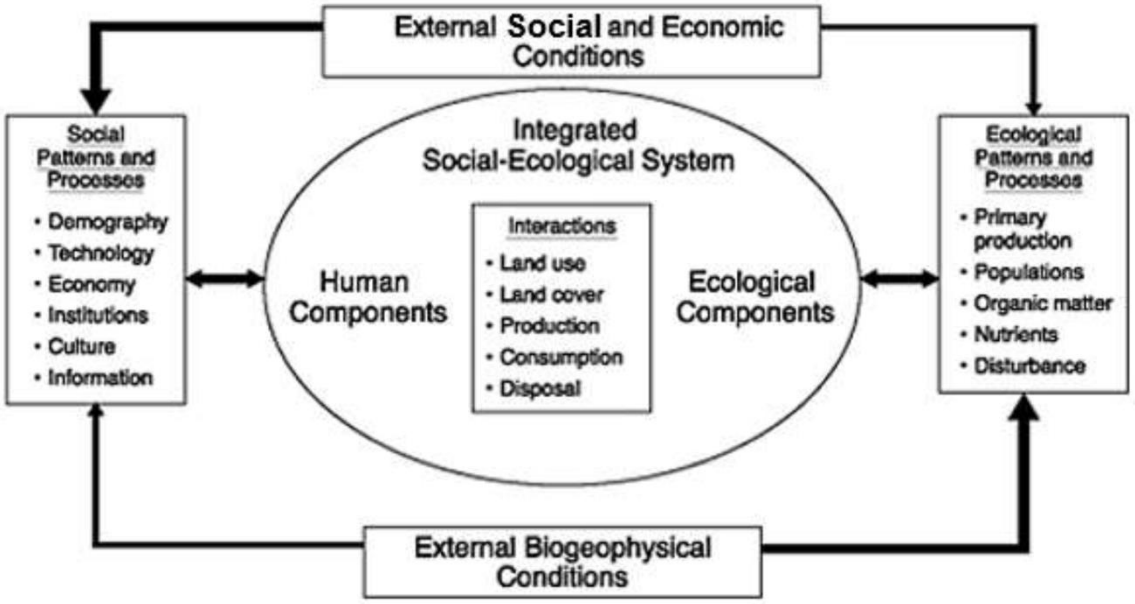

Figure 13. The Social-Ecological System Concept, IAA Sustainability framework (Adapted from The Social-Ecological System Concept, Marta Pérez-Soba, and Janet Dwyer, 2016)

Life cycle assessment is a method recognized for its ability to capture the complex relationships of industrial systems and assess their externalities may they be environmental, economic (through LCC), or social (through Social LCA).

As described earlier, one of the characteristics of LCA is the description of a function and the use of a functional unit. To understand the full impact and interconnectedness of a development project, it would be beneficial to define what is the function of it. In LCA, this is used to identify alternatives, something that is also a requirement under the IAA. Because quite a few process alternatives have a clear—indirect—influence on the structure of other parts of the industrial production system, there may be important indirect effects which could be analyzed with LCA (Tukker, 2000).

For instance, In LCA, we would seek to know what the function of the Voisey bay mine will be in a holistic way. The mine is being expanded for extracting copper, nickel, and cobalt for the global markets. We would like to know what the full life cycle of these metals will be because ultimately, this is part of the footprint (impacts) of the mine. Will there be any refinement? Processing? Transport? Manufacturing.

The nickel institute and copper alliance websites both discuss the uses and the life cycle of these metals. The life cycle activities include mining, smelting and refining, semi-fabrication, product manufacture, use phase, and end of life management, including recycling. Expanding the perspective taken to assess the potential mining development could highlight further opportunities (e.g., With the refinement, smelting, etc.) and additional issues (e.g., transport around the globe, lack of recycling facilities). With the function being described, you can then also define a functional unit that can be used to compare the impacts of alternatives.

Principle 2
Consider the well-being of present and future generations.

The long-term effects on the well-being of present and future generations are to be assessed even if these effects or VCs changes over time. It is recommended that communities be engaged to determine how effects on future generations should be considered. Communities and Indigenous groups may already have defined what well-being meant for them, and they are an important source of information for this type of assessment because their knowledge is built up through generations of people living in a project area. The sustainability framework recommends carrying the assessment in two phases. First, determine what the potential long-term effects are on well-being. Then assess how these long-term effects could affect future generations, maybe extending the time horizon beyond the lifecycle of a project. Supporting data and uncertainties need to be documented.

In LCA there is the concept of areas of protection which are the socially valued components also called endpoints (the endpoints are the quantified variables of the concerns). In Social LCA the typical areas of protection are human well-being and human health. Human health is both assessed from an environmental (via E-LCA) and social point of view (via S-LCA). The figure below shows a representation of the relationships from the product or company system in LCA and how they are related to valued components. The social impact subcategories that are presented in Figure 7 are the social issues (midpoint categories).

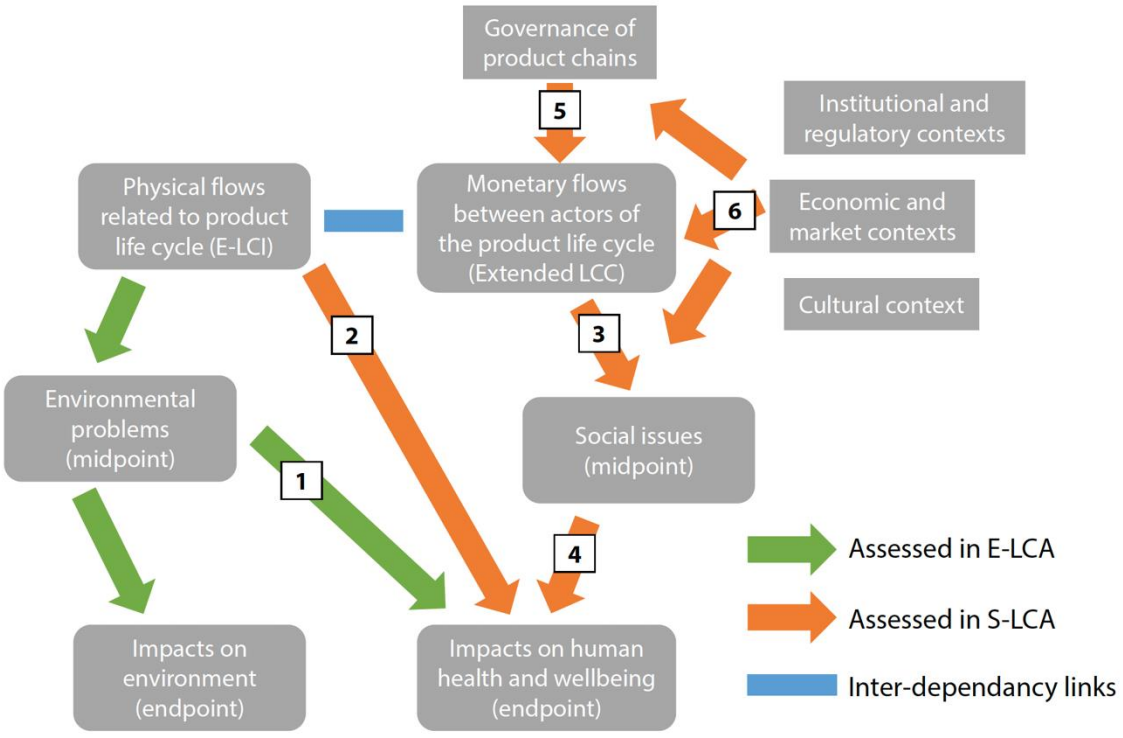

Figure 14. Sustainability approach and underlying theoretical approach for S-LCA (Sureau and Achten, 2018)

Principle 3
Consider positive effects and reduce the adverse effects of the designated project

In an impact assessment, the positive and negative consequences of changes to the environment and health, social or economic conditions must be considered. When adverse impacts are identified, mitigation measures that are technically and economically possible must also be researched and presented. Impacts must also be disaggregated for different subgroups in a community, identifying specific vulnerabilities, and also which groups are most likely to receive benefits.

The concept of footprint and handprint have been introduced to LCA (Norris, 2013). The footprint is the total adverse impacts related to a company or product overall or by impact category or subcategory (eg. a carbon footprint or a slavery footprint). 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 (Benoit Norris and Norris, 2018).

Principle 4
Apply the precautionary principle and consider uncertainty and risk of irreversible harm

There is an expectation that all uncertainties and assumptions, data sources, as well as the reliability and sensitivity of the models used to reach key conclusions be described and documented in the impact statement. If there are gaps in knowledge, these should be identified as well as how they should be addressed. Uncertainties can be characterized quantitively or qualitatively.

If there is a risk of irreversible harm to a valued component, a precautionary approach should be applied.

As we have seen in the SIA section, a common method to predict project impacts on communities is the comparative method. However, SIA studies use different ways to characterize social effects. This create uncertainties. Establishing definitions for effect characterizations that can be used for all projects could provide a more rigorous framework, reducing uncertainties and allowing comparisons between projects. (Orenstein, Westwood, Dowse, 2018).

Uncertainty and data quality can also be managed via a pedigree matrix approach. Pedigree matrices are used in LCA to convert data quality or uncertainty qualitative assessment results into quantitative figures. The pedigree matrix evaluation is fast to apply, and results may be aggregated over different criteria and aspects resulting in an aggregated data quality score. A pedigree matrix can be used during data collection to document data quality and ensure that the information meets required quality criteria. Quality-assessed datasets provide a more transparent picture of the results and can also be used for weighting indicators, datasets and impacts.

How could S-LCA bring value to the IA process

As discussed, the IA process includes the phases of planning, impact statement, impact assessment, decision making, and post-decision. Although we can argue that Social LCA can bring value at every step but decision making, the most obvious links are with the phases of impact statement and impact assessment.

If conducting a full S-LCA is not possible, certain aspects would almost always be useful and applicable in the IA process. From our analysis of S-LCA and SIA, we are proposing eight key areas where Social LCA would provide value. These items relate to the way projects are defined, the scope of the analysis, the social effects investigated, and the impact assessment methods used.

- → Expansion of the system by the description of a function and use of a functional unit when relevant.
- → Application of life cycle thinking.
- → Ensure that all relevant social effects are being considered for all phases of the project life cycle (and perhaps its value chain), including the VCs but going beyond if necessary, for better concordance with human rights under UNGP.
- → Identification and description of impact pathways using qualitative and quantitative methods.
- → Application of a reference scale approach for impact assessment.
- → Use of a pedigree matrix for uncertainty and data quality documentation.
- → Use the concept of footprint and handprint to refer to the adverse impacts and the positive impacts of change where relevant.
- → Plan for and implement monitoring of social impacts throughout the life of the project (Arce-Gomez et al., 2014).

This section will describe how these elements would provide value using a set of past and existing projects that have been subject to the previous environmental assessment legislation (CEAA 2012) or that are going through the IAA process. The projects were selected to be representative of the variety of projects considered in terms of size, province, sector, and particular interests regarding social impacts. The projects reviewed and use as case studies include:

1. Keeyask generation project, Manitoba. a Hydro project in Manitoba under the old legislation, CEAA 2012.

2. Marten falls road, Ontario. Currently being assessed under IAA. It is a road access project in Ontario on First Nation's land.

3. Gazoduq Pipeline (QC). This pipeline in Quebec representing a larger project under the IAA.

4. Roberts Bank Terminal 2 (BC). This port terminal expansion in British Columbia is under CEAA 2012.

5. Voisey's Bay Mine and Mill (NF). This mine in Newfoundland is under CEAA 2012.

1. Expansion of the system

The IAA requires a project description (initial and detailed) and outlines assessment requirements in the TISGs. Applying S-LCA's concept of "functional unit" would better achieve the requirements in the project descriptionn, and would help frame the TISGs and assessment.

The TISGs of the Marten falls road already calls for an in-depth description of the designated project. The description must include the key project components and ancillary activities, the scheduling details, the timing of each phase of the project, and other key features. It also needs to state if the project is part of a larger sequence of projects, outlining the larger context, including the likely future developments by other proponents that will use project infrastructure, and activities that may be enabled by the current project. In addition, the purpose of what is to be achieved, including the broad classification of the project, the target market, and the end-users as well as the objectives, must be defined. The underlying opportunity or issue that the project intends to seize or solve must also be described.

Many of the elements needed to describe the function in a S-LCA and establish the functional unit are already required for the TISGs. From the description of the purpose and objectives, target market, and end-users, it should already be possible to establish who will be using the road and for what. The derived function could be something like: to allow ground transport of persons, minerals, and metals from a four seasons remote area to a center. In an LCA, a functional unit would then be determined using a distance and a time horizon, (e.g. 1 km for 50 years). This, in turn, may allow to compare different types of pavement, technology, and transport types (rail v.s road).

2. Application of life cycle thinking

Applying life cycle thinking can allow us to think more holistically about the project and perhaps identify potentially beneficial activities (economic, social or environmental) that could be added to the scope or, in contrast, adverse impacts further up the value chain. It can also support the assessment of the contribution of the project to sustainable development since sustainable development calls for the consideration of inter-generational effects.

In a previous section, we gave the example of the Voisey Bay mine, which extracts copper, nickel, and cobalt for the global markets. Describing the full life cycle of these metals is necessary to understand the total footprint (impacts) of the mine. Projects tend to describe the construction, operation, and sometimes decommission phases in an IA. S-LCA would expand "operations" into more detail (e.g. smelting, refining, etc). The typical life cycle of metals includes the following phases: mining, smelting and refining, semi-fabrication, product manufacture, use phase, and end of life management, including recycling.

An example of how applying life cycle thinking can potentially expand opportunities is provided by the Voisey bay project for which a facility was built to process the metals in the province.

Building the processing facility creates more employment options and provide more economic benefits from the project for Newfoundland.

One of the metals extracted at the Voisey Bay mine is Cobalt. Cobalt is considered a mineral of concerns[3] and is a significant metal because it is a key component of lithium batteries, jet engines, cosmetics, magnetic steels, to name a few. It plays a vital role in emerging technologies that create a more responsible and sustainable lifestyle for the global community. In renewable energy, it is used in biogas, wind, and in batteries for energy storage. If the project proponent can show that the metal mined will contribute to the expansion of renewables in the country, that can be a strong argument for showing the contribution to sustainable development by the project and maybe connects to VCs.

3. Ensure that all relevant social effects are being considered for all phases of the project life cycle (and perhaps its value chain), including the VCs but going beyond if necessary, for better concordance with human rights under UNGP.

To better aligned with international human rights instruments and to better capture all potential social effects of the project, it is useful, besides developing VCs with project stakeholders, to use a checklist approach. By checklist approach, we mean that a full list of social components should be examined for each project, briefly explaining why they are not relevant and considered for the assessment of the project or reversely how they will be considered. This list would be flexible, with VC being added or subtracted depending on projects. Using this list can be done in the planning or impact statement phase.

For instance, one social component that was not considered in the Roberts Bank terminal 2 impact report but that would be relevant from a human rights perspective is discrimination/equal opportunities.

Discrimination was also overlooked by the Keeyask generation project as well as sexual harassment and human trafficking during the construction and operation phase.

Adverse social effects with human rights implication could also be linked to the material used for building a road in the case of Marten falls or a pipeline in the case of the Gazoduq pipeline. That is why it would be beneficial to do a screening that considers at least the most relevant phases of the life cycle.

4. Identification and description of impact pathways using qualitative and quantitative methods.

One of the impact assessment method type in Social LCA is the impact pathway method (IP or type 2 method). Qualitative and quantitative impact pathways are identified and applied in Social LCA studies.

The revised Social LCA Guidelines describe different impact pathway approaches. In general, they take the form illustrated in figure 15.

[3] https://www.sourceintelligence.com/blog/cobalt-new-conflict-mineral/

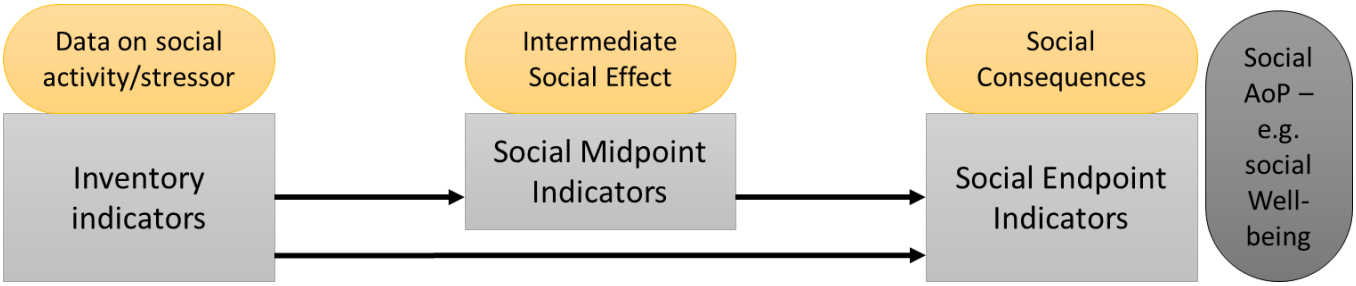

Figure 15: Illustration of the Social Impact Pathway Scheme applicable to Type II S-LCA (Draft revised S-LCA Guidelines)

There is an increasing number of examples and impact pathways described and used in studies published in the Social LCA literature. These could inform the development or be applied in the context of an IA.

For instance, a characterization model has been developed by Neugebauer et al. (2017) to determine fair wages based on three countries/region-specific and product-specific parameters: 1) living wages, 2) working time, and 3) income (in-)equality. This method could be applied in an impact statement and impact assessment for which this would be a relevant valued component and would help clarify whether employment from the project would be a benefit to the local and regional labour markets.

5. Application of a reference scale approach for impact assessment.

Reference scale approaches (RS or type 1) are more advanced then impact pathway approaches in Social LCA. As illustrated in the Social LCA section, they could be used to score each topic/ valued component. Several methods already exist and can be tailored to qualitatively assess the social impacts related to a specific project and its life cycle. This approach may not be relevant to all types of projects. It could be more beneficial to assess the social impacts of a mining project or other labor-intensive industrial type projects.

6. Use of a pedigree matrix for uncertainty and data quality documentation.

The use of a pedigree matrix introduced as an idea for uncertainty management by Funtowicz & Ravetz (1990) is commonplace in LCA. It can be used both for data quality and uncertainty documentation.

To assess the quality of the collected data, relevant elements of data quality are defined, 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 the 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.

The indicators and rating scales can be combined in a pedigree matrix, as illustrated by Table 6.

Indicator	Scores				
	1	2	3	4	5
Reliability of the source(s)	Statistical study[4], 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 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	Average of countries with different conditions, geography under study included, with small share, or not included	Data from unknown or distinctly different regions

[4] 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.

			different conditions		
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

Table 6. Pedigree Matrix for Evaluating the Data Quality in S-LCA (Adapted from Eisfeldt & Ciroth, 2017) (V3 draft revised Social LCA Guidelines, 2020).

7. Use the concept of footprint and handprint to refer to the adverse impacts and the positive impacts of change where relevant.

The concept of footprint enables us to calculate the total environmental or negative social impacts associated with a product life cycle or organization value chain. In Social LCA, it uses the method of life cycle attribute assessment described in the Social LCA section. It consists of calculating the total medium risk hours equivalent associated with the functional unit, for instance, ten years of the operation of a mine. It can be used to calculate the total social footprint or the footprint by impact category such as labor rights and decent work, human rights, governance, etc. or subcategory.

The concept of social handprint refers to the positive impacts that are created as a consequence of a change from business as usual. Social handprints are calculated by impact category or subcategory. A social handprint can reach beyond a product or organization (or project) system as a result of ripple effects.

To create social handprints, it is critical to understand what the root causes of a social issue are so that the changes brought truly address it. For instance, to address the issue of sexual harassment of indigenous women, the root causes need to be understood and addressed via changes of policies, programs, and resources.

8. Plan for and implement monitoring of social impacts throughout the life of the project

Significant social and human rights impacts (and opportunities) are tied to business operations, procurement, and relationships (Arce-Gomez, Antonio; Donovan, Jerome D.; Bedggood, Rowan E. 2014). For instance, a project uses contractors with poor labor practices or a project use of excessive force against protesters by public security forces stationed to protect business assets or a project is sourcing catering from local suppliers. These are issues that surface during the construction and operation or use phase of a project.

Social LCA could help develop and implement a monitoring plan that could also support human rights due diligence.

Potential contribution of S-LCA to the Gender-based Analysis Plus

The Impact Assessment Act under paragraph 22 (1)(s) requires applying a Gender-based analysis plus (GBA+) approach to the assessment of impacts (IAA, 2019). Gender-based analysis plus is an analytical framework that guides the assessment of how designated projects may have different positive and negative impacts on diverse groups of people or communities. It is a way of thinking, rather than a specific set of prescribed methods.

The Status of Women Canada considers the "plus" in GBA+ to acknowledge the multiple identity factors that intersect with sex and gender, and that affect how people may experience projects differently and be differently impacted by projects (Status of Women Canada, 2018).

The framework guides practitioners, proponents, and participants on how to ask vulnerable population groups important questions such as regarding inequalities, power structure, and discrimination. The intent behind the recommendation to use GBA+ stems from a recognition that there are power structures now and in the past and that projects' impacts are layered on top of these structures.

"Recognizing this context is important to understand why impacts may be different for diverse groups of people and how projects have the potential to both reinforce and transform existing inequalities and unequal power relations in communities." (GBA+ guidance)

Some of the methods and tools recommended consist in using a combination of descriptive statistics, interviews, and community forums. The particular mix will depend on the community and project context. The rationale for the methodologies applied, including the reference to the relevant literature, best practices, and input from communities, needs to be provided.

Using a GBA+ approach is broadly in line with the UN Guiding principles (UNGP) on Business and Human Rights which prioritizes assessing and remediating the most severe impacts on the most vulnerable populations first. In UNGP vulnerable groups, mean those groups within a society who experience political, social, or economic marginalization that makes them particularly vulnerable to business impacts (Shift, 2015).

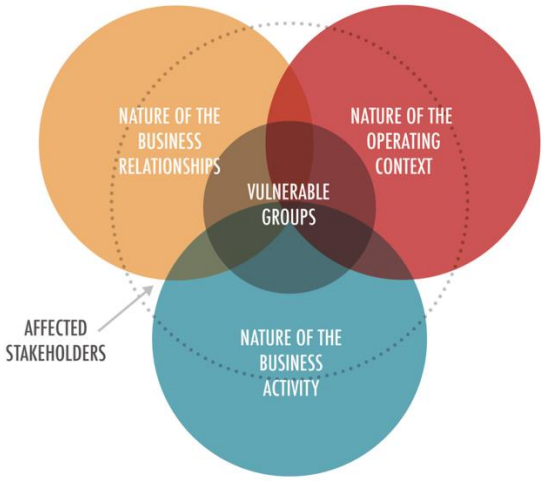

Figure 16. Sources of heightened human rights risks (Shift and IFC, 2015)

However, SIAs differ from Human Rights Impact Assessment (HRIA) because they generally focus on maximizing project benefits, thereby positioning communities as 'project affected people' and as 'beneficiaries.' Through a GBA +, the vulnerabilities of different subgroups in a community, and the differential distribution of costs and benefits are considered. The overall focus tends to be on groups and sub-groups of people in particular stakeholder categories (Gözmann et al., 2014)

In HRIA, the focus is on 'rights-holders,' emphasizing individual agency and facilitating an increased focus on and analysis of, impacts at a disaggregated level. Human rights are primarily individual, not collective rights, and HRIA, therefore, pays particular attention to impacts on the especially vulnerable or marginalized individuals within an impacted community. (Gözmann et al., 2014)

Social LCA morphs depending of the goal and scope of studies. Stakeholder groups can be further disaggregated and subcategories pertaining to vulnerable populations can be prioritized.

Generally, it would be beneficial that a GBA+ applies a human rights lens to the analysis of a project starting with a list of rights, in a more top-down approach in order not to miss important issues. This is especially relevant with vulnerable populations that may not have the ability to express their concerns or the feeling that they can safely do. The Social LCA list of subcategories is a good start that should be followed by a consideration of the UN declaration of Human Rights.

Challenges which may arise from the application of S-LCA in the IA process

Social LCA can enhance the IA process in many ways; however, there are technical, methodological, and adaptive challenges to overcome.

On the technical side, data availability and the lack of access to software tools or systems that would make the use of Social LCA easier or more effective may be a challenge.

The two main software tools used for Social LCA are Sima Pro and Open LCA. The SHDB released a web-based tool which provides many of the same capabilities but in an easier to use interface. To effectively use Sima Pro and Open LCA, training is required. The cost and the necessary efforts could be prohibitive. Excel spreadsheets are also commonly used for conducting a Social LCA but have limitations.

The value chain and life cycle data can be hard to access. There are a few specialized databases for Social LCA (SHDB and PSILCA) and to access risks data (Maplecroft), but a license needs to be purchased. Data can also be collected from NGOs, governmental and intergovernmental databases as well as directly from companies or communities, just as is currently the case for IA.

On the methodological side, Social LCA is still in development and that is especially true for the impact pathway approach that is poised to see the greatest changes in the near future. The fact that it will evolve requires that any recommendation to use this type of Social LCA impact assessment method is coupled with a strong recommendation to seek information on the latest developments.

Social LCA also has its language that new practitioners need to become familiar with.

On the adaptive side, while applying like cycle thinking will bring a lot of value to the IA process, it will also require changing the current mindset about the relevance of more comprehensive scope.

Conclusion

The enactment of the *Impact Assessment Act* has brought considerable changes regarding the evaluation of projects' social impacts. This research has investigated if:

- S-LCA would be an effective tool to use when conducting an impact assessment under the IAA
- The stages where S-LCA would be applicable, and most effective, in IA
- The data challenges that may exist when conducting an S-LCA under IAA

There is no doubt that S-LCA can bring value to the IA process overall. In particular, S-LCA can bring the most value in relation to the sustainability framework and the impact statement and assessment phases of the IA process.

Regarding the sustainability framework, applying life cycle thinking supports the imperative to implement systems thinking. S-LCA Impact assessment methods can strengthen the assessment of well-being through its systematic approaches. Although, as discussed, if the framework is here to stay, the specificities of the methods are likely to evolve.

The concept of footprint and handprint could bring clarity to the adverse effects versus the positive transformative changes that can be related to a project. The use of a pedigree matrix can help document uncertainties and data quality.

We provided a few examples of how these key elements could be integrated into projects and bring value to the IA process and sustainability assessment.

To gain more insights about the integration of S-LCA to the IA process, it is recommended to conduct case studies where the integration of the different elements would be tested. Based on these case studies, more specific guidance could be developed.

It is also recommended to explore in more depth how to align the IA process regarding social and indigenous community impacts with Human Rights Impact assessment where relevant. This could be beneficial for project proponents and in relation to growing international scrutiny.

In addition, stakeholder interviews with practitioners to gain further insights on the feasibility and value added of applying the identified elements in projects could be organized to gather different perspectives and create a road map for case studies.

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