



Comprehensive analysis of social subcategories throughout life cycle assessment approach for the textile industry

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Abstract

Purpose While the environmental and economic aspects of sustainability have been extensively studied, social sustainability has been largely neglected and necessitates a thorough investigation. The study examines the intricate nature of social impact assessments, considering the substantial significance of the textile industry in the global economy and its wide-ranging social implications. This study comprehensively examines critical social subcategories used in the life cycle assessment (LCA) methodology to highlight the social sustainability of the textile sector. The objective of the study is to enhance and optimize the subcategories proposed by UNEP/SETAC for social LCA by examining, expanding, and adapting them specifically to the textile industry, offering a more focused and sector-specific viewpoint on key metrics.

Methods The study examines its use in textile production and distribution by first carefully evaluating the subcategories established by UNEP/SETAC for social LCA. A systematic assessment of positive and negative social impacts throughout the entire supply chain is examined through global standards, textile-specific standards, and literature. Analysis of semi-structured stakeholder interviews and a comprehensive literature review reveals important social subcategories, some of which go beyond the S-LCA guidelines.

Results New social metrics, including quality, women's rights, gender pay gap, collaboration with NGOs, academic research, circularity implementation, and environmental issues, were formulated from stakeholders' perspectives, tailored specifically for the textile sector.

Conclusions The results of the study aim to promote a socially sustainable textile industry by guiding stakeholders to make informed decisions and adopt methods that prioritize social responsibility as well as environmental and economic factors.

Keywords Social life cycle assessment · Social protection · UNEP/SETAC · S-LCA guidelines · Textile industry · Stakeholder

1 Introduction

The textile industry is one of the largest and most important industries in the global economy, with a market size expected to reach USD 1.4 trillion by 2025. The demand for clothing is rising daily as a result of fast fashion trend in the textile industry and is expected to increase at a compound annual growth rate (CAGR) of 4.0% from 2022 to 2030 (Hansen and Schaltegger 2013; Remy et al. 2016; Grand View Research 2021). Although this industry provides significant economic benefits, it also has a considerable impact on both the environment and society. As the second-largest emitter of carbon dioxide and other greenhouse gases, the textile industry contributes to climate change and other environmental problems (Fidan et al. 2021a). Environmental impacts of the textile industry in the literature focus on a wide variety of aspects, including the textile chemicals

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(Roos et al. 2018) and estimation of critical environmental potentials in the textile and yarn industry (Jain et al. 2023). Moreover, the economic impacts of the textile industry have been extensively researched, especially in countries where it is a key sector, such as Türkiye and China (Zhang et al. 2020; Liu and Zhao 2022). Although significant advancements have been achieved in the field of the economic and environment dimensions, social aspects remain underrepresented. While extensive research has been conducted on environmental and economic sustainability, there is a noticeable gap in the literature on the social impact evaluation studies, incorporating social considerations into sustainability assessments (Lu et al. 2017; Jarosch et al. 2020; Rehman et al. 2021).

The labor-intensive nature of the textile industry, its complex supply chain spanning multiple countries and various raw materials, makes it the focus of various social concerns, including working conditions such as excessive working hours and temporary employment contracts, and health hazards (Becker 2001). Several non-governmental organizations (NGOs) have undertaken enduring projects to enhance awareness of societal problems with the aim of enhancing the well-being of their staff and the communities in which they function (Rieple and Singh 2010). Due to these challenges, major firms like Nike and H&M have implemented socially responsible policies within their supply chains (Shen et al. 2012; Ortega-Egea and García-de-Frutos 2019). All these developments reveal the importance of the social dimension in the textile industry and the need for further research and improved methodologies.

Social life cycle assessment (S-LCA) has emerged as a vital tool for assessing the social impacts of textile products and processes in response to these concerns. The S-LCA method examines the complete life cycle of a product or process, starting from the extraction of raw materials and ending with the disposal at the end of its life, in order to identify and address any social impacts. However, the use of S-LCA in the textile industry is still in its early stages, and there is no agreement on the specific subcategories and methods employed to assess social impacts. This is a challenge for scholars and professionals who aim to evaluate the social impact of industrial products and procedures. Regrettably, the absence of consensus among experts over subcategories and procedures has hindered its progress. The limited progress in S-LCA can be attributed mostly to the absence of agreement on subcategories and techniques (Zamagni et al. 2013; Pollok et al. 2021). Despite the existence of norms and methodology papers established by UNEP/SETAC (the S-LCA Guidelines), S-LCA still faces challenges (Andrews 2009; Arcese et al. 2018; Benoît Norris et al. 2020; UNEP 2020). However, the published guidelines 2020 for the social life cycle assessment of goods and organizations (the S-LCA guidelines) indicate that the methodology is advancing

(UNEP 2020). The aim of these recommendations is to provide a uniform method for doing S-LCA. Moreover, additional research is required to facilitate the effective implementation of S-LCA in the textile industry.

Many researchers have worked on subcategories and methods for S-LCA (Traverso et al. 2019; Mármol et al. 2023). There were studies to assess the social impact of steel, iron, concrete, and cement in Iran, citrus farming in Italy, a pavement project in China, carbon capture and use in Europe, identifying cement manufacturing in Indonesia, roses production in the Netherlands and Ecuador, and use phase of mobility services: a case study in Berlin (Amrina and Vilsa 2015; Franze and Ciroth 2011; Hosseinijou et al. 2014; Rafiaani et al. 2020; Zheng et al. 2020; Gompf et al. 2022; Traverso et al. 2022). In the textile sector, S-LCA was only made for a garment made in Italy, containing wool and cashmere (Lenzo et al. 2017).

Another barrier to the development of S-LCA is the relevance of the evaluated subcategories to specific industries. Since each sector has its own changing social impacts, it is important to choose the subcategories that should be taken into account while evaluating the social impacts, specifically for the sectors. Although there were studies in the literature to determine these subcategories for sectors such as cement and wood products, they were still limited (Amrina and Vilsa 2015; Siebert et al. 2018). According to our knowledge, there was no study that examines the subcategories in detail in the textile sector yet.

In order to accurately assess the potential social impacts of a product made in the textile industry, this study sets out to determine the most pertinent and appropriate social subcategories that could be combined into a comprehensive set of social indices. In order to contribute to the development of S-LCA, this study aims to examine in detail the sector-independent and then the textile sector-specific subcategories in order to fill the gap in the literature about subcategories. First of all, a review of the social certification and standards used in the international arena without sector restrictions was carried out. Afterwards, textile-specific standards and platforms were examined, and finally, a broad list of subcategories used in S-LCA was created by reviewing the literature. Although the basis of the evaluation was based on a detailed evaluation of the criteria published by UNEP/SETAC, subcategories not on this list were also determined via interviewing the stakeholders. Thus, it contributed to the development of the field in terms of being more applicable (Iribarren et al. 2022).

Hence, the objective of this study is to assess the subcategories employed for S-LCA in the textile sector. An extensive literature research was conducted and the present status of S-LCA subcategories was analyzed in the textile sector. The study also identified deficiencies and constraints in the current subcategories and offered suggestions for further

research in this field. This study made a significant contribution to enhancing the S-LCA technique for the textile industry, resulting in a more resilient and efficient approach. Ultimately, this will lead to a textile industry that is more sustainable and socially responsible.

2 Material and methods

2.1 S-LCA

S-LCA is a methodology that addresses the social consequences of products and services across their whole life cycles. It can be implemented at many levels, such as regional and national systems (Di Cesare et al. 2018). The technique used in this study is based on the environmental LCA and has been created following the guidelines of ISO 14040 and 14044 standards (Ekener 2015). The primary focus is to analyze the favorable and unfavorable impacts of a product, service, or organization on the welfare of individuals and society, cultural legacy, and social conduct (Sala et al. 2015).

The S-LCA process comprises four primary stages: goal and scope, life cycle inventory, impact assessment, and interpretation. Although the UNEP/SETAC has developed recommendations for S-LCA, the practical implementation of S-LCA is still at an early stage (Sala et al. 2015; UNEP 2020). In the literature, two methodological approaches called “performance reference point” methods and “impact pathways” methods are used for impact assessment in the analysis phase. Performance baseline methods take into account the conditions of stakeholders at different lifecycle stages; pathways of action methods, on the other hand, evaluate social impacts using characterization models with subcategories similar to LCA (Sala et al. 2015).

In the guidelines published by UNEP/SETAC in 2021 to be used in the life cycle inventory stage, six stakeholder categories were determined as workers/employees, local community, society, consumers, value chain actors, and children (UNEP 2021). The sub-categories of these stakeholder categories were also determined, and the main topics that caused the social impact were determined. Each stakeholder category is associated with the subcategories and the S-LCA analysis is performed with the data collected through these indicators belonging to subcategories. For example, the subcategories determined in the S-LCA guidelines for the worker category are “freedom of association,” “child labor,” “fair wages,” “working hours,” “forced labor,” and “discrimination”.

Although these social impact subcategories determined by UNEP/SETAC have made a unique contribution to the development of the S-LCA method, it is important to determine new specialized subcategories that will meet the

needs on a sectoral basis in order to improve the method and increase its applicability. This study made a unique contribution to the listing of textile-specific subcategories by examining in detail many standards and literature, and subsequently conducting interviews with industry experts. Thus, S-LCA can be implemented with less effort and pinpoint assessment to reduce social hotspots throughout the supply chain.

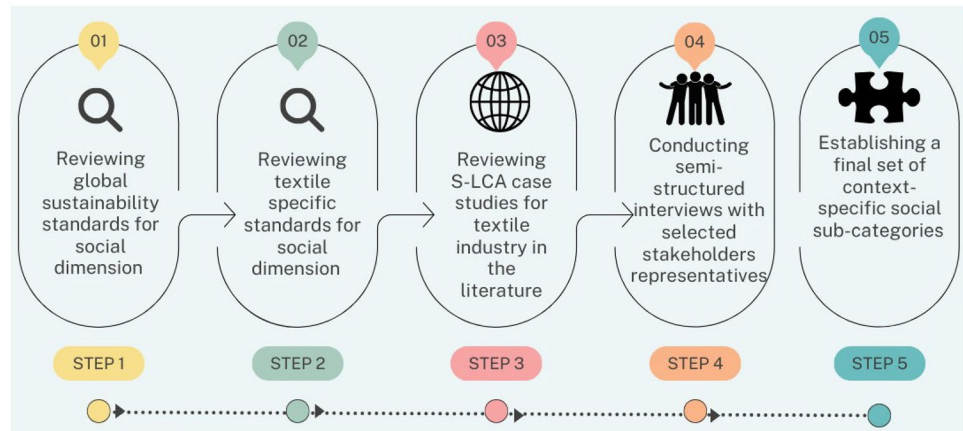
3 Methodological framework

The research framework included a review of global sustainability standards as well as textile sustainability strategies and certification standards, cross-checking information from literature analysis on S-LCA, and interviews with stakeholders to identify a range of global social issues. The methodological approach used in this research was developed in accordance with the literature (Siebert et al. 2018). A top-down approach was applied to combine aspects of social sustainability available in the global arena with context-specific ones and literature. The top-down approach involves starting with broad, overarching concepts or standards at a global level and then refining them to fit specific industry contexts and ultimately contextualizing them by combining them with the literature. This approach allows for a systematic and structured method of integrating global standards and strategies with industry-specific requirements, literature, and stakeholders' opinions. It provides a framework to ensure that it is based on established principles while also allowing the textile industry to address its unique needs and challenges regarding social sustainability. The flow chart of the research methodology is depicted in Fig. 1.

Specific research steps were followed to create a set of context-specific social subcategories. The screening process was carried out in line with the opinions of industry experts. The following criteria were used to review the literature (WOS, Science Direct, Scopus, Google search, etc.) internet search for which certificates were included in the screening process:

- Involve diverse stakeholders (experts, workers, local communities) for a comprehensive social impact assessment of textile products.
- Conduct a literature review in order to assess the rigorous nature of S-LCA.
- Ensure compliance with industry-specific standards and certifications to comply with social responsibility and legal requirements.
- Consider the social impact assessment perspective at each stage of the life cycle of textile products.

Fig. 1 The frequency of the Subcategories not listed in the S-LCA Guidelines



In the first step, global sustainability standards were reviewed to identify global and international social aspects. In order to evaluate social impacts, certification or framework standards used in the international arena independently of the industry have been determined. In the second step, the standards of certificates and frameworks specific to the textile industry were determined and those that included the social aspect were included in the analysis. In the third step, S-LCA case studies in the literature were scanned. Since S-LCA is still in the maturation stage, studies for the textile industry are limited to a few in the literature (Fidan et al. 2021b). For this reason, all S-LCA studies carried out until 2022 were investigated, regardless of the sector, in order to provide a broader perspective. In the fourth step, the subcategories determined in the first three stages were examined by interviewing the stakeholders in the textile industry for cross-checking. At this stage, the stakeholder was refined with the specific information of the field in order to make the subcategories applicable in the sector. In the last step, the shortlisted social aspects related to the textile industry were scanned and listed. This step resulted in a final set of context-specific social indices and associated social subcategories that will be used to evaluate the social performance of the textile industry.

3.1 Reviewing of global sustainability standards

A comprehensive analysis has been carried out to evaluate the certification and standards used in relevant literature to measure social impacts via social subcategories. These standards are widely used by many companies throughout their supply chains and are considered reliable because the evaluation is made by independent 3rd parties. This analysis was undertaken in a manner that is unbiased towards any specific industry. As a result of the analysis, it was revealed which of the subcategories included in the S-LCA guidelines were covered in these standards examined. A comparison of

social subcategories in the S-LCA guidelines and the global standards examined is given in Table 1.

Assessing the social dimension provides an inclusive and fair analysis of the sustainability efforts of an industry or business. The certifications and standards used in this evaluation process are intended to measure organizations' commitment to fulfilling their social responsibilities and focusing on ethical practices. Social certifications often include a set of criteria covering critical issues such as employee rights, gender equality, safe working conditions, and community participation. These certifications and standards guide companies' processes for monitoring, improving, and reporting their social impacts. In this context, these certifications and standards emerge as important tools that shape the social sustainability efforts of the business world.

The ETI base code The ILO's agreements serve as the foundation for the ETI Base Code, which is a widely accepted standard for ethical labor practices. It is frequently used as a benchmark to perform social audits and create ethical trade action plans and is regarded as a global reference standard (Initiative 2018).

The ISO 26000 social responsibility management system The first formal document on which social responsibility definitions and practices are agreed upon is the ISO 26000 Social Responsibility Management System. ISO 26000 is universally applicable to businesses of any kind or magnitude, irrespective of their geographical location or industry. This document offers clear direction on the concepts, values, and activities related to social responsibility that organizations can adopt to contribute to the achievement of sustainable development. ISO 26000 is an invaluable tool for firms aiming to synchronize their operations with the concepts of social responsibility. Although it does not offer a certification process, it provides a versatile framework that may be customized to suit different organizational situations and industries. ISO 26000 can be

Table 1 A comparison of social subcategories in the the S-LCA guidelines and the global standards and textile standards

	ETI Base Code	Global Standards						Textile Standards										Frequency
		ISO 26000	SA8000	SMETA	BSCI	GRI	Frequency	WRAP	FLA	HIGG INDEX	BCI	FAIRTRADE	STEP	GOTS	GRS	BLUESIGN	FWF	
WORKER	Freedom of association	●	●	●	●	●	6	●	●	●	●	●	●	●	●	●	●	10
	Child labour	●	●	●	●	●	6	●	●	●	●	●	●	●	●	●	●	10
	Fair salary	●	●	●	●	●	6	○	●	●	●	●	●	●	●	●	●	9
	Hours of Work	●	●	●	●	●	6	●	●	●	○	●	●	●	●	●	●	9
	Forced labour	●	○	●	●	●	6	●	●	●	●	●	●	●	●	●	●	10
	Equal opportunities /discrimination	●	●	●	●	●	6	●	●	●	●	●	●	●	●	●	●	10
	Health and safety	●	●	●	●	●	6	●	●	●	●	●	●	●	●	●	●	10
	Social benefits/ security	○	○	○	○	○	1	○	●	○	○	●	○	○	●	○	○	3
	Employment relationship	○	●	○	○	●	5	○	○	○	○	●	●	○	●	○	●	4
	Sexual harassment	○	○	○	○	○	0	●	○	●	○	●	○	○	○	○	○	3
CONSUMER	Smallholders including farmers	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0
	Health and safety	○	●	○	○	○	2	○	○	○	○	○	●	○	●	○	○	2
	Feedback mechanism	○	●	○	○	○	1	○	○	○	○	○	○	○	○	○	○	0
	Consumer privacy	○	●	○	○	○	2	○	○	○	○	○	○	○	○	○	○	0
	Transparency	○	○	○	○	○	1	○	○	○	○	○	○	○	○	○	○	0
LOCAL COMMUNITY	End of life responsibility	○	○	○	○	○	1	○	○	○	○	○	○	○	○	○	○	0
	Access to material resources	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0
	Access to immaterial resources	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0
	Delocalisation; Migration	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0
	Cultural heritage	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0
	Safe and healthy living conditions	○	○	○	○	○	1	○	○	○	○	○	○	○	○	○	○	1
	Respect for indigenous rights	○	○	○	○	○	1	○	○	○	○	○	○	○	○	○	○	0
	Community engagement	○	●	○	○	○	2	○	●	●	○	○	○	○	○	○	○	2
	Local employment	○	○	○	○	○	1	○	○	○	○	○	○	○	○	○	○	0
SOCIETY	Secure living conditions	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0
	Public commitment to sustainability issues	○	●	○	●	●	4	●	●	●	○	●	●	●	●	●	○	7
	Contribution to economic development	○	●	○	○	○	2	○	○	○	○	○	○	○	○	○	○	0
	Prevention and mitigation of armed conflicts	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0
	Technology development	○	●	○	○	○	1	○	○	○	○	○	○	○	○	○	○	0
	Corruption	○	●	○	○	○	3	○	○	○	○	○	○	○	○	○	○	0
	Ethical Treatment of Animals	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0
	Poverty Alleviation	○	●	○	○	○	1	○	○	○	○	○	○	○	○	○	○	0
VALUE CHAIN ACTORS	Fair competition	○	●	○	○	○	2	○	○	○	○	○	○	○	○	○	○	0
	Promoting social responsibility	○	●	○	○	○	2	○	○	●	○	○	●	○	○	○	○	2
	Supplier relationships	○	○	○	○	○	1	○	●	●	○	○	●	○	○	○	○	3
	Respect for intellectual property rights	○	●	○	○	○	1	○	○	○	○	○	○	○	○	○	○	0
CHILDREN	Education Provided in the Local Community	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0
	Health Issues for Children as Consumer	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0
	Children Concerns Regarding Marketing Practices	○	○	○	○	○	0	○	○	○	○	○	○	○	○	○	○	0

utilized by organizations to improve their comprehension of social responsibility and to direct the formulation of their plans and practices in this domain.

The SA 8000 standard The non-profit organization SAI (Social Accountability International) established SA8000 in the late 1990s as the fundamental framework for the independent evaluation of a company's commitment to social responsibility. Social issues such as child labor, forced labor, health and safety, freedom of association, discrimination, discipline, working hours, and pay are the main topics of the standards (SAI 2014). The basis of the SA 8000 standard is ILO (International Labor Organization) conventions constituting the UN Universal Declaration of Human Rights and the Convention on the Rights of the Child. This standard is an auditable certification standard that encourages organizations to develop, maintain, and implement socially acceptable practices in the workplace (Sartor et al. 2016).

The SMETA SMETA, which stands for Sedex's social audit methodology, is widely used as a social standard worldwide. It allows companies to evaluate their locations and suppliers in order to understand the working conditions, health and safety practices, environmental impact, and ethical standards within their supply chain (Sedex 2019). This standard is applicable to businesses of all sizes and industries, including public institutions and non-governmental organizations, in addition to those in the private sector. This system's goal is to promote sustainable development (Standardization 2010).

The business social compliance initiative Business Social Compliance Initiative (BSCI) is a broad-based approach to monitoring and evaluating the supply chain for social compliance. The BSCI Code of Ethics covers a wide range of topics, including legal observance, associational and collective bargaining freedoms, nondiscrimination, pay, working hours, occupational health and safety, the ban on child labor, the ban on forced and compulsory labor, disciplinary measures, and issues with the environment and security (Amfori 2018).

The global reporting initiative The Global Reporting Initiative (GRI) is an international independent standards body created to help businesses and organizations understand and communicate their impact on issues such as climate change, human rights, and corruption. Although GRI standards are divided into subsections such as Universal Standards, Industry Standards, and Subject Standards, all of them are used in their consolidated form in this study (GRI 2012). GRI standards provide a comprehensive framework suitable for many sectors and companies, while promoting transparency and accountability in sustainability-related measurement and reporting. The disadvantage of these standards is the

complexity of implementation, especially for small businesses. As a result, no standard has as detailed an indicator list as the S-LCA guidelines.

3.2 Reviewing textile certification standards

Since the textile industry is labor-intensive and has recently come to the fore with social issues, the industry has particular social standards or general standards that include social issues. These standards and the subcategories are given in Table 1.

The WRAP A group called Worldwide Responsible Accredited Production (WRAP) seeks to support production that is legal, safe, humane, and ethical. The primary focus of WRAP is the certification systems it has created especially for the apparel, footwear, and sewn goods industries (WRAP 2022).

The fair wear certification The Fair Wear Foundation (FWF) is an independent multi-stakeholder organization that works with apparel brands, garment workers, and industry influencers to improve working conditions in garment factories. The Fair Wear certification enables apparel companies to make ongoing, useful improvements to working conditions throughout the supply chain. For customers, it ensures the highest standard of social responsibility (Fair Wear Foundation 2022).

The higg index Developed by the Sustainable Apparel Coalition (SAC) and available on Higg.org, the Higg Index is a suite of tools that enables brands and retailers to measure and score the sustainability performance of a company or product. While providing the opportunity to evaluate social and environmental dimensions separately, it also provides reliable results through 3rd party audit firms (Yudina 2017). The Higg Index is a set of instruments for measuring value chains' sustainability in a consistent manner. It offers advice to manufacturers, retailers, governments, NGOs, and consumers on matters including carbon emissions and working conditions. The Higg Facility Social and Labor Module (Higg FSLM) seeks to provide secure and fair social and employment circumstances for value chain workers globally. The Higg Brand and Retail Module (BRM) gives brands the ability to develop stronger CSR plans that enhance worker welfare throughout the supply chain (SAC 2022).

The better cotton Better Cotton aims to promote the use of good cotton (Riisgaard et al. 2020). It is a sustainability initiative established to improve cotton farming and practices. It works to ensure that all employees benefit from decent working conditions (BCI 2020).

The fairtrade Fairtrade, commonly referred to as fair trade, is a market-driven social movement that aims to support developing-country producers and advance sustainability. The movement promotes social and environmental norms as well as increased pay for producers. It includes norms for a wide range of industries, including textiles, chocolate, and coffee. Due to its extensive application, Fairtrade, whose standards are rather broad, attracts attention (Fairtrade Foundation 2016).

The STeP by OEKO-TEX A modular certification program supporting sustainability for factories in the textile and leather industries is called STeP by OEKO-TEX®. The long-term implementation of environmentally friendly production methods, enhancement of health and safety, and promotion of socially responsible working conditions at manufacturing facilities are the goals of STeP (OEKO-TEX® 2021).

The global organic textile standard One of the top standards in the textile industry, the GOTS, verifies the complete textile supply chain with independent certification and establishes the requirements for processing organic fibers into textiles, including ecological and social factors (Textile Exchange 2019a).

The global recycled standard A voluntary product standard for tracking and confirming the amount of recycled materials in a finished product is the GRS. The standard covers traceability, environmental principles, social requirements, chemical content, and labeling and is applicable throughout the entire supply chain (Textile Exchange 2019b).

The bluesign® The Bluesign standard is an impartial certification program for the textile industry that takes into account every stage of production with the goal of reducing environmental impact and safeguarding public health. The standard not only addresses consumer safety but also sustainability factors like environmental and resource efficiency, product synthesis techniques, life cycle considerations, and social standards (Bluesign technologies ag 2020).

Fair labor association In order to encourage adherence to international and domestic labor regulations via social compliance program in their supply chains, a number of well-known garment and sportswear firms collaborate with colleges and NGOs through the FLA, a volunteer management organization with headquarters in the USA (FLA 2022).

3.3 Reviewing of S-LCA case studies

This section of the research focuses exclusively on carrying out a literature review of previously published S-LCA case studies. The literature review initially focused on the “Web

of Science” and “ScienceDirect” databases using the keywords “social life cycle assessment” or “S-LCA” and “textile.” Research articles meeting these criteria were included in the analysis. Initially, 36 results were identified, with 10 from “Web of Science” and 26 from “ScienceDirect.” From these, articles that were repetitive, unrelated to the textile industry, or lacking a life cycle perspective were excluded. Consequently, 8 articles remained. An additional search conducted on “Google Scholar” using the same keywords yielded 6 more relevant studies, bringing the total number of studies included in the review to 14. An overview of the social indicator applied in the current S-LCA case studies is given in Table 2.

Although the S-LCA method is still in its early phase, a limited number of S-LCA studies have been carried out on specific products, as documented in the literature. Due to the limited number of S-LCA research specifically focused on textile items, the analysis encompassed studies from all industrial sectors together. The worker stakeholder category has received substantial attention in S-LCA studies, with a notable absence of exploration into smallholders, including farmers, within this group. The local community category ranks as the second most studied, while the children category remains largely unexplored. Similarly, research on value chain actors, society, and consumer stakeholders exhibits analogous patterns of limited investigation.

3.4 Stakeholder interview

The information gathered from the stakeholder interviews conducted for this research significantly contributed to our comprehension of the complex social dynamics present in the textile industry. The insights provided by these interviews highlighted the industry’s opportunities and challenges from a critical perspective. We ensured a comprehensive analysis that encompassed all individuals impacted by social impacts, by incorporating experts from each stakeholder category. This approach contributed to a holistic understanding of this issue (Sandvik and Stubbs 2019; Huang et al. 2021). In order to provide thorough coverage, we conducted semi-structured interviews with at least one expert representative from each stakeholder group. This approach was essential in gathering viewpoints from stakeholders who may be either positively or negatively affected by social factors within the analysis. Responsibilities of interviewed people and stakeholder category are given in Table 3. The methods applied for the determination of new subcategories include focus group studies, interviews, and brainstorming. These methods were applied to a focus group of 10 people, consisting of sustainability experts with pioneering work in the field of textiles in Turkey. In the meetings, the subcategories used in the literature were discussed one by one, and a consensus was reached and new subcategories that would contribute to the

Table 2 Social subcategories applied in the S-LCA studies in literature

		Social Indicators Applied in the S-LCA Studies in Literature														
		(Aguilar Johansson & Björkner, 2022)	(Giuseppe Martina Nicolini et al., 2023)	(Grönqvist, 2019)	(Grace Annapoornan, 2017)	(Herrera Almaraz & Corona, 2020)	(Zamani et al., 2018)	(Lenzo et al., 2017)	(Huilas-Torres et al., 2022)	(van de Velden and Jørgensen 2017)	(Eden et al., 2021b)	(Sigcho et al., 2024)	(Rosa et al., 2016)	(Mahler et al., 2023)	(Lenzo et al., 2018)	Frequency
WORKER	Freedom of association	●	●	●	●	●	●	●	●	○	●	●	●	○	●	12
	Child labour	●	●	●	●	●	●	●	●	●	●	●	●	●	●	14
	Fair salary	●	●	●	●	●	●	●	●	●	●	●	●	●	●	14
	Hours of Work	●	●	●	●	●	●	●	●	●	●	●	●	●	●	14
	Forced labour	●	●	●	●	●	○	●	●	○	●	●	○	●	●	11
	Equal opportunities /discrimination	●	●	●	●	●	●	●	●	○	●	●	○	●	●	12
	Health and safety	●	●	●	●	●	●	●	●	●	●	●	●	●	●	14
	Social benefits/security	○	●	●	○	●	○	○	●	●	●	●	○	○	●	8
	Employment relationship	●	○	○	○	○	○	○	○	○	○	●	○	○	○	2
	Sexual harassment	●	○	○	●	○	●	●	○	○	○	●	●	●	○	7
CONSUMER	Smallholders including farmers	○	○	○	○	○	○	○	○	○	○	○	○	○	○	0
	Health and safety	○	●	●	○	○	○	○	●	○	●	●	○	○	○	5
	Feedback mechanism	○	●	●	○	○	○	○	●	○	●	●	○	○	○	5
	Consumer privacy	○	●	●	○	○	○	○	●	○	●	●	○	○	○	5
	Transparency	○	●	●	○	○	○	○	●	○	●	●	○	○	○	5
LOCAL COMMUNITY	End of life responsibility	○	●	●	○	○	○	○	●	○	●	●	○	○	○	5
	Access to material resources	●	●	●	○	●	●	○	○	○	○	○	○	○	○	6
	Access to immaterial resources	○	●	●	○	●	●	○	○	○	○	○	○	○	○	7
	Delocalisation; Migration	○	●	●	○	●	●	○	○	○	○	○	○	○	○	6
	Cultural heritage	○	●	●	○	●	●	○	○	○	○	○	○	○	○	8
	Safe and healthy living conditions	●	●	●	○	●	○	○	●	○	●	○	○	○	○	6
	Respect for indigenous rights	○	●	●	○	●	●	○	○	○	○	○	○	○	○	5
	Community engagement	○	●	●	○	●	●	○	○	○	○	○	○	○	○	7
	Local employment	●	●	●	○	●	○	○	○	○	○	○	○	○	○	9
SOCIETY	Secure living conditions	○	○	●	○	●	○	○	○	○	○	○	○	○	○	5
	Public commitment to sustainability issues	○	○	●	○	●	○	○	○	○	○	○	○	○	○	3
	Contribution to economic development	○	○	●	○	●	○	○	○	○	○	○	○	○	○	4
	Prevention and mitigation of armed conflicts	○	○	●	○	○	○	○	○	○	○	○	○	○	○	3
	Technology development	○	○	●	○	●	○	○	○	○	○	○	○	○	○	3
	Corruption	○	○	●	○	●	○	○	○	○	○	○	○	○	○	3
	Ethical Treatment of Animals	○	○	○	○	○	○	○	○	○	○	○	○	○	○	0
VALUE CHAIN ACTORS	Poverty Alleviation	○	○	○	○	○	○	○	○	○	○	○	○	○	○	0
	Fair competition	○	○	●	○	●	○	○	○	○	○	○	○	○	○	4
	Promoting social responsibility	○	○	●	○	●	○	○	○	○	○	○	○	○	○	4
	Supplier relationships	●	○	●	○	●	○	○	○	○	○	○	○	○	○	5
CHILDREN	Respect for intellectual property rights	○	○	●	○	○	○	○	○	○	○	○	○	○	○	3
	Education Provided in the Local Community	○	○	○	○	○	○	○	○	○	○	○	○	○	○	0
	Health Issues for Children as Consumer	○	○	○	○	○	○	○	○	○	○	○	○	○	○	0
	Children Concerns Regarding Marketing Practices	○	○	○	○	○	○	○	○	○	○	○	○	○	○	0

Table 3 People interviewed and stakeholder categories

Stakeholder category	Job title	Work experience	Relation with the topic
Worker	Health and safety expert	11 years	Working in a textile company with a background in social sustainability issues
	Sustainability manager	15 years	Working in a textile company with a background in environmental, social LCA, and certifications
	Blue collar worker	18 years	Working in a textile company
Local community	An industrial engineer	11 years	Living near a textile factory
	A legal representative	10 years	Municipal employee
Value chain actors	Supply chain coordinator	14 years	Working in a textile certification NGO
	Sustainability expert	14 years	Working in a textile company with a background having PhD degree in sustainability
Consumer	Academician	29 years	Research area includes environmental and social sustainability in textile sector
	A housewife	0 years	Conscious consumers
Society	A housewife	0 years	Participating in voluntary work in non-governmental organizations

S-LCA field were determined. During the conversation, the social dimension of sustainability was discussed, followed by an introduction to S-LCA and its associated subcategories. Subsequently, they were solicited for their viewpoints regarding crucial subcategories for the textile industry that were omitted from the provided list. Finally, interviews with a total of 10 people were completed.

4 Results and discussion of comprehensive indicator analysis

4.1 Results for subcategories listed in S-LCA guidelines

Within the scope of this study, we conducted a thorough examination of existing literature to identify prospective subcategories for social aspects in textiles, tailored standards for the textile industry, and global social standards. After conducting a comprehensive collection of data, we proceeded to assess the degree to which these social criteria are presently implemented in current practices. The first evaluation was made for stakeholders. According to the standards and articles examined, the stakeholders most included in the evaluation were determined. In Fig. 2, the most evaluated stakeholders in the S-LCA studies are given.

The most evaluated stakeholder category in S-LCA studies was workers. According to all standards and literature reviewed, the issue has been examined 227 times and has been placed before other stakeholders. This result was directly proportional to expectations, as employees were the ones most affected by the companies' activities (Lee et al. 2013; Su and Swanson 2019). The second most studied stakeholder category was the local community with 67 times. Although the local community was studied 67 times, less than half of the workers were discussed as subjects. The

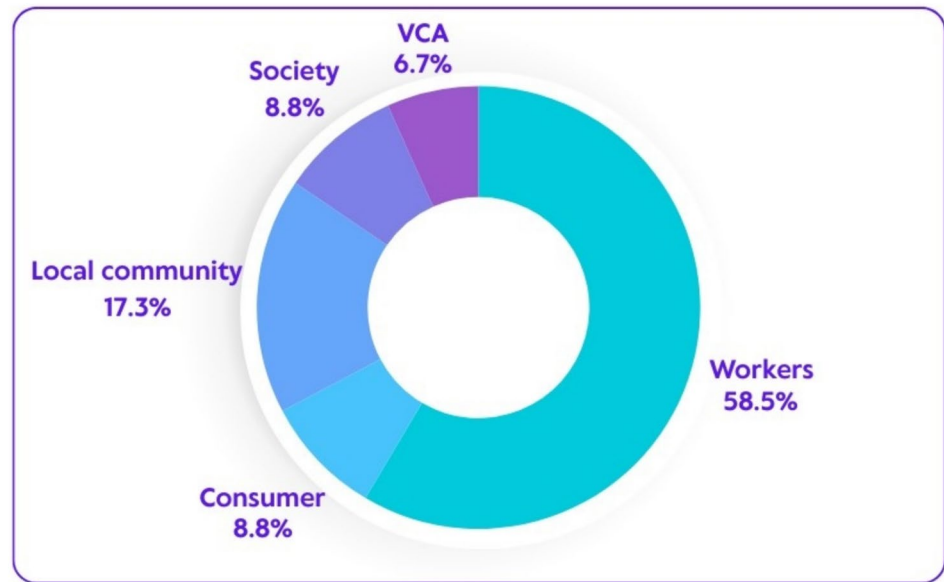
third most evaluated stakeholder category was society, 34 times. The stakeholder groups that were least evaluated were consumers and supply chain actors. More work needs to be done in the textile sector for these stakeholder categories, which have been examined 34 and 26 times, respectively. The stakeholder category children, newly added to the latest version of the S-LCA guidelines, has not yet been included in any studies. Studies are needed in all sectors for this stakeholder group.

Secondly, the subcategories used to evaluate stakeholders were examined and the results are presented in Fig. 3. Subcategories published by UNEP/SETAC were examined regardless of their stakeholders.

In particular, the most used subcategories were health which is included in all studies examined within the scope of this research. The most important category of social impact was health and safety, and this result was expected since the regulations of the working environment in the textile industry have been an important issue in the industry for a long time (Ratnasingam et al. 2010). The second most studied indicator category was fair salary, which was the subject of 29 of 30 studies and standards. This was followed by child labor, equal opportunities/discrimination, and hours of work, which were included 28 times (Fig. 3). Since these subcategories were related to each other, they were generally examined together. Equal opportunities/discrimination stand out with the increase in the awareness of society and the high rate of female employees in the textile sector compared to other sectors. In addition, child labor was common in the textile sector due to legal loopholes, especially in underdeveloped countries (Shahid and Khan 2020).

The widespread use of overtime in the sector and the non-payment of living wages, including these overtime wages, were important issues in the sector. Forced labor, on the other hand, has an important place in the sector with its

Fig. 2 Frequency of stakeholders evaluated in social frameworks (since the value for the stakeholder category children is zero; it does not appear in the figure; VCA, value chain actors)



25 frequencies. All of the 7 subcategories described so far belonged to the stakeholder category workers. These were followed by the public commitment to sustainability issues in the stakeholder category society. This indicator was included 15 times and this result was expected due to the fact that environmental sustainability issues were at the top of the agenda in the textile sector.

Among the 4 subcategories used to evaluate the value chain actors' stakeholders, the most used ones were supplier relationships, and promoting social responsibility which were included 9, and 8 times, respectively. Among the remaining subcategories, respect for intellectual property rights was reviewed 4 times and fair competition 5 times, and they were the least included subcategories for

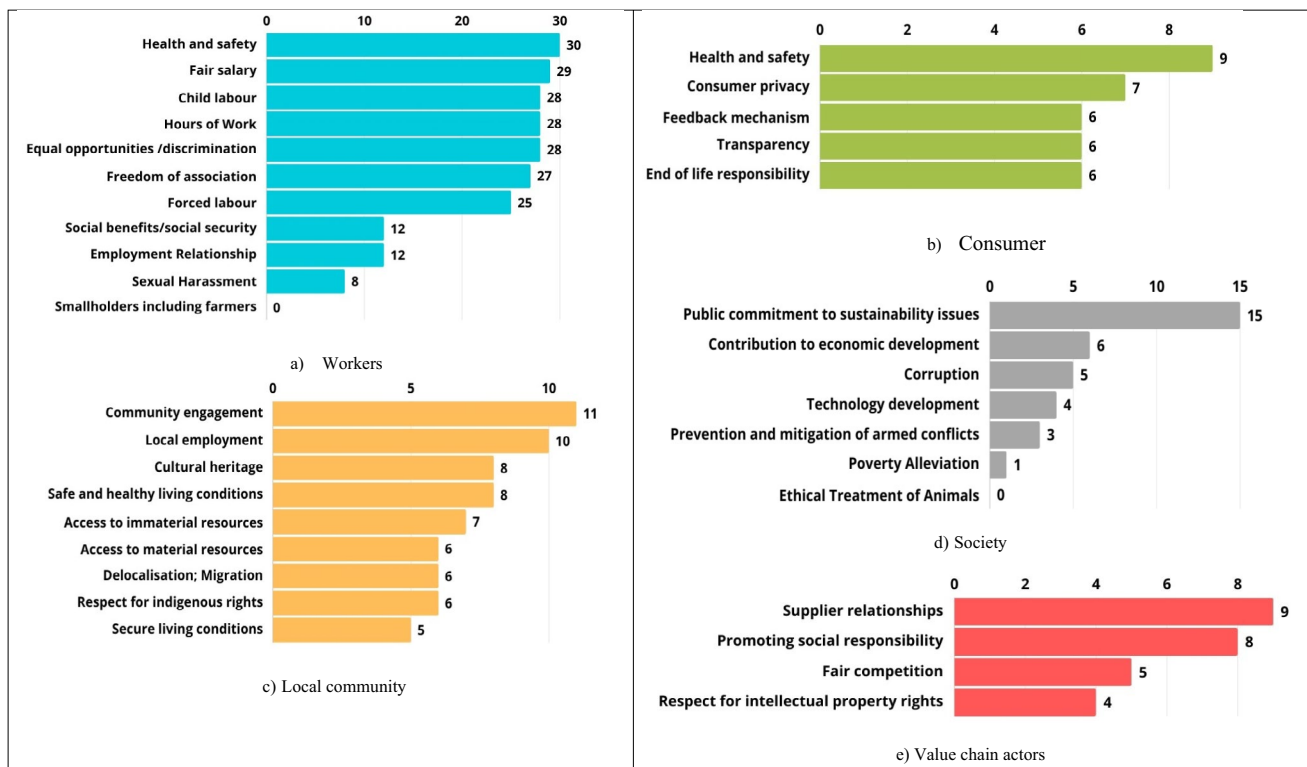


Fig. 3 Frequency of use of subcategories used in S-LCA studies, global, and textile standards

Table 4 Literature on textile sector social subcategories

	Global Standards						Textile Standards										Frequency
	ETI Base Code	ISO 26000	SA8000	SMETA	BSCI	GRI	WRAP	FLA	HIGG INDEX	BCI	FAIRTRADE	STEP	GOTS	GRS	BLUESIGN	FWF	
Disciplinary Practices	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	4
Management System/Policy	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	4
Respect for Human Rights	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1
Harassment and Abuse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	9
Regular Employment	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	5
Security	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	2
No Harsh or Inhumane Treatment	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	2
Training and Education	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	7
Ethical Business Behaviour	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1
Compliance with Legal Laws	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	2
Entitlement to Work and Immigration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1
Subcontracting and Homeworking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1
Employee Involvement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1
Termination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	3
Working Conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1
Safety of Buildings and Production Systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1
Migrant Workers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1

this stakeholder. The most used indicator for the consumer's stakeholder is health and safety which has been used 9 times. Although this number is the indicator with the highest value for consumers, it is quite low in general evaluation. This was followed by consumer privacy with its inclusion 7 times. The remaining subcategories of this stakeholder, feedback mechanism, transparency, and end-of-life responsibility, have been included equally 6 times. Greater inclusion of consumer-related issues in S-LCA studies is important for the sector (Lenzo et al. 2017).

When conducting textile-specific S-LCA studies, these subcategories are crucial to consider. Owing to the labor-intensive nature of the sector, it is imperative to assess employee stakeholders. The significance of community engagement is comparable because of the environmental impacts associated with the consumption of chemicals and water. Community engagement and the provision of secure living conditions are fundamental concerns for local public stakeholders. Furthermore, the equitable competition indicator is critical for all participants in the supply chain.

These aforementioned factors augment the broad scope and relevance of S-LCA investigations within the textile sector (Cai and Choi 2020).

4.2 Results for subcategories beyond the S-LCA guidelines

A comprehensive review encompassing global standards, textile-specific standards, and existing literature were conducted. The literature predominantly aligns with the S-LCA Guideline's subcategories. Significantly, additional subcategories such as customs compliance, subcontracting, and homeworking were introduced by global standards. A list of these non-S-LCA guideline subcategories is presented in Table 4, whereas the frequency of their occurrence is depicted in Fig. 4.

According to Fig. 4, harassment and abuse, training and education, and regular employment is provided were the most included subcategories. Harassment and abuse were included in 9 of the 23 guides, while training and education

Fig. 4 The frequency of the indicator not listed in the S-LCA guidelines



were included in 7 of them. Disciplinary practices and management system subcategories were examined 4 times each. Except for the S-LCA guideline categories, almost all of the included subcategories are still for the worker stakeholder. It should be noted that these subcategories may be included as subcategories even if they are not included in the main headings determined as subcategories by UNEP/SETAC. The definition of these subcategories are given below:

Harassment and abuse: This indicator monitors harassment and mistreatment of employees in the social dimension assessment of an organization. The presence or absence of such negative behavior in the workplace is an important criterion reflecting the performance of the organization from the perspective of social sustainability. **Training and education:** This indicator evaluates the efforts made to create a business culture in line with social responsibility and sustainability principles by reflecting the training and development opportunities an organization provides to its employees.

Regular employment is provided: This indicator aims to measure job security and stability through the practice of providing regular employment to employees. Its purpose is to support the economic well-being of employees in the workplace.

Disciplinary practices: This indicator measures the standards of ethical and fair behavior in the workplace by observing the disciplinary policies applied to employees and whether these policies are implemented fairly and appropriately.

Management system: This indicator evaluates the integration of the structure and processes in management with management systems and their compliance with the principles of these systems.

Termination: This indicator evaluates dismissal practices and checks whether dismissal processes are managed fairly and ethically. It is an important indicator that reflects respect for employee rights and compliance with the principles of social justice.

Security: This indicator evaluates an organization's practice of protecting its employees and workplace. Measures taken in areas such as physical security of employees, workplace security, and information security include important elements that reflect the social performance of the organization.

No harsh or inhumane treatment is allowed: This indicator emphasizes that there should not be any harsh or inhumane treatment towards employees in the workplace. This principle, which reflects the organization's understanding of social responsibility, is of critical importance in terms of respecting employees, working in a safe environment and creating a business culture that respects human rights.

Customs compliance: This indicator evaluates the organization's compliance with customs legislation and checks the compliance of trade activities with ethical and legal standards.

Ethical business behavior: This indicator measures whether the business behaves in accordance with ethical values. Ethical business behavior includes elements such as customer satisfaction, competitive style, transparency, and corporate social responsibility.

Compliance with legal laws: This indicator checks whether the business complies with the legal regulations applicable in the areas in which it operates.

Entitlement to work and immigration: This indicator evaluates whether employees have fair and legal rights in recruitment processes. Respecting the rights of migrant workers and complying with legal regulations is an

important element that reflects the organization's understanding of social responsibility.

Subcontracting and home working: This indicator evaluates subcontractors and home workers within a support's supply chain.

Employee involvement: This indicator is a criterion for evaluating the social support of an organization. It measures the allocation of employees to decision-making processes, internal communication and leadership style, democratic distribution in the centers, and the activation of employee growth.

Working conditions: This indicator evaluates the conditions, safety, health, and general well-being of employees in the work environment.

Safety of buildings and production systems: This indicator evaluates the safety of the buildings and production systems in which the business operates and examines the measures taken to protect employees and the environment.

Migrant workers: This indicator assessed whether their national rights were respected. It is an important criterion that aids and reflects social responsibility behavior on issues such as immigration conditions, work conditions, security, and social rights.

Respect for human rights: This indicator checks whether the business's activities respect human rights.

Transparency: This principle refers to the open and transparent sharing of information regarding the activities, decision processes, and performance of the business. In addition to building trust among stakeholders, transparency demonstrates compliance with social responsibility, ethical values, and sustainability principles.

4.3 Results of stakeholder interviews for subcategories beyond S-LCA guidelines

A notable aspect of this research was the utilization of semi-structured stakeholder interviews to investigate the social opportunities and problems that should be taken into account within the textile industry. The outcomes derived from the interviews are presented in Table 5.

Notably, customers emphasize product quality for both social and environmental aspects. Employee concerns include women's rights and gender-based wage disparities. Subcategories for the community stakeholder group involve NGO relationships and academic research involvement. Circular economy adoption gains importance throughout the supply chain, warranting evaluation for both environmental and social impacts. Additionally, addressing environmental issues for the local population emerges as a key concern. To conduct a comprehensive

Table 5 Social subcategories obtained through interviews with stakeholders

Stakeholder category	Subcategories
Consumer	Quality
Worker	Women rights, gender wage gap
Society	Collaboration with NGOs, academic research
Value chain actors	Application of circularity
Local community	Environmental issues

and accurate evaluation of the social dimension of sustainability in textile sector, it is crucial to consider the new subcategories derived from stakeholder interviews.

Quality This indicator, which is the key to long-lasting use and consumer satisfaction, is the most important issue in the sustainability efforts of the textile industry, transcending both social and environmental dimensions. Quality is the key to customer satisfaction, not only in terms of product performance and durability for customers but also by meeting the demands of sustainable fashion with long-lasting use. Meeting customers' quality expectations strengthens the reputation of the textile industry and plays a critical role in maintaining a loyal customer base.

Women's rights The existence of special rights provided to women to increase their participation in the workforce is a significant indicator for labor stakeholders. This will make a significant contribution to sustainability, reflecting the industry's commitment to promoting fair and inclusive labor practices that are vital to social responsibility.

Gender wage gap The closure of the gender wage gap should be seen as a significant measure to safeguard women's rights and promote equality among workers. Addressing the gender pay disparity is not only crucial for economic reasons, but also serves as a basic measure to advance women's rights and foster workplace equality. The pervasive issue, originating from fundamental social frameworks, emphasizes the necessity for collaborative endeavors to rectify past disparities and advocate for equity in compensation.

Cooperation with NGOs The cooperation between the textile industry and non-governmental organizations will make significant contributions to the advancement of the social dimension with a multiplier effect. This participation is an important indicator as it will demonstrate a broader commitment to the well-being of society and the advancement of knowledge, aligning the sector with the social values it serves.

Academic research Considering the impact of academic research on society, the textile industry's cooperation with these institutions and its participation in research should be considered as an important indicator. Academic research develops knowledge-based solutions to various problems faced by society.

Implementation of circularity Today, the application of circularity throughout the value chain is at the center of supply chain applications and emphasizes the responsible use of resources and waste reduction. This approach is not only compatible with environmental sustainability but also has important social implications, ensuring ethical practices across the operational spectrum of the sector. Therefore, it should be considered an important indicator for supply chain actors.

Environmental issues Addressing environmental issues at the local community level is an essential aspect of the textile industry's social responsibility. The sector must contribute to the well-being of the communities in which it operates by actively reducing environmental concerns that directly affect local populations, and promoting positive relationships and sustainable practices.

5 Conclusion

This study examines the assessment of social subcategories suggested by UNEP/SETAC to determine their suitability in S-LCA specifically in the textile sector. The process entails a comprehensive evaluation of both global and textile-specific criteria, coupled with a detailed examination of relevant literature, in order to gain a deep understanding of the effects these subcategories have on the development of S-LCA research. In addition, this study extends the S-LCA guideline framework by including additional sets of subcategories that are likely to be significant in this area. These subcategories were discovered and incorporated through semi-structured stakeholder interviews, thereby enhancing the existing literature in this sector.

The six stakeholder categories examined in this study were workers/employees, local community, society, consumers, value chain actors, and children in the guide published by UNEP/SETAC. According to the results obtained, the worker stakeholder was the most evaluated category, and subcategories of this category varied for many issues. For this stakeholder category, health and safety, equal opportunity/discrimination, and freedom of association were the most used subcategories from the S-LCA guideline list. Harassment and abuse, training, and education subcategories were not listed in the S-LCA guideline subcategories for the worker category. Still, they were most frequently referenced in the other reviewed literature documents. Smallholders including farmers' subcategories have been added

to the list of S-LCA guidelines with a revision and this indicator has not been examined in any document yet. The second most evaluated stakeholder was the local community, and community engagement was the most used indicator when evaluating this category. Public commitment to sustainability issues is the most important indicator for society stakeholder category. The evaluations did not adequately involve the stakeholders of the consumer and value chain actor categories. Therefore, there is a need to do more studies in this area. The children stakeholder category and its subcategories have not been examined in any study yet, and this area has emerged as the most important subject open to research.

The findings of this study are of great importance to both academics and professionals in the textile industry. This study substantially enhances the comprehension of the viewpoints of all stakeholders by pouring light on subcategories that have been neglected in the existing literature. Moreover, it provides organizations with a strategic framework for setting their social responsibilities first. The potential for wider applicability of the methodology and insights exceeds multiple sectors, indicating that further research is needed to develop indices for assessing social subcategories not exclusively covered in the S-LCA guidelines.

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Data availability All data supporting the findings of this study are available within the paper. All data used in the study are given in the tables.

Declarations

Conflict of interest The authors declare no competing interests.

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