



# Social life cycle assessment in the chocolate industry: A Colombian case study with Luker Chocolate

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## Abstract

**Purpose** Chocolate is a widely consumed product and consumers are increasingly interested in its sustainability. However, the lack of scientific studies covering the social dimension hinders a holistic assessment of the sustainability. A social life cycle assessment (S-LCA) was conducted in cooperation with a Colombian chocolate manufacturer following the *Guidelines for S-LCA of Products and Organizations 2020*. This study represents the first application of S-LCA in the chocolate sector covering both cocoa cultivation and chocolate manufacturing.

**Methods** The study aimed to identify the main social hotspots within the value chain of a dark chocolate product, as well as to identify the potential and actual social performance of this product. The stakeholders assessed in the study were *workers* (in the cocoa plantation and manufacturing plant), *society*, and the *local community*. Primary inventory data was collected through on-site semi-structured interviews as well as through the review of company reports. Secondary data used to build the reference scales for impact assessment were taken from national regulations and best practice standards. In total, 16 subcategories were assessed.

**Results and discussion** The overall results showed an outcome of at least a compliance level (0), and a performance beyond compliance (+1 or +2) for the *local community* and *society*. The latter was attributable to the role of the company as an agent of change in a region heavily impacted by violence and poverty. Furthermore, numerous interviewees stressed the importance of companies in the Colombian post-conflict context to re-integrate former conflict actors back into the labor market. For *workers*, the results also indicated a performance on the compliance level or above, with *child labor* and *health and safety* scoring as +2 and *social benefits/social security* scoring as +1. Areas of improvement were identified in subcategories where the score was on the compliance level (0) such as *working hours*, *fair salary*, *equal opportunities*, and *employment relationships*.

**Conclusions** A main challenge encountered was the definition of reference scales for subcategories with no recognized standards applicable to the socio-political context. This suggested a necessity for further S-LCA applications in regions with armed conflicts. The study provided insight into the social sustainability of the chocolate industry across the life cycle, covering the cocoa plantation and the manufacturing plant. At the same time, it provided the company with a tool to measure the positive and negative social impacts of their actions on stakeholders and redirect efforts towards the areas most in need.

**Keywords** Social life cycle assessment · Reference scale approach · Social life cycle impact assessment · Armed post-conflict · Chocolate manufacturing · Cocoa farming · Colombia

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## 1 Introduction

Sustainable development is most commonly defined as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland 1987). The Brundtland definition does not only encompass intergenerational justice but also distributive justice: “the essential needs of the world’s poor, to which overriding priority must be given” (Brundtland

1987). Although the social dimension is thus essential for truly sustainable progress, it has not received the same importance in sustainability research and policy-making, compared to economic and environmental topics (Sivaraman 2020).

### 1.1 Social life cycle assessment (S-LCA)

Social life cycle assessment (S-LCA) was developed to complement and enable a full assessment of goods and services within the context of sustainable development (UNEP/SETAC 2009). In 2009, the UN Environment Programme (UNEP) and the Society of Environmental Toxicology and Chemistry (SETAC) published the first *Guidelines for Social Life Cycle Assessment of Products* (UNEP/SETAC 2009). These guidelines set the first systematic map for conducting an S-LCA aligned with the International Organization for Standardization (ISO) 14040 2006 and ISO 14044 2006 standards for LCA (ISO 2006a, b). Since the release of the guidelines, several LCA practitioners have applied, tested, and provided recommendations to continue improving their applicability in real-life scenarios. As a result, a new updated version was published, *Guidelines for Social Life Cycle Assessment of Products and Organizations 2020*, hereafter referred to as *The Guidelines* (UNEP 2020). This new edition provides a more detailed guide through the methodology, including extracts from case studies to support the practitioner's work (UNEP 2020).

### 1.2 Chocolate and its impacts

Chocolate is a highly processed product widely consumed in the Global North, despite the environmental, economic, and social impacts of its production (García-Herrero et al. 2019). The ISO 34101 series provides an international standard for sustainable and traceable cocoa production (ISO 2019). The standard covers all the organizational, economic, social, and environmental aspects of cocoa farming, including strict requirements in terms of traceability (ISO 2019). ISO 34101, however, does not cover the chocolate production stage (García-Herrero et al. 2019).

The main ingredient of chocolate is cocoa, which needs to be planted, cultivated, harvested, and then dried before it is transported to the factory where chocolate is produced (ICCO 2023). The supply chain is often difficult to trace from the cocoa cultivation by smallholders, through the local and large-scale cocoa traders, to the chocolate manufacturer (Lafargue et al. 2022). Across the life cycle, the main contributions to both potential environmental and social impacts of chocolate production are from cocoa cultivation (nursery cultivation, planting, harvest, and bean drying) (Ramirez et al. 2016; Sharaai et al. 2020; Boakye-Yiadom et al. 2021) and chocolate manufacturing (including cocoa cleaning,

grinding, pressing, mixing and refining, and packing) (Vesce et al. 2016; Recanati et al. 2018; Bianchi et al. 2021).

On the consumer level, there has been increasing awareness of the consumer's role in achieving sustainable development, as emphasized by Sustainable Development Goal (SDG) 12 "Responsible consumption and production" (United Nations 2015). The United Nations Conference on Trade and Development (UNCTAD) highlighted the need to encourage consumers to make informed, sustainable, and healthy choices (UNCTAD 2017). However, the perceptions held by buyers and experts about chocolate's sustainability are not entirely aligned (García-Herrero et al. 2019). Some of the consumers' misconceptions stem from insufficient knowledge about the socio-economic impacts of cocoa production and missing information about the origin of raw materials and traceability (García-Herrero et al. 2019). Hence, more social sustainability studies are required to complete the big picture for assessing the sustainability of chocolate along its life cycle.

### 1.3 Related work: environmental and social assessments of chocolate production

Existing environmental LCAs include Italian chocolate production (Vesce et al. 2016), a comparison of milk and white chocolate with three cocoa-producing countries (Ghana, Ecuador, and Indonesia) and chocolate production in Italy (Bianchi et al. 2021), chocolate production and consumption in the UK (Konstantas et al. 2018), cocoa cultivation and chocolate production in Ghana for different types of chocolate (Boakye-Yiadom et al. 2021), and Italian dark chocolate production from cradle-to-grave (Recanati et al. 2018). From a life cycle perspective, the environmental dimension of chocolate production is more widely studied than the social dimension. An S-LCA was conducted for cocoa soap including cocoa cultivation in Brazil, where it was found that cocoa cultivation had the worst social performance profile of all process steps considered (Ramirez et al. 2016). Another S-LCA was conducted on cocoa production in Malaysia from cradle-to-gate, assessing *workers* and the *local community*, where it was identified that workers are barely making a living with the payments obtained and need further professional training (Sharaai et al. 2020). However, to determine the sustainability of this product in a holistic way, more scientific studies in the social dimension are needed covering the full life cycle from cocoa cultivation to chocolate manufacturing (Petti et al. 2018). No study attempted to incorporate the three dimensions of sustainability with a systematic approach to chocolate production (García-Herrero et al. 2019), which could be due to the lack of scientific literature focused on social assessments (Petti et al. 2018).

Further studies on the social impacts of the cocoa value chain are needed due to the ongoing human rights challenges in cocoa-producing countries. Poverty, child labor, old-growth forest deforestation for cocoa production, low living income, and gender inequality continue to be part of the daily life of workers and communities involved (Fountain and Huetz-Adams 2020).

Furthermore, the chocolate market is continuously growing: valued at \$138.5 billion in 2020, it is expected to reach \$200.4 billion by 2028 (Sumesh 2019). To meet this increasing demand, producing countries are expanding their production rapidly, while lacking sufficient technical assistance, labor force, and farm gate price adjustments (Benjamin et al. 2019). This adds complexity to the above-mentioned challenges and makes the outlook for environmental and societal improvement more uncertain.

#### 1.4 Our chocolate case study and its local context

Colombia is a middle-income country with a population of approximately 50 million (CIA 2021), with at least 11 million people living in rural areas (DANE 2018). It is the third most biodiverse country globally, following Brazil and Indonesia (Nash 2022). In 2016, the Government of Colombia signed a peace accord with the militant guerrilla group “Revolutionary Armed Forces of Colombia” (FARC), ending more than half a century of conflict (U.S. Department of State 2021). With the ratification of the peace agreement, cocoa has become a key factor within the post-conflict framework for the substitution of illicit crops and the transition to a legal source of income in different rural areas (Moran et al. 2018). Not only the access to producing farms that were located in conflict zones was facilitated, but also to new areas suitable for cocoa production. It is no coincidence that the areas where coca grows in Colombia coincide with the cocoa-growing regions, since these two plants share similar cultivation conditions (Benjamin et al. 2019). The cocoa-producing departments, especially those located on the border with Ecuador in the south and with Venezuela and Panama in the north, have the highest density rates of coca cultivation in the country as identified by the United Nations Office on Drugs and Crime (UNODC) illicit crop monitoring system in Colombia (UNODC 2018, 2020).

As part of the peace agreement, a plan was implemented to wean rural communities to uproot their coca plantations and receive instead monthly support and technical assistance for the transition to other crops (International Crisis Group 2021). Nonetheless, in some cases, this support never came, and communities were forced to replant their illicit crops to ensure a steady income (Carlsen 2021). Colombian law enforcement officials estimate that 40% of forcefully eradicated coca crops are replanted (UNODC 2021). Voluntary

replacement of coca crops with other crops is much more promising, with replanting rates near zero (Palau 2018).

There are approximately 65,341 cocoa-producing families in Colombia (DANE 2021). Most of the producing families have a low social background and are located in economically depressed areas (e.g., with low levels of schooling, poor access roads, and low income), which in some cases are characterized by tense conflict situations (e.g., presence of illegal armed groups) (MARD 2018). In addition to this, farmers lack equipment (e.g., fermenter boxes) and adequate training in order to take advantage of the country’s high yield potential (MARD 2021).

Luker Chocolate, the B2B (business-to-business) unit of the Casa Luker group, is a family-owned chocolate manufacturer. It aims to support the sustainable development of rural communities in Colombia as well as the elaboration of gourmet chocolates that create shared value at origin (Luker Chocolate 2020). Casa Luker is a member of the National Cocoa Council and along with Grupo Nutresa (a Colombian food processing company) accounts for between 80 and 90% of the total national cocoa production, being also one of the biggest cocoa and chocolate exporters in Colombia (Abbott et al. 2017; Sánchez et al. 2019).

#### 1.5 Contributions

As a result of the company’s strategic sustainability plan, several stakeholders have benefited across the three dimensions of sustainability: social, environmental, and economic (Luker Chocolate 2020). However, impact measurement has only been performed for specific programs and parts of the value chain. By contrast, this paper presents a comprehensive S-LCA case study using social hotspots assessment and the reference scale approach of one specific chocolate product, to assess the social impacts along the entire life cycle, from cocoa cultivation to chocolate manufacturing.

Our paper thus makes a twofold contribution to the growing body of S-LCA literature. First, it presents a case study in a novel domain, chocolate production. The paper is the first to present an S-LCA of chocolate production covering both major impact hotspots: cocoa cultivation and chocolate manufacturing. Second, based on the experiences gained by using social hotspots assessment and the reference scale approach in this case study, we present encountered methodological challenges and reflections.

## 2 Methods

An S-LCA is a method used to assess the social and socioeconomic aspects of products and organizations, as well as their actual and potential impacts along their life cycle (UNEP 2020). S-LCA makes use of generic and site-specific

data of a quantitative, semi-quantitative, or qualitative nature and follows to a certain degree the ISO 14040 framework (ISO 2006a).

This study was conducted in line with *The Guidelines* and includes the four main phases: goal and scope definition (Sect. 2.1), life cycle inventory (Sect. 2.2), life cycle impact assessment (Sect. 2.3), and interpretation (Sect. 2.4) (UNEP 2020). The Social Hotspots Database (SHDB) was used to prioritize stakeholder groups and subcategories for the study (see Sect. 2.1.2.4) (Benoît-Norris et al. 2019).

## 2.1 Goal and scope definition

### 2.1.1 Goal definition

The goal of this study was to first identify the main social hotspots within the value chain of the product *El Rosario*, a 78.5% dark chocolate product, as well as to qualify the potential and actual social performance of this product. Thus, the study intended to provide Luker Chocolate with a decision-making instrument to direct its social sustainability efforts to the sectors of the value chain most in need. The results of this study were intended to be disclosed to both internal and external stakeholders of the organization, which entails the management, especially the sustainability department, and the public.

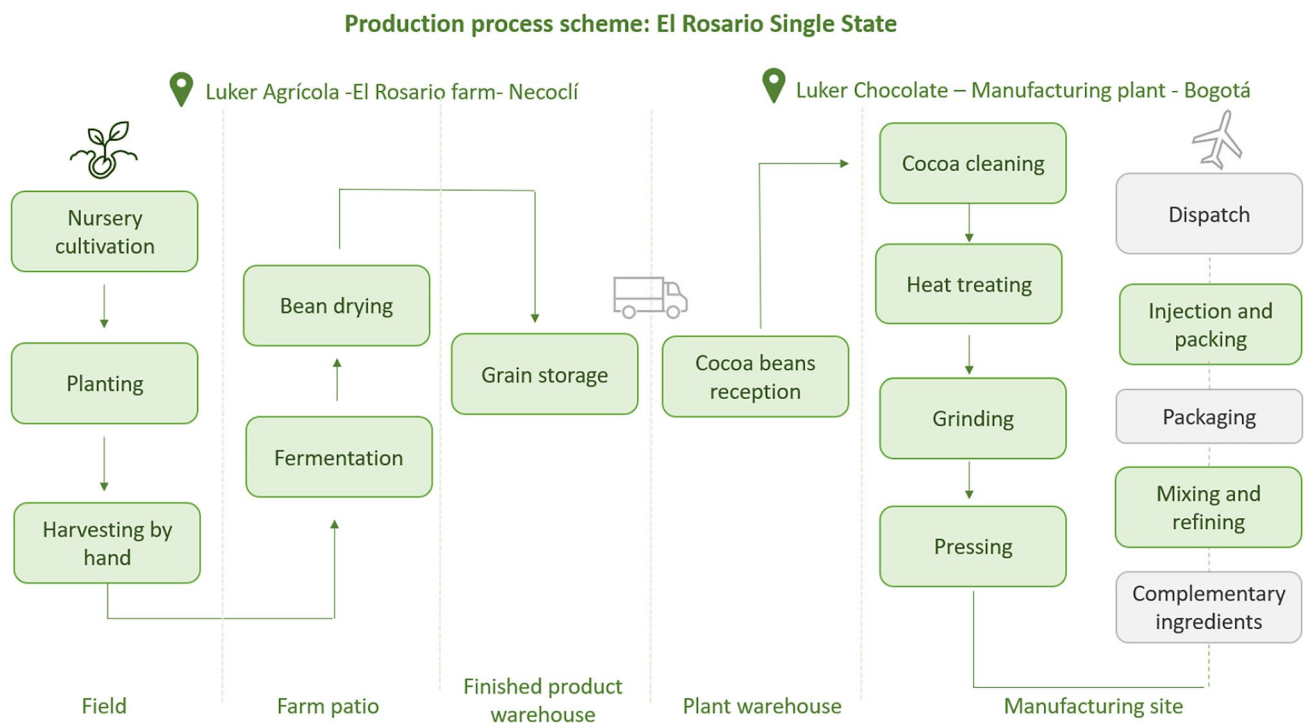
### 2.1.2 Scope definition

The product assessed is a dark chocolate product labeled “*El Rosario* 78.5% Single Estate—extra dark chocolate”. Its function is to provide 83 servings of chocolate as raw material in the confectionery and pastry industries.

**Functional unit** The functional unit was 2.5 kg net weight of *El Rosario* 78.5% Single Estate—extra dark chocolate, which corresponds to the weight of the product at the gate of the company’s manufacturing plant.

**System boundaries** The value chain processes involved in the production of the aforementioned product are outlined in Fig. 1. These correspond to a “cradle-to-gate” system boundary perspective, including upstream processes that comprehend the production of raw cocoa, comprising plantation set up, maintenance, and harvest as well as downstream processes covering the industrial processing of the beans to obtain chocolate.

Luker has the financial and operational control of the entire cocoa value chain (Luker Chocolate 2020). It was thus assumed that a cradle-to-gate S-LCA could be evaluated without being hindered by traceability issues due to, for example: limited data, as a result of poor operational



**Fig. 1** Illustration of the life cycle stages of the product “*El Rosario* 78.5% single estate—extra dark chocolate” (The process steps within the system boundaries are shown in green)



**Table 1** Scoring conversion for each risk level (scoring based on the SHDB (Benoît-Norris et al. 2019))

	No data/No characterization	0
	Low risk	(0-1]
	Medium risk	(1-2]
	High risk	(2-3]
	Very high risk	(3-4]

control, geographic constraints within the supply chain (e.g., large distances between supply chain actors), or a substantial number of implied stakeholders (Saltini et al. 2013). The use phase and end-of-life were excluded from the system boundaries to maintain a high level of data quality and to be in line with the goal of the study.

Other activities related to the production of complementary ingredients for making *El Rosario* dark chocolate, such as sugar, cocoa butter, and soy lecithin, which are supplied by third parties, were not included in this assessment. The packaging materials were also excluded from the assessment. The complementary ingredients and packaging materials were excluded because they are supplied by third parties and the assessment aimed to assess the cocoa value chain within the control of Luker Chocolate, where high-quality and primary data could be obtained. The transportation of cocoa beans from the farm to the manufacturing plant and the dispatch of the finished products were also excluded from the system boundaries.

**Data sources** Since the aim of this study is to identify the social hotspots within the chocolate value chain and jointly qualify the potential and actual social performance of the product, a mixture of generic and site-specific data was chosen. An evaluation of generic, organization-, and site-specific data is needed for a comprehensive analysis (Franze and Ciroth 2011). Generic data obtained using the SHDB provide meaningful insights regarding the social risks of the different stakeholders involved in both crops and food product sectors in Colombia, by assessing publicly available information on 132 social impact indicators from various data sources (Benoît-Norris et al. 2019). Site-specific data collected through site visits and interviews, on the other hand, expand and complement the findings derived from the generic analysis with context-specific characteristics influencing the social performance of the product analyzed. The inclusion of primary, site-specific data enabled the assessment of the actual social impacts in addition to the potential social impacts.

**Selection of stakeholders and subcategories** The stakeholder selection was done using a combination of two approaches: generic and specific. On the generic level, the

SHDB risk mapping tool enabled the identification of key human rights issues in the product supply chain of crops and food product sectors in Colombia, and thus defined the most relevant socio-economic topics and key stakeholders to include in the study (Benoît-Norris et al. 2019). The insights from this step were compared with the latest materiality assessment of the company developed in 2021 (Casa Luker 2021a), yielding a consolidated result of the most relevant stakeholders and social topics for both of these industry sectors and the company.

The risk levels of the different indicators per social topic were averaged to obtain a single score for each topic. Table 1 indicates the scale of scores corresponding to each risk level. The final scores for both economic sectors can be seen in Sect. 3.1.1.

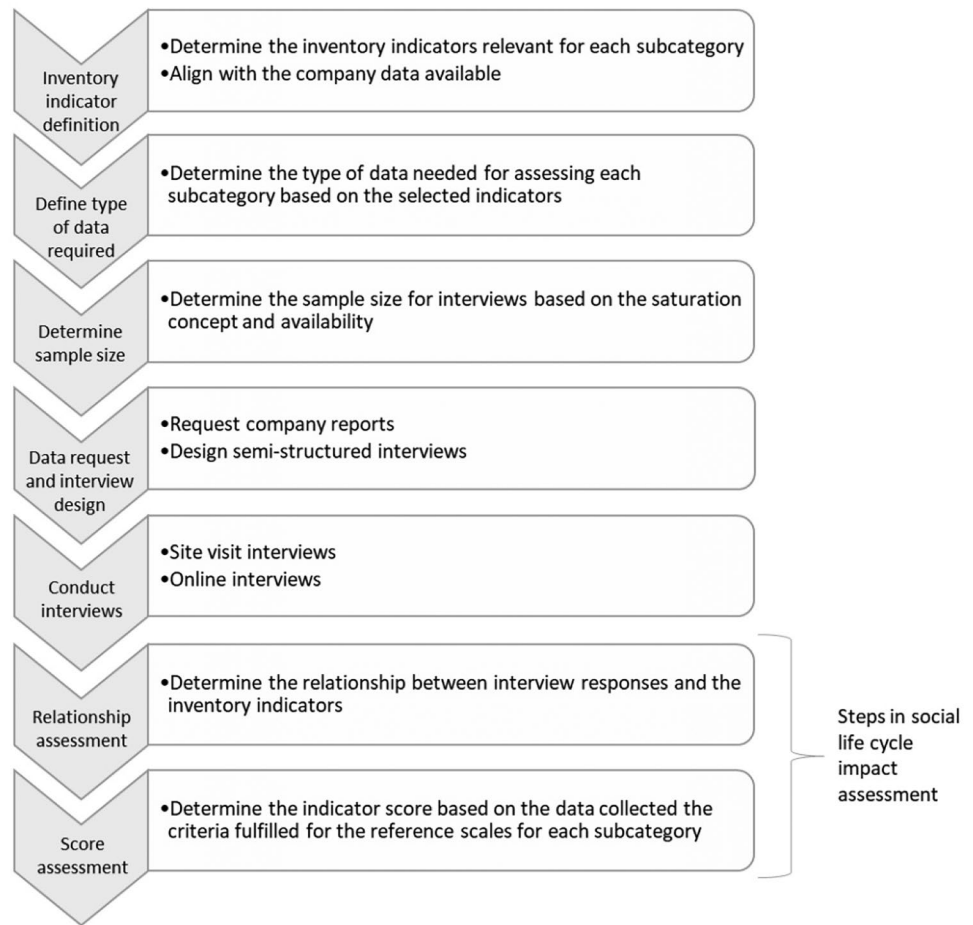
Following the preliminary selection of key stakeholder groups and subcategories based on the SHDB, a comparison with the materiality assessment of the company developed in 2021 was conducted (Casa Luker 2021a). The purpose of this comparison was to align both of the results and enable a final selection of those stakeholder groups and subcategories with higher relevance for the sector and the company. The materiality assessment recognized eight key stakeholder groups, namely: employees, suppliers, customers, communities, allies, partners, executives, and consumers. Moreover, it considered 15 key sustainability issues, representing the essential and dynamic elements emerging in the foresight of the business, the sector, and the market (Casa Luker 2021a). The sustainability issues related to responsible sourcing, creation of shared and sustainable value, labor well-being and diversity, inclusion, and equality, were identified by Casa Luker as the elements with the highest importance for stakeholders and the highest impact on the business (Casa Luker 2021a).

The social subcategories identified as relevant for each stakeholder group were adapted to meet the ones developed under the framework of the *Methodological Sheets for Subcategories in Social Life Cycle Assessment* (UNEP 2021), for gaining a systematic approach for the data collection. Section 3.2 presents the final selection of stakeholder groups and subcategories.

## 2.2 Life cycle inventory

### 2.2.1 Data collection procedures

The life cycle inventory assesses the relationship between a company (Benoît et al. 2010), Luker, and their stakeholders (*workers, society, local community*). The data collection followed the stages described in Fig. 2.

**Fig. 2** Data collection procedure**Table 2** Total number of sample participants

Stakeholder	Value-chain location	Number of people involved	Planned sample size	Number of people interviewed	Remarks
<b>Workers</b>	El Rosario farm—cocoa production	67 (Luker Agrícola) + 103 (contract employees)	23 employees	16 employees	2 interviewees from the managing staff and 2 contract workers
	Manufacturing plant—dark chocolate line only	25 employees	12 employees	7 employees	Maintenance, warehouse, and mechanics personnel were not interviewed because they had no direct involvement with the product
	Luker Chocolate headquarters	23 administrative employees	4 employees	4 employees	Casa Luker's CEO, the sustainability director, head of HR, and the sustainability coordinator were interviewed
<b>Local community</b>	Villages surrounding the farm	Number of families Caribia: 160 Limoncito: 168 Buenos Aires: 102 Alto Carito: 40 Guacamaya: 146 Gariton: 91	10 members of the community	6 members of the community	The sample size was restricted due to safety concerns

### 2.2.2 Definition of inventory indicators and type of data required

The inventory indicators assessed were established in the *Methodological Sheets for Subcategories in S-LCA* published by the UNEP/SETAC in 2013 and updated in 2021 (UNEP/SETAC 2013; UNEP 2021). The *Methodological Sheets* serve as a complementary document to *The Guidelines* to assist the practitioner in the arduous task of data collection (UNEP/SETAC 2013; UNEP 2021). Indicators were selected by relevance, based on the sector context as well as data availability. For the latter, several meetings with the company were necessary to determine if it would be possible to obtain the requested information. Section 3.2 presents the inventory indicators defined per subcategory and stakeholder group. Data collection methods included reviewing company policies, company wage records, HR reports, Occupational Safety and Health (OSH) reports, facility visits, interviews with workers and managers, interviews with the Sustainability Director of Luker Chocolate, and interviews with the community members.

### 2.2.3 Interview design and implementation

Semi-structured interviews were used to gather primary data from Luker Chocolate (including plant workers, plant managers, farmers, and the sustainability department) and from the local community, as they enable free interaction with the stakeholders. Confidence and a conversational environment could thus be established. The interviews for plant workers and farmers had to be tailored differently due to the different disclosure levels of the two companies. Although both are within the Luker family, their maturity levels vary in terms of sustainability reporting, available policies, and traceability. Therefore, interviews with plant workers were intended to corroborate data from the reports; hence, the questions were more concrete. The interviews with farmers, on the other hand, had a more explorative setup. Their aim was to gather new insights, rather than to verify existing information.

The sample size used in qualitative research is often smaller than in quantitative research (Dworkin 2012). The type of data required for this study is mainly qualitative, as this is the nature of many social aspects. For this reason, the sample size was established following the concept of “saturation” defined by (Charmaz 2006) as the point at which gathering fresh data no longer sparks new theoretical insights or no longer offers any new or relevant data.

To determine the sample size for worker interviews, it was necessary to assign them to the product under consideration, i.e., to determine which people are directly involved in the production of “El Rosario” and which are not. For the farm, this identification was not possible, since it was impossible to determine which specific

workers sowed, cultivated, and harvested the beans later used for “El Rosario”. Thus, it was decided to interview people in charge of different tasks within the farm, such as irrigation operators, field operators, cocoa sanitation workers, tractor drivers, administrative staff, and cleaning staff, trying to interview people of different genders where possible. The final sample comprised 23 workers.

For the manufacturing plant, this selection could be carried out to a certain degree since separate production lines are operated. Initially, half of the personnel operating the dark chocolate production line were to be inquired, around 12 people. Additionally, interviews were arranged with administrative members who, although not exclusively dedicated to the product, fulfill a significant role in its value chain, i.e., human resources, sustainability managers, and the CEO. For local communities, no sample size could be established, as for security reasons, members of the community could not be interviewed randomly, but had to be people trusted by the company. The list of contacts provided by the company contained 10 people.

The interviews were conducted in November 2021 at the Luker Chocolate facilities in Bogotá and the cocoa plantation facilities in Necoclí, Antioquia. They were conducted by the first author and by Luker Chocolate’s Sustainability Intern in the native language of the workers (Spanish). The interviews were conducted mostly individually, and in certain cases in focus groups of a maximum of three people. Group interactions tended to provide less new information, as the group members ratified what the others said.

After conducting and recording the interviews, the audio was transferred to text using Happy Scribe transcription software (Happy Scribe 2021). Since the interviewees used very specific local slang, the first author reviewed each transcript to ensure that the local slang was correctly interpreted. The first author then translated the texts into English. The “back translation” method was not carried out, as the first author is proficient in English (C1) and her native language is Colombian Spanish.

Table 2 provides an overview of the number of people involved in the product life cycle, compared to the initial sample size, and the final number of people interviewed. The initial sample size changed either because the saturation point was reached or due to unforeseen circumstances.

Several challenges occurred during data collection. Interviews had to be conducted in person due to poor Internet connection in the local communities. Arrangements were made to visit Colombia during a short period, which coincided with a high production peak in the plant and a heavy crop disease period. This caused difficulties in arranging free slots with the personnel during their shifts to conduct the interviews.

To guarantee the security of the study team, it was suggested to only interview members of the community who were known to the company's workers. Therefore, the local communities' interviews depended on the availability of the selected person.

## 2.3 Life cycle impact assessment

In this phase of the study, the collected data was classified, evaluated, and aggregated according to the stakeholder and subcategory in question, in order to understand and assess the significance of the potential and actual social impacts that arise throughout the life cycle of the product (UNEP 2020). There are two types of impact assessment in S-LCA, the impact pathway approach and the reference scale approach (UNEP 2020). The impact pathway approach uses characterization models that define causal relationships to assess the social consequences resulting from the product system. However, there are not yet well-developed impact pathways for all relevant subcategories, with most impact pathway studies focused on the *workers* (UNEP 2020). Therefore, the reference scale approach was selected for use in this study to cover the *workers*, *local community*, and *society* stakeholder groups.

### 2.3.1 Reference scale approach

The impact assessment method chosen for this study is a five-point scale-based approach, in which the gathered data are interpreted. Scores are attributed according to pre-defined reference scales for each subcategory. The reference scales are tailored against national norms, sector or country averages, or international standards. Each position on the scale is a performance reference point (PRP), where the middle level (0) represents compliance with the aforementioned standards, the two upper levels (+1, +2) imply performance above the standard of conformity, and the two lower levels

(−1, −2) imply either non-compliance or no attempts to resolve the social issue observed.

Section 3.3.1 provides an exemplary reference scale. The full set of reference scales used both to evaluate the interviews and the organizational reports can be found in the supplementary material (SM 1).

### 2.3.2 Data processing procedure

After classifying the collected data by stakeholder and corresponding subcategory, the next step was cross-checking the compliance or non-compliance with the defined criteria necessary to achieve the ideal level of performance. The number of criteria depends on the specifications demanded in the law, the best practice requirements subject to context, and the number of indicators assessed. If all criteria points required for an outstanding performance were met, the subcategory was scored with a +2. For each unmet criterion, a lower score was awarded, as explained in Table 3. In the case of compliance by one of the companies, but non-compliance by the other, half a point was assigned to the corresponding subcategory. An example of this scoring method can be seen in Table 4. The scoring assessment of the other subcategories is shown in the supplementary material (SM 2).

If a subcategory only considers 3 criteria points, and none of them is fulfilled, an additional step is required to determine the overall score: it is necessary to assess in detail the data collected and compare it to the reference scales.

## 2.4 Interpretation

The last step in conducting an S-LCA is the interpretations of the findings according to the analyzed criteria. This enables an iteration of the analysis through the previous steps and to reach final conclusions based on the goal and scope of the study (UNEP 2020). Recommendations for improvement were also given for those subcategories that had the lowest scores.

**Table 3** Example of data processing calculation based on a four-criteria subcategory

Number of criteria:			Score	Description
5	4	3		
5/5	4/4	3/3	+2	Ideal performance; a positive output achieved and reported
4/5	3/4	2/3	+1	Progress beyond compliance is made
3/5	2/4	1/3	0	Compliance with local laws and/or aligned with international standards
2/5	1/4	0/3 + individual assessment	-1	Non-compliant situation, but actions to improve have been taken
1/5	0/4		-2	No data, or non-compliant situation; no action taken



**Table 4** Scoring method according to the number of criteria fulfilled per subcategory

Subcategory: social benefit/social security			Score
Criteria:	Result	Points	
1. All employees are eligible to enrol the social security system	Yes	1	+1
2. Complementary and non mandatory services are offered by the company to its employees	Yes	1	
3. Minimum number of paid leave days obliged by the law requirements (minimum 15 days) are given	Yes, workers receive the minimum paid days off	1	
4. Workers receive more than the minimum number of paid leaves (more than 15)	No	0	
Total		3	

### 3 Results

#### 3.1 Stakeholder and subcategory selection

##### 3.1.1 Social hotspots assessment

Based on the Social Hotspots Assessment using the SHDB (Benoît-Norris et al. 2019), the social topics of *child labor*, *freedom of association*, and, for the crop sector, *wage assessment* were the most vulnerable (Table 5). It is also important to emphasize that none of the social topics analyzed in both value chains had a general score below one. This means that the complete value chain is under medium to very high risk of social vulnerability.

##### 3.1.2 Comparison to materiality assessment

As shown in Table 6, the stakeholder groups *workers*, *local community*, and *society* were chosen following a comparison of the materiality assessment of Luker Chocolate (Casa Luker 2021a) to the SHDB results. Although the product value chain is split into two separate companies, which operate in the same country, but in different regions, the stakeholder *society* is partly shared. However, stakeholders such as *workers* and the *local community* must be assessed separately, considering that the geographical, political, and economic situation of the country varies significantly within its borders (Pérez et al. 2014).

**Table 5** The average risk level per social topic for the sector *crops nec* (not elsewhere classified) and *food products nec* (not elsewhere classified) (as named in the Social Hotspot Database (SHDB)) in Colombia was used for social risk identification (yellow indicating medium risk (1–2], orange indicating high risk (2–3], and red indicating very high risk (3–4]). Individual indicators on the sector and country-level data from the SHDB (Benoît-Norris et al. 2019) were averaged by the authors

Sector	Characterized social topic	Risk level
Crops nec	Child labor	3.17
Food products nec		3.17
Crops nec	Forced labor	2.5
Food products nec		2.5
Crops nec	Freedom of association, Collective bargaining, Right to strike	3.3
Food products nec		3.3
Crops nec	Labor laws	1.8
Food products nec		2
Crops nec	Migrant workers	2.25
Food products nec		2.25
Crops nec	Poverty	3
Food products nec		3
Crops nec	Unemployment	3.5
Food products nec		4
Crops nec	Wage assessment	4
Food products nec		1.5
Crops nec	Working time	2
Food products nec		2

### 3.2 Inventory results

Tables 7, 8, and 9 contain the defined inventory indicators per subcategory and stakeholder group and the data collection method. The inventory analysis results are described in detail below for each impact subcategory (Sections 3.2.1 to 3.2.3). Transcriptions of the interviews are presented in the supplementary material (SM 3).

#### 3.2.1 Workers

**Child labor** Colombian law allows the employment of minors (defined as under 18 years old) (ICBF 1997) under strict conditions and subject to specific labor contracts (ICBF 1997). For example, apprenticeship contracts allow minors aged 14 to be employed if they are part of an educational institution (ICBF 2003). The minimum age for admission to regular work is 15 years old, with the authorization of the local territorial entity (ICBF 2006). Both Luker Chocolate and Luker Agrícola have declared in their *Human Rights Policy* measures of protection against child exploitation (Casa Luker 2022). They express their intention to only hire people of legal age and stress the legal obligations and requirements if minors are hired. Additionally, records of all workers' names, identification numbers, and birth dates are kept on file. During the site visits in both companies, no child was seen engaging in any type of labor. As part of its sustainability strategy and shared value programs, the company has developed several projects to encourage

early childhood education, for example, the improvement of school facilities: “The schools have been supplied with school materials, uniforms, a water collection system as well as toilets, and psychological support for the children is provided by Luker allies” (Teacher [personal interview], 2021).

**Fair salary** In Colombia, the legal minimum monthly wage in 2020 (877,802 COP without transport aid, around 200€ at the time (MinTrabajo 2019)) was approximately twice the amount of the poverty line. However, almost 50% of the country's total workforce earned less than the minimum wage, according to a 2020 Human Rights Report (U.S. Department of State 2021). According to Luker, all of its employees receive at least the monthly minimum wage and all legally required benefits. The interviews as well as the review of randomly picked payrolls of both farm and factory workers confirmed this statement. The interviews with factory packaging operators and farm personnel (the company's lowest earners), revealed that their wages at the time of the study were not sufficient to cover their personal and family expenses. Factory packaging operators considered it necessary to work overtime (nightshifts and/or Sundays, both better paid), even though the average wage for this role was around 374,076 COP (approx. 80€) above the base salary of packing operators from other companies in Bogotá (Indeed 2023). However, farm workers stressed the increase in living costs in their region, mainly due to rising food prices, triggered by the arrival of the migrant population from Haiti, which spent in dollars and caused food shortages

**Table 6** Selection of stakeholders and subcategories

Stakeholder	Stakeholder characterization		Subcategory
	Luker Chocolate	Luker Agrícola	
<b>Workers</b>	Employees of the manufacturing plant in Bogotá (including administrative personnel) involved exclusively in the dark chocolate production lines	Employees of the farm “El Rosario” in Necoclí, Antioquia (including administrative personnel) and contract workers of the company “Agrícola El Poleo”	Child labor Fair salary Working hours Health and safety Equal opportunities/discrimination Social benefits/social security Employment relationship
<b>Society</b>	Group of people involved with each other directly or indirectly, sharing the same geographical territory, here Colombia, subject to the same political authority and dominant cultural expectations		Public commitments to sustainability issues Prevention and mitigation of armed conflicts Corruption Poverty alleviation
<b>Local community</b>	Communities surrounding the manufacturing plant in the city of Bogotá, which have direct contact with the company	Communities surrounding the farm “El Rosario” in the city of Necoclí, which have direct contact with the company (includes the villages: Caribia, Limoncito, Buenos Aires, Alto Carito, Guacamaya, and Gariton)	Delocalization and migration Cultural heritage Respect of indigenous rights Access to material resources Community engagement

**Table 7** Inventory indicators and data collection method for *workers*

Impact subcategory	Indicator	Data collection method
<b>Child labor</b>	Absence of working children under the legal age of 15 years old (14 years old for developing economies)	Review of the human rights policy
	Records on all workers stating names and ages or dates of birth are kept on file	Review of the HR reports
	Working children younger than 15 and under the local compulsory age are attending school	Visit to the facilities
<b>Fair salary</b>	The lowest-paid workers consider that their wages meet their needs	Interviews with workers
	Regular and documented payment of workers (weekly, bi-weekly)	Review of the wage records
	Lowest-paid worker, compared to the minimum wage	Review of the wage records
<b>Working hours</b>	Number of hours effectively worked by employees (at each level of employment)	Review of the time records
	Number of holidays effectively used by employees (at each level of employment)	Review of the time records
	Clear communication of working hours and overtime arrangements	Interviews with workers and coordinators
	Number/percentage of injuries in the organization by job qualification within the company	Review of the company's OSH reports
<b>Health and safety</b>	The presence of a formal policy concerning health and safety	Review of the company's OSH reports
	Adequate general occupational safety measures are taken	Interviews with workers and coordinators
	Presence of formal policies on equal opportunities	Review of the human rights policy
<b>Equal opportunities/ discrimination</b>	Ratio of the basic salary of men to women by employee category	Review of the sustainability report and validation through review of the wage records
	List and description of social benefits provided to the workers	Interviews with managers and workers
<b>Social benefits/ social security</b>	Percentage of permanent workers receiving paid time off	Review of the attendance reports and contracts
	There is a written contract which defines the relationship between the employers and workers	Interviews with workers

*HR* human resources, *OSH* occupational safety and health

during their temporary stay in the country (Ramírez 2021). Prices remained high even after their departure, and wages were not modified. Many workers thus grow crops at home to earn extra money. Both the field workers at the farm and those at other companies performing the same work earn the legal minimum wage, according to research on labor platforms in the region (Indeed 2023).

**Working hours** Colombian law stipulates a regular work-week of 48 h and a minimum rest period of 8 h between two consecutive work shifts (MinJusticia 1950). Luker plant workers are assigned to three rotating shifts (6 am–2 pm, 2–10 pm, and 10 pm–6 am) of 8 h each, from Monday to Saturday. Schedules have improved, since years ago, and the production shifts summed up to 12 consecutive hours. Nonetheless, during production peaks, workers are required to work overtime, which is either paid or compensated through other means such as additional paid leaves. It was stated by

factory and farm employees that the schedules are clearly stipulated by the coordinators and that the hours are tracked and paid at the end of the month.

On the farm, workers have a fixed schedule from 6 am to 3 pm, with required extra hours in certain positions, which are previously arranged between worker and supervisor, and remunerated. Nevertheless, some workers highlighted the non-follow-up of extra hours, and thus, no remuneration for them.

Regarding paid leave, the law establishes that the employee is entitled to 15 working days (not counting weekends or bank holidays) of continuous paid leave annually (MinJusticia 1950). In the company, paid leave is recorded and followed up by the HR team. Nonetheless, some contract workers stated that the contracting firm asked them to quit if they wanted to have holidays and assured them that they would be called back when they wished to return to work rather than taking paid leave.

**Table 8** Inventory indicators and data collection method for *society*

Impact subcategory	Indicator	Data collection method
<b>Public commitment to sustainability issues</b>	Presence of publicly available documents such as promises or agreements on sustainability issues	Review of the sustainability report
	Presence of mechanisms to follow-up the realization of promises	Interview with the sustainability director
	The organization has pledged to comply with the Global Compact Principles and has engaged itself to present a yearly Communication on Progress (UNGC 2015)	Review of the sustainability report
<b>Prevention and mitigation of armed conflicts</b>	Organization's role in the development of conflicts	Interviews with the sustainability director and local community members combined with further internet research
<b>Corruption</b>	Formalized commitment of the organization to prevent corruption, referring to recognized standards (OECD et al. 2013)	Review of the human rights policy and the supplier relations policy
	The organization carries out an anti-corruption program	Interviews with the sustainability director and sales manager
	The organization installs or co-operates with internal and external controls to prevent corruption	Interview with the sustainability director
<b>Poverty alleviation</b>	The organization carries out poverty alleviation programs, has an emergency management plan, training programs, and a recovery/restoration plan	Review of the sustainability report and an interview with the sustainability director
	Formalized commitment of the organization to reduce poverty	Review of the sustainability report and an interview with the sustainability director

**Health and safety** At Casa Luker's manufacturing plant and cocoa plantation, an OSH management system is in place and employees and visitors are required to use personal protective equipment (PPE). During 2021, a total of 27 labor-related accidents were reported in Luker Chocolate, which corresponds to 0.15% of the total 18,113 accidents in the Colombian food manufacturing sector (Fasecolda 2021). Most workers attributed these accidents to the mere lack of attention of the operators while using the machines; however, some of them pointed out that during high production months, more importance is given to meeting production targets than to complying with the protocols.

From Luker Agrícola, no accident rates were received, even though the company measures them. Interviews with the OSH coordinator and employees indicated a generally low rate of serious accidents, although they did note that minor accidents are not uncommon in agricultural duties. The workers claimed to be aware of the protocols in case an accident occurs during field work. Additionally, OSH trainings are provided to both employees and contract workers on-site and virtually during the year.

**Equal opportunities/discrimination** A total of 35% of Luker Chocolate's employees are women (data from 2019), while the rate of women in the manufacturing sector in Colombia in 2019 was only 12.8% (DANE 2020). However, none of the board directors are women or belong to an underrepresented group (Casa Luker 2021b). Given this context, the

company has developed different mechanisms to promote gender equality and women's empowerment in the workplace. For instance, the *Human Rights Policy* states that the selection of human talent should be based on the competences and merits of the person (Casa Luker 2022). Additionally, the company adopted the Women's Empowerment Principles (WEPs), which are a set of principles to foster business practices that empower women, such as equal pay for work and zero tolerance against sexual harassment in the workplace (UNGC and United Nations Women 2022). Despite these efforts, vacancies continue to be filled predominantly by men. Of the 56 new employees in 2019, 70% of them were men (Luker Chocolate 2020).

Luker Agrícola also has a no-discrimination policy; however, there is a general perception towards an accepted separation of tasks by gender in the field duties. While high physically-demanding tasks were viewed as men's tasks, administrative, general service, or cocoa sanitation positions were seen as more suitable for women. A total of 21% of the 67 direct Luker Agrícola's employees and 17% of the 103 contract workers identify themselves as women (review of employee's reports), while the rate of women in the Colombian agricultural sector overall was about 6.7% in 2019 (DANE 2020). Although 2021 data was not available, it was assumed that Luker Agrícola's rate is still above the sector's average, because the COVID-19 crisis increased the unemployment rate of women on a national level from 12.7% in 2019 to 17.2% in 2021 (DANE 2021).

**Table 9** Inventory indicators and data collection method for the *local community*

Impact subcategory	Indicator	Data collection method
<b>Delocalization and migration</b>	Strength of organizational procedures for integrating migrant workers into the community	Interviews with members of the local community and the sustainability director
<b>Cultural heritage</b>	Strength of policies in place to protect cultural heritage	Interview with the sustainability director
	Presence/strength of an organizational program to include cultural heritage expression in product design/production	Interviews with members of the local community and the sustainability director
<b>Respect of indigenous rights</b>	Strength of policies in place to protect the rights of indigenous community members	Interview with the sustainability director
	Annual meetings held with the indigenous community members	Review of the Materiality Assessment and interviews with members of the local community
<b>Access to material resources</b>	Development of infrastructure with mutual community access and benefit	Review of the sustainability report and a site visit
	The existence of a certified environmental management system	Review of the human rights policy and the sustainability report
<b>Community engagement</b>	Diversity of the community stakeholder groups that engage with the organization	Review of the Materiality Assessment
	Number and quality of the meetings with community stakeholders	Review of the Materiality Assessment and interview with the sustainability director
	Organizational support provided by the company (volunteer-hours or financial) for community initiatives	Interview with the regional sustainability coordinator

No gender wage gap could be determined in any of the companies since this indicator is not measured and the comparison of a limited number of wage records of female and male employees in the same position could not deliver meaningful and representative insights. However, out of the interviews with the workers of both companies, it could be identified that wages do vary depending on the job position and seniority level, but not because of gender.

**Social benefits/social security** Aside from the basic benefits a company has to provide its employees by law (MinJusticia 1950), complementary services offered in Luker Chocolate include subsidized meals, access to credits, eyeglasses subsidy, school aids, child birth aid, funeral aid, and vacation bonus. During the pandemic, employees were additionally provided with a bus service, to avoid infections during public transportation.

At Luker Agrícola, administrative employees are supported with 50% of the tuition fees for studying English, and field workers are offered a school leveling program, for those who want to finish elementary and high school. Classes are given at the farm facilities. The target was the enrollment of 50 workers; however, only 35 attended.

The company provides its employees the 15 paid days-off required by law (MinJusticia 1950).

**Employment relationship** At Luker Chocolate, a copy of the contract, which defines the relationship between the employer and employees was provided to every interviewed employee. It was also stated that with new responsibilities,

new clauses are added to the contract and a copy with the new arrangements is provided. Every year, all the employees must take an online course where the company's new rules and worker-aids are presented.

At Luker Agrícola, each position has its own occupational chart, specifying that if the plantation requires support in another sector, field operators would change tasks (with prior authorization from the coordinator, and an introduction to new machinery, if required). Any position change is reflected in a new contract.

Additional measures were implemented in the past to foster better relationships between the organization and its employees, such as feedback rounds to inquire employees about their workload perception. According to the interviewees, however, these activities have been stopped for some time now.

### 3.2.2 Society

**Public commitment to sustainability issues** Sustainability and transparency reports aim at documenting the company's impact on its stakeholders, and at tracking the progress of the different social, economic, and environmental programs. The company pledged to publish each of these reports every second year, alternating between the sustainability report and the transparency report, both structured according to the Global Reporting Initiative (GRI) framework (GRI 2023).

The company has further initiated its path to become certified as a B Corporation, meaning not only relatively high standards of verified social and environmental performance



but also specific requirements on public transparency and legal accountability (B Lab 2023). As part of the certification process, Luker Chocolate is scored according to its performance across different indicators, while countermeasures have to be defined and monitored yearly.

To ensure that the promises and objectives set are being fulfilled, the management keeps track of a three-layer performance dashboard, which previously was composed of only one layer: the company's financial performance. Casa Luker's CEO stressed how challenging it has been to measure the impact of their social and environmental performance, as it is something very new for both the company and the industry.

**Prevention and mitigation of armed conflicts** The armed conflict in the region of the Antioquian Urabá, the province where the farm is located, has been a constant from the mid-twentieth century until today (Negrete Padilla 2020).

A historically weak government presence in the region has made it easier for some armed structures to settle and exercise dominion over rural villages and suburbs, which to this day play the role of the state, as mentioned by Negrete Padilla (2020) and confirmed by community members in the interviews. In other words, they establish order in the community, improve infrastructure (e.g., roads), and in many cases benefit some people economically by planting coca, hiding weapons, or alerting illegal groups of governmental presence. Sometimes, these activities represent the only income source for many families.

Luker Chocolate's role in this conflict is not to directly encourage farmers to uproot their coca crops or eliminate their connections with criminal gangs. As Camilo Restrepo, Casa Luker's CEO, mentioned in his interview, that is not the role of a company, but of the state. The company, however, aims to work in those areas highly influenced by violence and encourage the cultivation of cocoa as a legal crop. Luker Chocolate's contribution thus is to promote legality in the territories and influence people to join a different lifestyle, by showing them the benefits of legality, although financially it might be less profitable. As evidenced in the interviews, more and more families are being influenced by this model proposed by Luker Chocolate.

**Corruption** The Corruption Perception Index (CPI), which scores countries by their perceived level of public sector corruption according to experts and businesspeople, gave Colombia a score of 39 in 2020, with 100 being "very clean" and 0 "highly corrupt" (Transparency International 2021). Contributing to this perception, the 2020 Human Rights Report published by the U.S. Department of State (2021) announced 40 ongoing investigations into public officials, including ministers, governors, and mayors, for corruption

related to the administration of contracts for COVID-19 emergency support.

Considering this corruption at the national level, Luker Chocolate and Luker Agrícola are committed to preventing corruption in the organization, as stated in their *Anti-fraud and Anti-corruption Policy* (Casa Luker 2021c), framed under the internationally recognized principles against corruption from the UNGC (2015). This policy is extended to Casa Luker's suppliers by ensuring compliance with social, environmental, and economic regulations. Audits are carried out to verify compliance, and contracts are double-checked, especially in the procurement and sales areas. In addition, annual trainings on the anti-corruption system are provided and an anonymous mechanism for reporting suspicions is in operation. Although internal control takes place, there is no individual or departmental oversight, and the company does not engage in collective action with governments, community organizations, NGOs, and other companies to fight corruption.

**Poverty alleviation** One of the five pillars of the company's sustainability strategy, as mentioned in the sustainability report, is creating shared value in cocoa-producing territories, which are heavily influenced by the armed conflict, and thus suffer dire conditions of poverty (Luker Chocolate 2020). In 2020, multidimensional poverty, which evaluates the deprivation of households in 5 dimensions (education, work, children and youth, housing, and health), reached a national incidence of 18.1%, with 12.5% in major cities and 37.1% in rural areas (DANE 2021).

During interviews, community members explained how the community looked before Luker Chocolate's arrival. For instance, there was no aqueduct system and the few schools available were in very penurious conditions, as told by one of the teachers of the school in the village of Buenos Aires: "The first day I set foot here in the school I started crying, because how could they send me to a school that has no doors, no book, no whiteboard, nothing. I had worked in places farther away than this one, but never in these conditions."

The Chocolate Dream, the collaborative plan of Luker Chocolate which strives to transform the cocoa value chain from its origin has been the driving force of change in this region, as mentioned not only by employees but also by local community members (Luker Chocolate 2023). Some of the finished projects under this plan included the provision of new school facilities (240 children impacted), an entrepreneurship program, which sought to diversify the household's income (48 entrepreneurs were supported with trainings and tutors), and an aqueduct system for the village of Caribia in Necoclí, which was built in collaborative action with other entities (Luker Chocolate 2020).

### 3.2.3 Local community

**Delocalization and migration** In 2020, Colombia was the second country worldwide in terms of internally displaced people (5.8 million) due to conflict and violence, according to the International Organization for Migration (IOM) in the World Migration Report 2020 (McAuliffe and Khadria 2020). Indeed, many of the interviewed employees of both Luker Chocolate and Luker Agrícola are not originally from the regions or cities where the farm and manufacturing plant are located. Particularly, farm workers told how they had to move with their families to the farm surroundings some years ago because of violence and better job opportunities. On top of this internal displacement crisis, Colombia has become a host of more than 1.7 million Venezuelans, from the estimated 5.4 million that fled their country since 2014 (Reid 2022). Of the 1,630,903 Venezuelan nationals living in the country in 2019, more than half did not have work permission, thus leaving informal employment as their only source of income (Ministry of Foreign Affairs of Colombia 2020).

From the interviews with the HR personnel and employees in both companies, it was found that no migrants work in any of the companies and that there are no policies or direct organizational procedures for integrating migrant workers into the labor force and communities. Nonetheless, HR managers emphasized that the diffusion of vacancies is broad, and if a foreign person applies, meets the profile, and has the required documents, there will not be hesitation in hiring them. Additionally, they also mentioned that nobody had applied so far, possibly due to a lack of work permits. Nonetheless, a community member also pointed out how closed rural communities are to outsiders, thus making it easier for immigrants to settle and integrate in big cities than in the countryside.

**Cultural heritage and respect of indigenous rights** The Spanish colonizing waves, beginning in the nineteenth century, severely impacted the cultural composition of the region. Afro-descendants from the Caribbean and Pacific coast and Sinuans, coming from what today is the Department of Córdoba, arrived and settled in Urabá along with the indigenous Cuna and Embera tribes that already inhabited the region (Negrete Padilla 2020).

In contrast, the communities surrounding the farm have a more homogeneous heritage (Hoyos, C. [personal interview], 2021); 95 families from the village of Caribia are part of a cabildo (Indigenous Council) of the indigenous Sinú or Zenú tribe, originally from the lower Sinú. Nevertheless, as Carlos Hoyos comments, this process of self-recognition has not been easy. Historical events such as colonization and the agrarian conflicts caused the expropriation, evangelization, and in some cases even the extermination of many tribes

(Negrete Padilla 2020). Thus, the survivors no longer wanted to identify as indigenous, and many aspects of their cultures and customs were lost.

The Cocoa Festival is a local celebration of Caribia that goes around the main source of employment in the region, cocoa. The objective of the festival is to rescue the cultural practices of the first inhabitants of Caribia. The celebration brings together groups of folkloric dancers and musicians and brings back temporarily former members of the community who left many years ago (Ramírez 2020).

Luker Chocolate has a major role in this activity, not only because the company is the main source of employment, but also because it subsidizes and organizes many of the cultural activities of the celebration. However, the interpretation given by Luker Chocolate's organizers was that the cultural practices of Caribia were the same as those of Necoclí. As in Necoclí, they dance *Bullerengue* (Afro-Colombian music genre and dance), and it was assumed that in Caribia too. Yet, the typical dance of the community, connected to their Sinuan heritage, is the *Porro* (a subgenre of the cumbia rhythm, originally a folkloric expression from the Sinú River). Although the communities are grateful for the company's support, they feel that such details are a setback to the advances that are being made to recover their culture.

**Access to material resources** On top of the already mentioned infrastructure-related projects developed by Luker Chocolate for local communities, such as the new school facilities or the aqueduct system, a Center for Social Innovation was inaugurated in 2018 in the chocolate plantation. This center aims to provide accommodation and a space of exchange for innovators, entrepreneurs, or anybody who wants to donate their time and knowledge to improve the quality of life of Colombian farmers (Luker Chocolate 2020). During the site visits, a marketing and sales session was given by one member of the international sales team to the participants of the youth entrepreneurship program. Additionally, the organization's environmental management system under ISO14001 has been certified (ISO 2015).

**Community engagement** A materiality assessment, which seeks to identify those stakeholder groups that have a great impact on the organization, and jointly assess and prioritize the key issues (environmental, social, and economic) that are relevant for both parties, is conducted on an annual basis and serves as the foundation for project development and decision-making for a win–win outcome. Based on the 2021 materiality assessment, the company's key stakeholder groups include clients, managing directors, consumers, collaborators (employees), local communities, suppliers, allies (including shareholders), and cocoa-producing organizations (Casa Luker 2021a). To understand their specific needs,

**Table 10** Example reference scales for the subcategories *child labor* and *fair salary* for the stakeholder *workers*

Stakeholder	Impact subcategory	+2	+1	0	-1	-2	Reference
Workers	Child labor	No child labor detected (all workers above 18 years old) and company supports programs to encourage school attendance of community minors	No child labor detected (all workers above 18 years old) and company has policy of protection against child exploitation	No child labor was identified, or only SENA trainees (14–18 years old) but in compliance to local regulations (e.g., Written learning contract in accordance with the code of childhood and Adolescence)	Working child detected (15–18 years) in compliance to local regulations (e.g., written authorization from the Ministry of Labor, or the first local authority)	Child labor detected and not in compliance with local regulations (e.g., workers are aged under 15, and/or workers ages 15- and 16-years' work more than 30 hours per week)	Colombian congress (1977 and 2006). Article 1 of law 27 of 1977 and Article 35 of law 1098 of 2006. URL: <a href="https://www.icbf.gov.co/cargues/avance/docs/ley_0027_1977.htm">https://www.icbf.gov.co/cargues/avance/docs/ley_0027_1977.htm</a>  U.S. Department of state. (2020). Report on Human Rights Practices: Colombia. Section 7: workers' rights, C. Prohibition of child labor and minimum age of employment. URL: <a href="https://www.state.gov/report/s/2020-country-reports-on-human-rights-practices/colombia/">https://www.state.gov/report/s/2020-country-reports-on-human-rights-practices/colombia/</a>
Workers	Fair salary	Workers receive a satisfactory remuneration that ensures personal and familiar existence in accordance with human dignity, wages received are above the average wages in the region for the same type of job.	Workers receive wages above the minimum living wage and consider their wages helps them meet their personal and familiar basic needs.	Workers receive the minimum wage, according to the national legal minimum wage in force.	Workers receive wages below the minimum wage, but above the poverty line.	Workers receive poverty line wages.	Colombian government (2020). Decree 1785 of 2020, whereby the minimum legal monthly salary is established. URL: <a href="https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=154126">https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=154126</a>

expectations, and priorities with respect to the company's relevant topics, several meetings and surveys were conducted according to Luker Chocolate.

In regard to the organization's support for community initiatives, Casa Luker has a portfolio of projects that the company develops together with different stakeholders (academia, clients, private institutions, etc.) that impact both Luker Chocolate and Luker Agrícola, in the areas of governance, environment, social, and economic development. From the total number of 39 projects to date, 64% impact Necoclí, i.e., the environmental surroundings of the farm, the local communities, and their workers.

### 3.3 Social life cycle impact assessment and interpretation

#### 3.3.1 Reference scale approach

The reference scales (as described in Sect. 2.3.1) were defined based on Colombian and international laws and standards. Table 10 provides an example of the reference scales for the *workers* subcategories: *child labor* and *fair*

*salary*. The supplementary material (SM 1) presents all reference scales used in this study.

#### 3.3.2 Impact assessment results and interpretation

This section presents and interprets the results of the impact assessment by subcategories for the stakeholders *workers*, *local community*, and *society*. A more detailed interpretation is provided for those subcategories for *workers* and *local community* that were scored as compliant (0), to broaden the findings and provide meaningful insights that can be used to improve the current performance. For the stakeholder *society*, all subcategories performed above compliance; however, limitations in their assessment and further improvement were also highlighted as they discussed sensitive issues of the country's political context and history.

**3.3.2.1 Workers** Table 11 provides an overview of the resulting scores, where the subcategories *child labor* and *health and safety* achieved the highest performance, while the *social benefits/social security* subcategory revealed practices beyond compliance. For example, complementary and non-mandatory services are offered to the employees of

**Table 11** Impact assessment for *workers*

Impact subcategory	Child labor	Fair salary	Working hours	Health and safety	Equal opportunities/discrimination	Social benefits/social security	Employment relationship
Score	+2	0	0	+2	0	+1	0

both companies on top of the social security system mandatory by law. The other subcategories were performed at the level of compliance. Labor regulations under the Colombian Labor Code (MinJusticia 1950) were followed; all employees received at least the minimum legal wage, were granted at least the minimum days of paid leave, worked a maximum of 48 h per week (not including overtime), and received a labor contract with clearly outlined duties and responsibilities, while a policy to ensure equal workplace opportunities exists.

**Fair salary** This subcategory is performed at the compliance level. Although legal requirements are followed strictly, additional measures are not being taken to improve the economic conditions of the lowest-paid workers in the value chain. This being said, Luker Chocolate's lowest-paid workers do receive wages slightly above the minimum legal wage and the region's average for the same type of job. Most workers believe that their wages help them meet their needs, which may be contradictory to their need to work several hours of overtime per month to obtain enough funds to meet those needs.

When it comes to Luker Agrícola, 40% of the lowest-paid workers do not consider that their salaries are enough to cover their basic expenses, leading many of them to seek other forms of income, for example, growing crops at home. They earn the minimum wage, on par with workers from other companies in the area.

**Working hours** As mentioned above, numerous employees need to work overtime to meet their basic needs. Therefore, many workers voluntarily work from Monday to Sunday and only rest one Sunday a month. Although the company remunerates or compensates overtime, physical and mental fatigue among the workers could be observed. Additionally, even with accumulating holidays, employees carry their daily factory duties for a long time without a break, which can affect their health negatively. In the cocoa plantation, a few workers complained about the non-documentation of overtime hours, followed by a lack of payment. Other contract farmers also complained about the Luker's contractors' refusal to grant them the days off required by law, instead asking them to resign and call them back once they were ready to work again. Workers in the region do not have the economic conditions to afford the risk of not being called

again and have chosen to continue working under those conditions.

**Equal opportunities/discrimination** Even though the company has made significant progress over the years to promote gender equality in the workplace, the numbers still indicate a male predominance and a low share of members from underrepresented groups. The nature of duties in an agricultural and manufacturing company, however, requires a great deal of strength and physical burden, making men in most cases the best candidates. And both Luker Chocolate and Luker Agrícola employ substantially more women than the industry average. Moreover, from the limited number of analyzed salary reports, there was no gender wage gap. This indicator is not measured by either company; thus, it is recommended to consider it in the future.

**Employment relationship** This subcategory scored neutral because Luker Chocolate complied with all agreements established in the labor contracts. However, many programs that were in place in the past to actively foster a better relationship between the organization and its employees have been discontinued. In the past, for example, feedback from employees was constantly sought to improve the overall performance. Although there are still some spaces for exchange, these require the employees to proactively speak up about their concerns rather than being asked for their opinions. Their overall loyalty to their institution, however, makes it unlikely for them to complain and express their dissatisfaction.

**3.3.2.2 Society** The results in Table 12 indicate that the company's commitment to societal issues goes beyond compliance, and actions are being taken to address the different challenges entailed in each subcategory.

**Public commitment to sustainability** The subcategory public commitment to sustainability issues performed particularly well, as the company publicly discloses an overview of the impact of its operations and engages in continuous improvement, which is communicated annually in its sustainability and transparency reports. Although these reports are structured under the framework of international standards, e.g.,

**Table 12** Impact assessment for *society*

Impact subcategory	Public commitment to sustainability issues	Prevention and mitigation of armed conflicts	Corruption	Poverty alleviation
Score	+2	+1	+1	+2

**Table 13** Impact assessment for the *local community*

Impact subcategory	Delocalization and migration	Cultural heritage	Respect of indigenous rights	Access to material resources	Community engagement
Score	0	0	+1	+1	+2

GRI (2023), this subcategory could be further improved by having its reports audited by third parties.

**Poverty alleviation** A similar performance was evidenced in the company's efforts to mitigate poverty, which include various strategies to address the material aspects of poverty, but also employ the company's human resources to educate the communities and empower them to develop themselves, for example, by offering them courses in entrepreneurship and personal finance management.

**Prevention and mitigation of armed conflicts** This subcategory showed actions above the compliance level, including various strategies to promote legal employment in the region and indirectly contribute to the de-escalation of the armed conflict. Due to the ongoing conflict conditions that have severely affected the country for many years, a score of +2 seems currently unreachable in a Colombian context. It would imply that the company directly promotes the de-escalation of the conflict. As for now, however, direct involvement could be very dangerous for the company and its members.

**Corruption** Similarly, progress beyond compliance was evidenced in terms of corruption. Aside from having in place a formalized commitment against corruption and fraud, measures are taken to guarantee adherence to this policy. Most of these measures, such as audits according to the requirements set by the Organization of American States (OAS), impact the sales and procurement areas, which are more prone to irregular contracts (OAS 2018). The fruits of these efforts are reflected in the zero reported cases of corruption during the last 12 months. However, it is worth clarifying that the latter is based solely on the trustworthiness of the company's responses since it was not possible to access any database. In order to keep improving this critical area that affects the country in so many ways, cooperation with internal or external stakeholders is recommended.

**3.3.2.3 Local community** The results of the impact assessment for the *local community* evidenced mixed performance, all of them achieving at least the compliance requirements, as indicated in Table 13.

The subcategory of *community engagement* obtained the highest score, due to the company's efforts to continuously engage with diverse community leaders and together with them organize territorial committees, which seek to inquire

about the perceptions and needs of their people, discuss the status of the projects, and develop new strategies to keep fostering the community's development.

Subcategories such as *access to material resources* and *respect of indigenous rights* showed actions above compliance; however, there is still room for improvement. Indigenous rights are indeed respected, and some projects have greatly benefited them, e.g., the construction of an aqueduct. However, for an area with such a strong indigenous presence, it could be expected that the protection and development of this community would be a key point in the social development agenda of the company.

The subcategory *access to material resources* received a score of +1 due to the substantial help the community has received to improve tangible resources, i.e., roads, educational infrastructure, and potable water. Nevertheless, environmentally speaking, running a monoculture cocoa plantation induces high water demands. Therefore, the farm has a permit to collect water from the river that supplies the nearby communities. This water collection could represent a risk of resource deprivation, which in times of drought could negatively affect the population.

**Delocalization and migration** Internal displacement and migratory waves are acute issues in the country's current affairs. Casa Luker, despite being aware of this situation, does not actively seek to undertake an initiative to improve the quality of life of these people. On the other hand, many of the company's workers have been victims of these internal migrations, and the company thus had a positive, albeit not targeted impact.

**Cultural heritage** Expressions of the community's cultural heritage, closely linked to the community's indigenous heritage, have not been repressed or prohibited by the company. On the contrary, the company supports diverse community initiatives aimed at the recovery of these practices, such as the Cocoa Festival (Ramírez 2020). While these actions represent a performance above the level of compliance, no indicator proposed by the *Methodological Sheets* (UNEP 2021) was met. For example, the company has no policy to protect the cultural heritage of the region, although it informally does, and there is no initiative to integrate cultural expression practices in the product designs. Therefore, two of the four criteria were unmet, resulting in a neutral score of 0 (see all criteria points in SM 2). Given this specific context,



in which the community is facing an arduous process of recovering its customs, a more suitable indicator would be to assess the presence/strength of the organizational program to promote the recovery of the cultural heritage of the region.

## 4 Discussion

### 4.1 Primary findings

The chocolate production sector in Colombia is increasingly gaining importance nationally and internationally, while parallelly cocoa producing families still live in economically depressed areas with limited legal job opportunities and the presence of armed groups (Fountain and Huetz-Adams 2020). Cocoa cultivation is the stage with the lowest social performance profile within the chocolate production life cycle (Ramirez et al. 2016). Nonetheless, our work has shown how the presence of a sector-leading company in those regions has a far-reaching impact on society, workers, and local communities. Examples include the improvement and construction of new basic infrastructure for the communities, such as schools, aqueducts, and roads (Sect. 3.2.3.3). In addition to providing a direct benefit to the community, this improved infrastructure also provides new opportunities for the creation of businesses in a previously inaccessible area.

Another key aspect that concerns not only the company analyzed but the rest of Colombian enterprises is their crucial role in the post-conflict context as highlighted by Barrios Hernández (2016). In the post-conflict framework, which according to Ugarriza (2013) describes the period following the total or partial overcoming of armed conflicts, the role of the organizations is essential to guarantee the social inclusion of the former actors of the conflict (victims, displaced, and combatants) in the labor market. In this way, the former actors of the conflict can secure an economic income to satisfy their needs and avoid reinsertion into illegal activities, while the employer can benefit from a skilled labor force to expand its operations. Löhr et al. (2021) found that fostering sustainable agricultural practices fosters social cohesion and is a valuable contribution to post-conflict peacebuilding as evidenced by experiences in cocoa production in Colombia and Côte d'Ivoire. Luker Chocolate's role in establishing smallholder cocoa farms in Colombia as an alternative to illicit crops as part of the national peacebuilding strategy was also highlighted by Furumo and Lambin (2020) in their work on zero-deforestation initiatives in post-conflict Colombia.

It was identified that Luker Chocolate has internal processes to promote local employment, which led to the return of several people native to the area, who were forced to flee many years ago due to the conflict (Sect. 3.2.2.2). Interviews with workers and local community members revealed the

company's interest in training local youth as an incentive for them to join the company after completing their studies. However, the interviews also confirmed the involvement of local youth in illicit crop-related jobs due to the better economic retribution involved. These statements are in line with the results obtained from the analyzed *fair salary* subcategory, which indicates that 40% of the lowest-paid workers of the cocoa plantation farm do not consider that their salaries are enough to make ends meet, leading many of them to seek further forms of income. A similar conclusion was drawn in the S-LCA conducted on cocoa production in Malaysia (Sharaai et al. 2020).

While sustainability was one of the main principles to which Luker Chocolate has been committed for the past years, it was also evident that an instrument to measure the impact of its actions on the social dimension was lacking. The company's Sustainability Report 2018–2019, for example, focuses on listing achievements in company-led social projects but does not cover the negative impacts of its operations or any actions needed to address them (Luker Chocolate 2020). This led to difficulties in data collection, as in some cases the indicators assessed had never been measured before (e.g., gender wage gap).

Since the company was already familiar with the concept of product life cycle assessments, given that they were conducting a product environmental LCA in parallel, conducting a product S-LCA proved to assist the management and sustainability department in tracking the company's social development targets. S-LCA was selected as the methodology to provide a life cycle perspective for the social dimension of sustainability at Luker Chocolate. The results of this study, while not representative of evaluating the social performance of all cultivation, manufacturing, and distribution sites throughout the country, may thus serve as a powerful indicator for reviewing and challenging company-wide policies and corporate objectives.

### 4.2 Limitations

One of the main challenges encountered during this study was the development of reference scales for those subcategories for which no international standards or best practices exist. The subcategory *prevention and mitigation of armed conflicts* is one of them. since social conflicts have so many shades, backgrounds, and players behind them, it is quite challenging to determine to which extent the company contributes to the resolution of the conflict or, on the contrary, nourishes it more. The established reference scales recognize the direct efforts of a company to contribute to the resolution of the conflict, however, not what happens if that step cannot be taken yet, as evidenced in this study.

A similar situation applies to the subcategory of *cultural heritage*. Defining in five points how the actions of a company can have a negative or positive impact on the cultural heritage of a community, without any formalized suggestion from an official institution, leaves a lot of room for creativity, but also for vagueness and misinterpretation. In this study, Luker Chocolate was indirectly collaborating to preserve the cultural heritage, but these actions were not part of any company policy, nor part of their company values. It was simply the result of their efforts to engage with the communities. One potential mitigation approach would be to provide an example of reference scales for each subcategory based on studies conducted in the past. These could then serve as a basis, which practitioners could adapt according to the context of the study.

Furthermore, due to the heterogeneity of impact indicators as well as data collection methods used, a major challenge was to employ a unified scoring method applicable across subcategories. Other S-LCA studies, such as the one developed by the company Japfa as part of the S-LCA Pilot projects, used a close-ended questionnaire with a fixed number of responses for collecting data (Life Cycle Initiative and Social Life Cycle Alliance 2022). This method enabled a consolidated assignment of scores, linked to the number of options chosen from the multiple-choice or yes/no questions. However, because of the explorative character of this study, a data collection method was needed that allowed the collection of detailed descriptions for the societal issues inquired. We thus opted to follow a semi-quantitative criteria-checkscheme, in which the final score was assigned according to the number of fulfilled criteria within each subcategory. These criteria were assembled in accordance with the established reference scales. An ordinal scale was used for the scoring assessment, in which the order of values is known, but not the distance between them. It is, for example, impossible to assess that a company that has a policy to protect cultural heritage and integrates expressions of the region's cultural practices into its products is twice as good as one that does not.

The study also showed a perceived contradiction of the scores for *Society—Poverty alleviation* (scored + 2) and *Worker—Fair salary* (scored 0). While these scores seem contradictory at first sight (how can a company work towards poverty alleviation by scoring only average on fair wages?), it is important to understand the different focus of evaluation for each subcategory. The subcategories are semantically related but different indicators lead to different scores. *Poverty alleviation* aims to assess the presence of proactive activities to reduce poverty in society, while *fair salary* assesses whether the company is meeting legal wage requirements or if they pay their workers above the minimum wage (UNEP 2021). The Luker Chocolate employees receive minimum wage and therefore, the company received

a compliance score for the subcategory *fair salary*. However, the company received a best-in-class score for the subcategory *poverty alleviation*. This is due to the company's regional efforts to improve education and its entrepreneur program.

Additionally, a more robust sample size that covers all the stakeholder groups of both Luker Agrícola and Luker Chocolate would improve the results, making the findings more representative of the actual impacts. With our sample size, it is, for example, unclear whether the allegations against the company are widespread or isolated cases. Moreover, the data collection method might have led to biased responses as some employees with high loyalty were interviewed. Given that we did also collect healthy criticism, this does not seem to have been the case, at least not in a generalized way. Due to safety concerns, we also had no other option. Assessments in different contexts, however, should ideally inquire about workers outside of their working schedules, avoid recording, and choose interview locations where they feel safe to talk freely. For inquiring about sensitive topics, such as fair wages, a more impersonal data collection method, such as questionnaires that ensure anonymity, might be more appropriate.

To create the final dark chocolate product, in addition to cocoa, other complementary ingredients were used in low proportions, such as sugar, cocoa butter, and soy lecithin. These complementary ingredients and their associated social impacts along their value chain were not covered in this study. For a comprehensive assessment of the social impacts of the “El Rosario” product, an S-LCA covering all the ingredients involved should be performed.

## 5 Conclusions

This paper presented an S-LCA of chocolate production in Colombia, using social hotspots assessment and the reference scale approach. It covered both of the major impact hotspots: cocoa cultivation and chocolate production. Based on the experiences gathered during this process, it also discussed several methodological challenges and further methodological reflections which could contribute to the further refinement of the S-LCA framework.

The social impacts across the life cycle of “El Rosario” illustrated an outcome at least on the compliance level with national regulations and best practices in the assessed subcategories. The highest performances were achieved in the *society* and *local community* stakeholder groups. This is attributable to the role the company has taken in the region as an agent of change, attracting the collaboration of various external groups, including academia, governmental entities, customers, and investors who have joined forces to design

and implement strategies to continuously improve the living conditions of the people and ecosystems in the territory.

On the other hand, the areas with the greatest improvement potential are related directly to *workers*. Therefore, Luker Chocolate can enhance its social performance as outlined below.

- **Fair salary:** The legal minimum wage in Colombia is not enough to cover the modest expenses of the families of Luker Chocolate's lowest-paid employees. This is particularly evident in Necoclí, where workers often are the only source of income in their households and are affected by volatile food price fluctuations, but constant wages. Therefore, we recommend an analysis of regional economic changes and appropriate measures to counteract the economic instability suffered by workers as a result of external changes. Beyond an increase in salaries, further beneficial measures could include a subsidized lunch service at the farm restaurant or transportation subsidies in line with current prices.
- **Working hours:** The need for extra resources serves as a motivation to work the maximum allowed overtime hours. Although a voluntary decision, it is underpinned by a need. Hence, it is recommended to pursue strategies to address the core need, so that workers have the time to take care of themselves and their families. Furthermore, the allegations of non-documentation of extra hours in the cocoa plantation need to be investigated.
- **Equal opportunities/discrimination:** Women employees highlighted three main reasons why women are under-represented in Luker Agrícola's workforce: (1) most of the work is more suitable for men; (2) the villages do not have a place where they can leave their children, so only the husband can go to work; and (3) due to transportation reasons, as the farm is very far away and the roads are not good, which hinders the access to work. Strategies addressing the latter two points should be developed. To further promote gender equality in a sector heavily influenced by a male-dominated workforce, it is recommended that the gender pay gap is measured by the company.
- **Employment relationship:** To strengthen the organization's relations with its employees, it is advisable to reactivate the feedback rounds, thus promoting spaces dedicated to the exchange and generating valuable insights that can be used for the development of internal engagement projects.

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**Data availability** The reference scales used and interview data generated during the current study are available in the supplementary material. Internal company data is not available due to confidentiality agreements.

## Declarations

**Competing interests** The authors declare no competing interests.

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## References

- Abbott PC, Benjamin TJ, Burniske GR et al (2017) An analysis of the supply chain of cacao in Colombia. DC, United States, Washington
- B Lab (2023) About B Corp Certification. <https://www.bcorporation.net/en-us/certification>. Accessed 3 Mar 2023
- Barrios Hernández R (2016) Responsabilidad social empresarial: el Papel de las Organizaciones en el Postconflicto Colombiano. *Rev ENSAYOS* 9:45–56
- Benjamin TJ, Wilcox MD, Mark Lundy JM et al (2019) Cacao for peace: a community development approach to improve the Colombian cacao supply chain
- Benoît C, Norris GA, Valdivia S et al (2010) The guidelines for social life cycle assessment of products: just in time! *Int J Life Cycle Assess* 15:156–163. <https://doi.org/10.1007/s11367-009-0147-8>
- Benoît-Norris C, Norris GA, Bennema M (2019) Social Hotspot Database V4:2019
- Bianchi FR, Moesch L, Gallo M et al (2021) Environmental analysis along the supply chain of dark, milk and white chocolate: a life cycle comparison. *Int J Life Cycle Assess* 26:807–821. <https://doi.org/10.1007/s11367-020-01817-6>
- Boakye-Yiadom KA, Duca D, Pedretti EF, Ilari A (2021) Environmental performance of chocolate produced in Ghana using life cycle assessment. *Sustainability* 13:1–20. <https://doi.org/10.3390/su13116155>
- Brundtland GH (1987) Our common future ('The Brundtland Report'): world commission on environment and development. United Nations
- Carlsen W (2021) Helping Coca farmers transition to cacao. In: Borgen Proj. <https://borgenproject.org/coca-farmers/>. Accessed 5 Mar 2023
- Casa Luker S.A. (2021a) Materiality assessment 2021 (Internal report)
- Casa Luker S.A. (2021b) Casa Luker Corp B certification report (Internal report via online tool)

- Casa Luker S.A. (2021c) Programa de transparencia y etica empresarial. Bogotá
- Casa Luker S.A. (2022) Human Rights Policy
- Central Intelligence Agency (CIA) (2021) The world factbook: Colombia. <https://www.cia.gov/the-world-factbook/countries/colombia/>. Accessed 4 Mar 2023
- Charmaz K (2006) Constructing grounded theory: a practical guide through qualitative analysis. Sage Publication Ltd., London, Thousand Oaks, and New Delhi
- DANE (2020) Pobreza Monetaria en Colombia Actualización metodológica Resultados 2019
- DANE (2021) Boletín Técnico- Pobreza multidimensional en Colombia Año 2020. Bogotá, Colombia
- Departamento Nacional Administrativo de Estadística (DANE) (2018) Censo Nacional de población y vivienda. <https://www.dane.gov.co/index.php/estadisticas-por-tema/demografia-y-poblacion/censo-nacional-de-poblacion-y-vivenda-2018/donde-estamos>. Accessed 4 Mar 2023
- Dworkin SL (2012) Sample size policy for qualitative studies using in-depth interviews. *Arch Sex Behav* 41:1319–1320. <https://doi.org/10.1007/s10508-012-0016-6>
- Federación de Aseguradores Colombianos (Fasecolda) (2021) Sistema General de Riesgos Laborales. Cifras de la industria 2021.
- Franze J, Ciroth A (2011) A comparison of cut roses from Ecuador and the Netherlands. *Int J Life Cycle Assess* 16:366–379. <https://doi.org/10.1007/s11367-011-0266-x>
- Fountain AC, Huetz-Adams F (2020) Cocoa Barometer 2020
- Furumo PR, Lambin EF (2020) Scaling up zero-deforestation initiatives through public-private partnerships: a look inside post-conflict Colombia. *Glob Environ Chang* 62:102055. <https://doi.org/10.1016/j.gloenvcha.2020.102055>
- García-Herrero L, De MF, Vittuari M (2019) Sustainability concerns and practices in the chocolate life cycle: integrating consumers' perceptions and experts' knowledge. *Sustain Prod Consum* 20:117–127. <https://doi.org/10.1016/j.spc.2019.06.003>
- Global Reporting Initiative (GRI) (2023) GRI Standards. <https://www.globalreporting.org/how-to-use-the-gri-standards/gri-standards-english-language/>. Accessed 1 Mar 2023
- Happy Scribe (2021) Automatic transcription software
- ICBF (1997) Ley 27 de 1997. [https://www.icbf.gov.co/cargues/avance/docs/ley\\_0027\\_1977.htm](https://www.icbf.gov.co/cargues/avance/docs/ley_0027_1977.htm), Colombia
- Indeed (2023) Buscar salarios. In: Indeed. <https://co.indeed.com/career/salaries>. Accessed 5 Mar 2023
- Instituto Colombiano de Bienestar Familiar (ICBF) (2003) Decreto 933 DE 2003. Colombia
- Instituto Colombiano de Bienestar Familiar (ICBF) (2006) Código de la Infancia y la Adolescencia - LEY 1098 DE 2006. Colombia
- International Crisis Group (2021) Deeply Rooted: Coca Eradication and Violence in Colombia - Latin America Report N°87
- International Cocoa Organization (ICCO) (2023) Processing Cocoa. <https://www.icco.org/processing-cocoa/>. Accessed 20 Nov 2023
- International Organization for Standardization (2006a) ISO 14040 (2006) Environmental management – life cycle assessment – principles and framework. Geneva
- International Organization for Standardization (2006b) ISO 14044 (2006) Environmental management – life cycle assessment – requirements and guidelines. Geneva
- International Organization for Standardization (ISO) (2015) ISO 14001:2015 Environmental management systems - Requirements with guidance for use
- International Organization for Standardization (ISO) (2019) ISO 34101–1:2019 Sustainable and traceable cocoa - Part 1: Requirements for cocoa sustainability management systems
- Konstantas A, Jeswani HK, Stamford L, Azapagic A (2018) Environmental impacts of chocolate production and consumption in the UK. *Food Res Int* 106:1012–1025. <https://doi.org/10.1016/j.foodres.2018.02.042>
- Lafargue P, Rogerson M, Parry GC, Allainguillaume J (2022) Broken chocolate: biomarkers as a method for delivering cocoa supply chain visibility. *Supply Chain Manag* 27:728–741. <https://doi.org/10.1108/SCM-11-2020-0583>
- Life Cycle Initiative, Social Life Cycle Alliance (2022) Pilot projects on guidelines for social life cycle assessment of products and organizations 2022
- Löhr K, Aruqaj B, Baumert D et al (2021) Social cohesion as the missing link between natural resource management and peacebuilding: lessons from cocoa production in Côte d'Ivoire and Colombia. *Sustainability* 13:1–25. <https://doi.org/10.3390/su132313002>
- Luker Chocolate (2020) Luker Chocolate Sustainability Report 2018–2019
- Luker Chocolate (2023) The chocolate dream: creating shared value at origin. <https://www.lukerchocolate.com/en/beyond-sustainability/the-chocolate-dream/>. Accessed 26 Feb 2023
- MARD (2021) Cadena de Cacao
- McAuliffe M, Khadria B (2020) World migration report 2020. International Organization for Migration, Geneva, Switzerland
- Ministerio de Agricultura y Desarrollo Rural (MARD) (2018) Cadena de Cacao: Indicadores e Instrumentos Julio 2018
- Ministry of Foreign Affairs of Colombia (2020) Gobierno expide permiso especial de trabajo para ciudadanos venezolanos. <https://www.cancilleria.gov.co/newsroom/news/gobierno-expide-permiso-especial-trabajo-ciudadanos-venezolanos>. Accessed 5 Mar 2023
- MinJusticia (1950) Ley 3743 de 1950 y 905 de 1951. Colombia
- MinTrabajo (2019) Salario mínimo para 2020 será de \$877.802
- Moran A, Raleigh C, Busby JW, Wight C (2018) Fragility and climate risks in Colombia
- Nash M (2022) The 201 most (& least) biodiverse countries in 2022. In: The swiftest. <https://theswiftest.com/biodiversity-index/>. Accessed 4 Mar 2023
- Negrete Padilla KJ (2020) Analizar el conflicto armado en la región norte del Urabá antioqueño desde 1950 hasta la actualidad. Universidad de Córdoba
- OECD, UNODC, World Bank (2013) Anti-corruption ethics and compliance handbook for business
- Oficina de las Naciones Unidas contra la Droga y el Delito (UNODC) (2021) Colombia: Monitoreo de territorios afectados por cultivos ilícitos 2020. Bogotá, Colombia
- Organization of American States (2018) Methodology for presenting best practices on preventing and combating corruption and for compiling them, and promoting their use. DC, United States, Washington
- Palau M (2018) Swapping cocaine for peace. In: Foreign policy. <https://foreignpolicy.com/2018/12/28/swapping-cocaine-for-peace-colombia-drugs-farc/>. Accessed 2 Mar 2023
- Pérez GJ, Cepeda Emiliani L, Sánchez Jabba Andrea Otero Cortés A, et al (2014) Economía de las grandes ciudades: seis estudios de caso, First. Editorial Nomos S. A., Bogotá, Colombia
- Petti L, Serreli M, Di Cesare S (2018) Systematic literature review in social life cycle assessment. *Int J Life Cycle Assess* 23:422–431. <https://doi.org/10.1007/s11367-016-1135-4>
- Ramírez PKS, Petti L, Brones F, Ugaya CML (2016) Subcategory assessment method for social life cycle assessment. Part 2: application in Natura's cocoa soap. *Int J Life Cycle Assess* 21:106–117. <https://doi.org/10.1007/s11367-015-0964-x>
- Ramírez V (2020) Healing with Art: Part One. In: Luker Choc. <https://www.lukerchocolate.com/en/beyond-sustainability/chocolate-social-healing-art/>. Accessed 3 Mar 2023
- Ramírez S (2021) En Necoclí cobran hasta 50 dólares por arrendar una habitación a migrantes. Caracol Radio
- Recanatí F, Marveggio D, Dotelli G (2018) From beans to bar: a life cycle assessment towards sustainable chocolate supply chain. *Sci Total Environ* 613–614:1013–1023. <https://doi.org/10.1016/j.scitotenv.2017.09.187>



- Reid K (2022) Venezuela crisis: Facts, FAQs, and how to help. World Vis.
- Saltini R, Akkerman R, Frosch S (2013) Optimizing chocolate production through traceability: a review of the influence of farming practices on cocoa bean quality. *Food Control* 29:167–187. <https://doi.org/10.1016/j.foodcont.2012.05.054>
- Sánchez VH, Zambrano JL, Iglesias C (2019) La cadena de valor del cacao en América Latina y el Caribe. FONTAGRO, Washington, DC, United States
- Sharaai AH, Zulkipli L, Harun AH, Hui AY (2020) Social life cycle assessment (S-LCA) of cocoa production on local community and workers in Pahang, Malaysia. *Int J Adv Sci Technol* 29:1786–1797
- Sivaraman A (2020) Five things you need to know about social sustainability and inclusion. In: World Bank. <https://www.worldbank.org/en/news/feature/2020/09/02/five-things-about-social-sustainability-and-inclusion>. Accessed 4 Mar 2023
- Sumesh K (2019) Cocoa products market by product type (cocoa beans, cocoa butter, cocoa powder & cake, cocoa paste & liquor, and chocolate) and application (confectionery, food & beverages, cosmetics & pharmaceutical): global opportunity analysis and industry forecast, 2. In: Allied mark. Res. <https://www.alliedmarketresearch.com/cocoa-products-market>. Accessed 4 Mar 2023
- Transparency International (2021) Corruption perceptions index 2020. Transparency International, Berlin, Germany
- U.S. Department of State (2021) 2020 Country reports on human rights practices: Colombia
- Ugarriza JE (2013) La dimensión política del postconflicto: discusiones conceptuales y avances empíricos. *Colomb Int* 77:141–176. <https://doi.org/10.7440/colombiaint77.2013.06>
- UNEP (2020) Guidelines for social life cycle assessment of products and organizations 2020
- UNEP (2021) Methodological sheets for subcategories in social life cycle assessment (S-LCA) 2021. United Nations Environment Programme (UNEP)
- UNEP/SETAC (United Nations Environment Programme and Society for Environmental Toxicology and Chemistry) (2009) Guidelines for social life cycle assessment of products
- UNEP/SETAC (United Nations Environment Programme and Society for Environmental Toxicology and Chemistry) (2013) The methodological sheets for sub-categories in social life cycle assessment (S-LCA)
- United Nations Conference on Trade and Development (UNCTAD) (2017) Achieving the sustainable development goals through consumer protection. New York and Geneva
- United Nations Global Compact (UNGC) (2015) The ten principles of the UN global compact. <https://www.unglobalcompact.org/AboutTheGC/TheTenPrinciples/index.html>. Accessed 3 Mar 2023
- United Nations Global Compact (UNGC), United Nations Women (2022) Women's empowerment principles welcome package
- United Nations Office on Drugs and Crime (UNODC) (2020) Densidad de cultivo de coca en Colombia, 2019. In: UNODC. <https://simcimetadatos.unodc.org.co/geonetwork/srv/spa/catalog.search#/metadata/2cbbd8c6-5dff-4b26-9ba6-9d1a62508a83>. Accessed 4 Mar 2023
- United Nations Office on Drugs and Crime (UNODC) (2018) Colombia: Monitoreo de territorios afectados por cultivos ilícitos 2017. Bogotá, Colombia
- United Nations (2015) The 2030 agenda for sustainable development
- Vesce E, Olivieri G, Pairotti MB et al (2016) Life cycle assessment as a tool to integrate environmental indicators in food products: a chocolate LCA case study. *Int J Environ Heal* 8:21–37. <https://doi.org/10.1504/IJENVH.2016.077660>

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