

PSILCA v4.0.1

Product Social Impact Life Cycle Assessment Database

Documentation, 2025

PSILCA

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Product Social Impact Life Cycle Assessment Database

Database version 4.0.1

Documentation

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1 Minor update to PSILCA 4.0.1

The databases released as 'PSILCA 4.0.1' include updates to the social indicator 'contribution to economic development' and the jython script that comes with the database.

Contribution to economic development

The risk levels shown in Table 1 were updated to the risk levels shown in Table 2 to be in line with the social indicator in the previous versions with four ordinal risk levels. The same was updated the elementary flows across the database with the jython script available in the database.

Table 1: Risk levels in the June release of PSILCA v4.0.

Indicator value y, % of GDP	***Opportunity level***
0 = y	*No opportunity*
0 ≤ y ≤ 10	*Very Low opportunity*
10 ≤ y ≤ 17	*Low opportunity*
17 < y ≤ 26	*Medium opportunity*
26 < y ≤ 40	*High opportunity*
40 < y	*Very High opportunity*

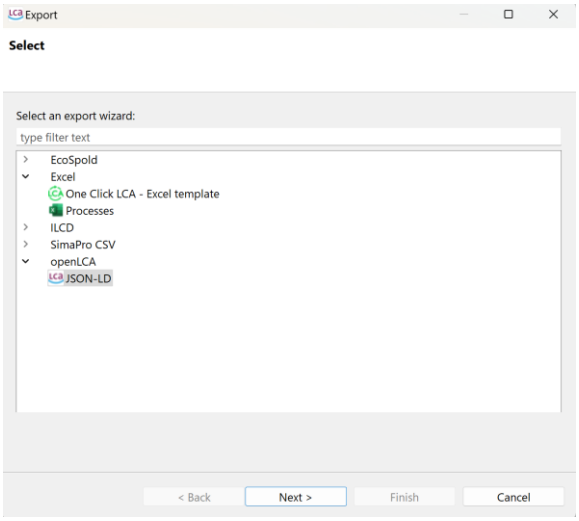
Table 2: Updated risk levels in PSILCA v4.0.1

Indicator value y, % of GDP	***Opportunity level***
n.a.	*No data*
0 = y < 1	*No opportunity*
1 ≤ y <10	*Low opportunity*
10 ≤ y < 25	*Medium opportunity*
25 ≤ y	*Very High opportunity*

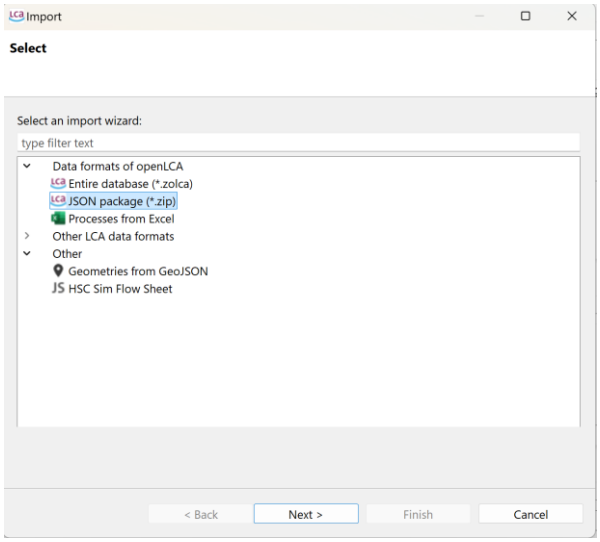
Updating from PSILCA 4.0 to PSILCA 4.0.1

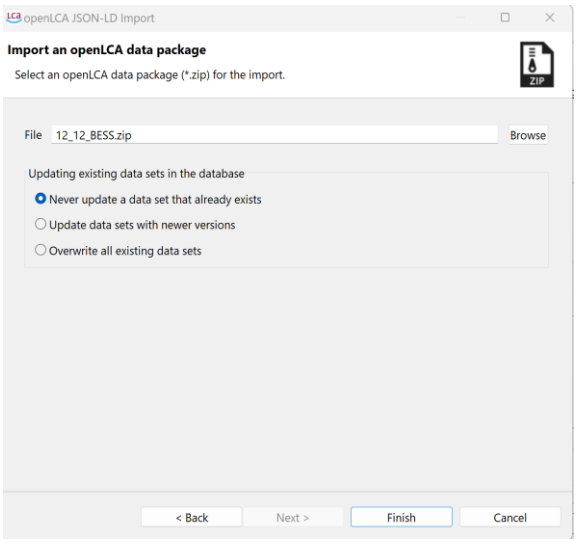
If you have already built models in PSILCA v4,

- export your processes or product systems from the previous version as JSON-LD



- Import them into the new version of database with the option "do not overwrite existing datasets"





This should allow you to import your datasets with updated background processes considering the new risk levels for the indicator 'contribution to economic development'

Accessing the Jython script

The Jython script is included in PSILCA 4.0.1 under 'scripts' in the navigation pane and can also be found in the updated manual.

2 Forword to PSILCA 4.0.

This document introduces PSILCA 4.0, the latest version of the PSILCA database for Social Life Cycle Assessment (S-LCA). Building upon version 3.1, this update incorporates substantial improvements in data quality, methodological refinement, and user support.

Key Enhancements:

- **Data Updates and Source Improvements:**

All indicators have been updated with the most recent data. Several indicators now rely on more suitable sources, ensuring better alignment with their intended social topics.

- **Expanded Indicator Set:**

Forty-one new indicators have been added, broadening both sectoral and geographic coverage. This expansion results in a more comprehensive representation of social risks.

- **Refined Methodologies and Risk Levels:**

For some indicators, calculation methods and risk categorizations have been revised. These changes, made where necessary, are transparently documented within each indicator's description.

- **Improved User Support and Documentation:**

Bugs from previous versions were corrected, and user feedback was incorporated. Additionally, a complete, updated S-LCA case study on a hooded sweatshirt (developed using openLCA) is now available. The corresponding life cycle model is free to download for licensed users, while the report is freely accessible.

- **Relation to External Sustainability Reporting**

To strengthen the link between social indicator interpretation and corporate sustainability disclosure, each indicator in PSILCA 4.0 has been mapped against key external frameworks. Specifically, its alignment with the UN Sustainable Development Goals (SDGs), GRI (Global Reporting Initiative) standards, and Social Product Declarations have been analysed to facilitate broader integration into sustainability reporting practices.

- **Positive Impact Indicator:**

PSILCA continues to include the indicator “Contribution of the sector to economic development,” which is assessed using opportunity levels rather than risk categories. In line with this orientation, the reference scale for two additional indicators, “Embodied value added” and “Females with a financial account”, has also been redefined to reflect opportunity levels.

- **Direct Impact Assessment Method**

Introduced in PSILCA 3 and continued in this version, the direct impact assessment method enables social risk calculation directly from indicator values, bypassing the intermediate allocation via working hours. Details are provided in Section 2.7.2.

- **Library version of PSILCA**

Libraries are precalculated matrixes of the original database, and they are available for all variants of PSILCA. To read more on them see Section 5.

- **Updated script to allow the change of risk levels**

The professional and developer version now comes with a global script that allows the change for risk levels

for a given indicator across the entire database.

1 Background and motivation

In today's globalized economy, it is increasingly difficult to trace the origins of products and their components, and to identify the conditions under which they are produced. As supply chains become more complex, so does the challenge of understanding the social and environmental consequences embedded in the life cycle of products. Meanwhile, consumers and stakeholders are becoming more conscious of the broader impacts associated with their purchases, expressing growing demand for transparency across supply chains in order to make informed choices between more or less sustainable products.

This shift has prompted companies and policymakers to move beyond traditional environmental footprint and Life Cycle Assessment (LCA) approaches, recognizing the need to also evaluate social impacts to achieve a more comprehensive sustainability assessment. While the integration of social dimensions into LCA, commonly referred to as S-LCA, is still emerging, it offers powerful potential: not only to uncover social risks, but also to highlight positive social contributions that are often hidden within product systems.

Despite this potential, a major challenge remains: the lack of a consistent, transparent, and comprehensive global database containing non-valuated social data across product life cycles. Social data tend to be qualitative, context-dependent, and often subjective. This makes them more difficult to collect, structure, and assess systematically compared to quantitative environmental data. These challenges underscore the importance of transparency in both methodological design and data sourcing.

It is in response to this gap that PSILCA was developed. PSILCA aims to provide a practical and globally applicable database to support the identification, assessment, and communication of social impacts throughout the life cycle of products.

This manual serves to document the structure of the database, the indicators it comprises, and the methodological choices made in its development. Particular emphasis is placed on the transparency of data collection and modelling procedures, an essential principle given the inherent complexity and sensitivity of social information.

2 Methods used for creating the database

2.1 A multi-regional input/output database as basis

To enable global supply chain modelling and the tracing of upstream and downstream social risks, PSILCA is built upon a multi-regional input/output (MRIO) database. Specifically, it employs the Eora database, a comprehensive MRIO system designed to represent the global economy at the sectoral level.

From PSILCA version 3.1 onwards, the **2019 release** of the Eora World MRIO database is used as the foundational input/output framework, using economic data from the year **2015** (World MRIO, 2022). Eora is one of the few MRIO systems that claim full global coverage, offering sector-level detail for nearly every country.

Eora was developed and is maintained by Manfred Lenzen and collaborators (Lenzen et al., 2012; Lenzen et al., 2013; Wiedmann et al., 2013; Eora, 2019). It is widely recognized in sustainability research and environmental-economic modelling for its robustness, transparency, and scope.

Key features of the Eora MRIO database include (Eora, 2019):

- Representation of 189 individual countries, comprising a total of 14,838 distinct sectors, categorized under entities such as industries, commodities, value added, and final demand
- Inclusion of multiple environmental extensions, including air pollution, energy use, greenhouse gas emissions, water use, ecological footprint, and human appropriation of net primary productivity
- Support for both a high-resolution heterogeneous sector classification and a 26-sector harmonized classification
- Integration of raw data from authoritative international sources, such as the UN System of National Accounts, UN COMTRADE, Eurostat, IDE/JETRO, and national statistical agencies
- Price distinction through five mark-ups between basic prices and purchasers' prices
- Provision of reliability statistics (e.g., standard deviations) for all model outputs

Based on Eora, PSILCA integrates data for approximately 15,000 sectors across 189 countries. However, PSILCA currently does not utilize Eora's time series functionality. Instead, **the reference year 2015** (the latest year available in the 2019 release of Eora) is used as the baseline for the economic structure. In contrast, each social indicator within PSILCA uses the most recent year available from its respective source, meaning reference years vary depending on the indicator's data provider.

Eora's heterogeneous classification was deliberately selected by its developers to preserve the integrity of national input-output (I-O) or supply-use table classifications, wherever available. This approach results in considerable detail for countries with high-resolution data. For example:

- The United Kingdom is represented by 1,022 industry and commodity entries
- The United States by 858 entries
- China by 123 commodity sectors

Conversely, for approximately one-third of the countries included in Eora, either national I-O tables were unavailable, or the sectoral detail did not meet a common international standard (e.g., ISIC). In such cases, Eora applies a harmonized 26-sector classification (Lenzen et al., 2013, p. 25). Figure 1 illustrates this harmonized structure. In contrast, for countries with more detailed sectoral data, highly specific entries can be found, such as "bookbinding" in the UK, shown in Figure 2.



Figure 1: Example of a 26-sector classification in Eora and PSILCA, for Afghanistan, screenshot from openLCA.



Figure 2: Example of a classification in Eora and PSILCA, for UK (showing only some of the sectors), screenshot from openLCA.

This heterogeneous classification approach is advantageous, as it reduces the need to impute or construct entire sectors where limited or no national data exist. As a result, the overall data structure is more stable and reflective of actual economic reporting practices. However, this approach introduces certain inconsistencies: sector names vary across countries, some are in non-English languages (e.g., Spanish), and typographical errors exist in the original Eora database.

To ensure consistency and usability within PSILCA, all sector names were harmonized across countries. This included translating non-English sector names into English, correcting typographical errors, and aligning sector labels with standard ISIC nomenclature wherever possible. For example, sectors labeled as “Horeca,” “Lodging; food and beverage serving services,” and “Horeca services” in different country datasets were standardized under the unified label: “Accommodation and food service activities.”

As an input-output (I-O) database, Eora models inter-industry relationships and supply chain structures through monetary flows, providing the basis for linking economic activity with potential social impacts.

Comprehensive technical documentation on the construction and methodology of the Eora MRIO database is available at World MRIO (2025).

2.1.1 Difference between industries and commodities

The Eora database classifies economic sectors into two distinct entities: industries and commodities. This classification is retained in PSILCA for several countries where data for both types are available.

A **commodity** represents the average output of a specific good or service as produced by multiple industries within a country. In this context, the commodity aggregates supply from different industry sectors that contribute to its provision. For example, the commodity "metal ores" in Finland may be produced by both the "mining of metal ores" industry and the "other mining and quarrying" industry, as illustrated in Figure 3. Since commodities reflect a more average and product-oriented view, they are generally recommended for product-based life cycle assessments when both options are available.

An **industry**, by contrast, refers to a specific economic sector that may produce multiple outputs, including its core product as well as several by-products. For example, the Finnish industry "mining of metal ores" primarily produces metal ores but may also output natural gas, basic metals, and other materials. The inputs to an industry are typically sourced as commodities, and often come from various countries, as shown in Figure 4.

In some countries within the PSILCA database, users may only have access to one type of entity, either industries or commodities, depending on the availability and structure of national data. In such cases, the only available option should be selected for modelling purposes.

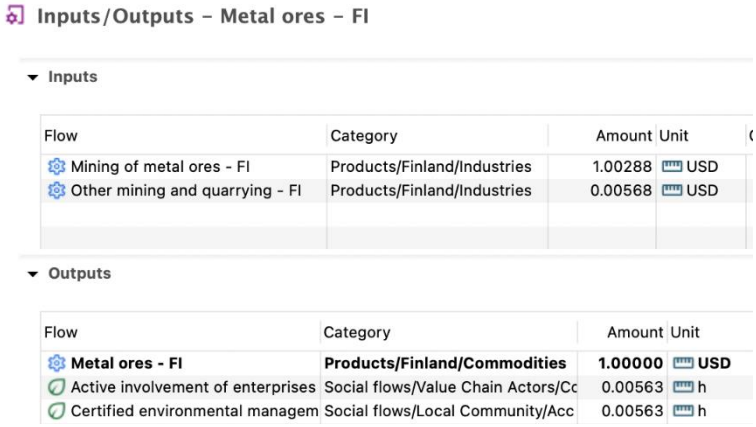


Figure 3: Example of a commodity sector in PSILCA.

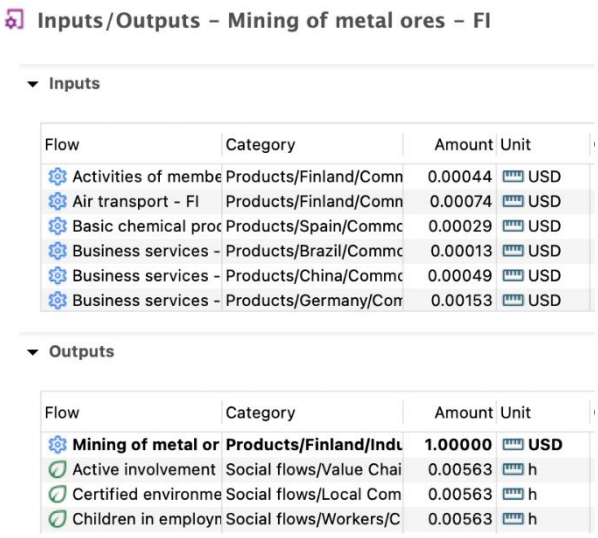


Figure 4: Example of an industry sector in PSILCA.

2.1.2 Which economic activities are covered by a PSILCA sector?

The sectors in PSILCA are derived from the underlying structure of the Eora MRIO database. According to the Eora website (World MRIO, 2022), "The Eora26 sector classification is based on common sector classifications, but no concordance matrix to/from other classifications is available. Such concordances are maintained, but we reserve these for use in paid projects or academic collaborations."

As a result, while PSILCA users benefit from a globally harmonized yet country-sensitive sectoral structure, understanding the precise scope of a given PSILCA sector may require referring to national or international classification systems. These systems offer greater detail on the economic activities included under each sector label.

Common references include:

- **NACE** (Statistical Classification of Economic Activities in the European Community; Eurostat, 2008), widely used in European countries (see example in Figure 5)
- **NAICS** (North American Industry Classification System; U.S. Census Bureau, 2022), primarily used in the United States

Additionally, most countries have national versions or adaptations of such classifications, typically published by their national statistical institutes. Examples include DESTATIS (Germany), ISTAT (Italy), INSEE (France), and CAPMAS (Egypt). Users seeking to better understand the economic scope of a sector in PSILCA are encouraged to consult these sources to ensure accurate interpretation and alignment with the intended application.

24.4 Manufacture of basic precious and other non-ferrous metals

24.41 Precious metals production

This class includes:

- production of basic precious metals:
  - production and refining of unwrought or wrought precious metals: gold, silver, platinum etc. from ore and scrap
- production of precious metal alloys
- production of precious metal semi-products
- production of silver rolled onto base metals
- production of gold rolled onto base metals or silver
- production of platinum and platinum group metals rolled onto gold, silver or base metals

This class also includes:

- manufacture of wire of these metals by drawing
- manufacture of precious metal foil laminates

This class excludes:

- casting of non-ferrous metals, see 24.53, 24.54
- manufacture of precious metal jewellery, see 32.12

Figure 5: Example of sector description from NACE rev. 2

2.2 Indicators in PSILCA, and their structure

Selecting indicators for a social LCA database requires thoughtful methodological decisions. Unlike environmental impacts, which are governed by physical laws and supported by relatively standardized metrics, social impacts are shaped by human behaviour, institutional contexts, and ethical perspectives. Their measurement is often more qualitative, and their interpretation is inherently value laden. As a result, there is no universal agreement on what constitutes a social impact or how it should be assessed.

While Social LCA remains a developing field, major strides have been made toward methodological consolidation. Several initiatives have played a pivotal role in this evolution, including the PRé Roundtable for Product Social Metrics (Goedkoop et al., 2020), the H2020 ORIENTING project (H2020 Orienting, n.d.), and the foundational UNEP/SETAC working group (UNEP/SETAC, 2009). Across these efforts, identifying relevant, reliable, and feasible indicators has been a recurring challenge and a core focus of debate.

A major milestone in this trajectory is the recent publication of ISO 14075:2024, *Environmental management , Social life cycle assessment , Principles and framework*. This international standard provides, for the first time, a globally recognized structure for conducting Social LCA. It formalizes core principles such as stakeholder inclusion, system boundary definition, and methodological transparency. PSILCA is aligned with the foundational elements of ISO 14075, particularly in its categorization of stakeholder groups, transparent data sourcing, and emphasis on context-specific risk and opportunity interpretation.

PSILCA's indicator structure also supports SPDs, which are increasingly used to communicate social performance in a standardized, verifiable way. The indicator system is designed with awareness of the Product Category Rules (PCRs) that govern SPD disclosures, allowing for structured integration into such frameworks, particularly with respect to stakeholder-level reporting and alignment with social themes identified in ISO 14075 and UNEP guidelines.

To accommodate the diverse needs of practitioners and varying data conditions across regions and sectors, PSILCA adopts an inclusive and flexible approach. The current version of the database includes 106 indicators, both qualitative and quantitative. These indicators are expressed using different formats, such as absolute values, percentages, categorical levels of risk or opportunity, and narrative descriptions, depending on the nature of the data and the social topic under consideration. Sub-indicators are used in some cases to provide additional depth or differentiation.

These indicators are grouped into a revised and expanded set of subcategories, reflecting updates to previous classifications and the addition of new thematic areas. The updates respond to evolving user needs, broader data availability, and emerging concerns in social sustainability, such as access to finance, child labour, and consumer vulnerability.

Crucially, PSILCA now organizes indicators under six stakeholder categories, revised from the original four to include two additional groups:

- Workers
- Local community
- Society
- Value chain actors
- Children
- Consumers

The inclusion of **Children** and **Consumers** as distinct stakeholder categories reflects both academic advances and regulatory shifts in the field and supports more precise modelling of impacts across diverse life cycle stages. This structure is consistent with the requirements of ISO 14075 and the growing emphasis on rights-holder perspectives in sustainability assessments.

An overview of stakeholder groups, subcategories, and associated indicators in PSILCA is presented in Table 1. The table also specifies whether each indicator is country-specific or both sector- and country-specific.

Further details including definitions, measurement methods, units, and data sources are provided in Chapter 3

Table 3: Existing, new, and updated, indicators with units of measurement in the PSILCA database

Stakeholder	Subcategory	Indicator	Unit of measurement	New Indicator (Yes/No)	Coverage[1]
Local Community	Access to material resources	Certified environmental management systems	Number of CEMS per 10.000 employees	No	S
		Extraction of biomass (related to population)	annual ton/cap	No	C
		Extraction of fossil fuels	annual ton/cap	No	C
		Extraction of industrial and construction minerals	annual ton/cap	No	C
		Extraction of ores	annual ton/cap	No	C
		Level of industrial water use	% of total actual renewable water resources per year	No	C
		Level of industrial water use	% of total water	No	C
		Extraction of biomass (related to area)	annual ton/cap	No	C
		Waste management	Score	New	C

[1] . Coverage: C= indicator available at country level; S=indicator available at sector level per country

Stakeholder	Subcategory	Indicator	Unit of measurement	New Indicator (Yes/No)	Coverage[1]
	Environmental footprints	Embodied agricultural area footprint	Hectare/ 1USD	No	S
		Embodied forest area footprint	Hectare/1 USD	No	S
		Embodied water footprint	Mm3/USD	No	S
		Embodied CO_2-eq footprint	ton per USD	No	S
	GHG footprints	Embodied CO_2 footprint	ton per USD	No	S
	Respect of indigenous rights	Indigenous People Rights Protection Index	6-point scale	No	C
		Presence of indigenous population	yes/no	No	C
	Secure living condition	Homicides	Rate per 100,000 population	Yes	C
		Internally displaced people	Rate per 10,000 people	Yes	C
Society	Contribution to economic development	Contribution to economic development	% of GDP	No	S
		Embodied value-added total	USD/USD	No	S
		Labour productivity	USD/hour	Yes	C
		Informal employment, total	% Informal employment rate	Yes	S

Stakeholder	Subcategory	Indicator	Unit of measurement	New Indicator (Yes/No)	Coverage[1]
		Informal employment, male	% Informal employment rate male	Yes	S
		Informal employment, female	% Informal employment rate	Yes	S
	Secure living condition	Global Peace Index	Index	No	C
		Global Terrorism Index	Score	Yes	C
		Social Protection Expenditures	% of GDP	No	C
	Health and safety	Health expenditure, domestic general government	% of total health expenditure in reference year	No	C
		Health expenditure, external resources	% of total health expenditure in reference year	No	C
		Health expenditure, out-of-pocket	% of current health expenditure	No	C
		Health expenditure, total	% of GPD	No	C
		Life expectancy at birth	Years	No	C
		Household air pollution attributable DALYs, female	DALY rate per 1,000 inhabitants in the country per year	Yes	C
		Household air pollution attributable DALYs, male	DALY rate per 1,000 inhabitants in the country per year	Yes	C

Stakeholder	Subcategory	Indicator	Unit of measurement	New Indicator (Yes/No)	Coverage[1]
	Censorship and oppression	Internet freedom scores	Score	Yes	C
		Freedom of the press	Score	Yes	C
	Access to immaterial resources	Global freedom scores	Score	Yes	C
	Ethical Treatment of animals	Animal protection	Score	Yes	C
	Nature	Biodiversity & Habitat	Score	Yes	C
		Ecosystem services	Index	Yes	C
		Number of threatened species	Number of species / 1USD	No	S
	Governance	Political stability and absence of violence	Normalized units for governance	Yes	C
		State of democracy	Score	Yes	C
	Poverty alleviation	Population below national poverty line	% of population	Yes	C
		Food Insecurity	Score	Yes	C
		Safe access to drinking water coverage	% of population	No	C

Stakeholder	Subcategory	Indicator	Unit of measurement	New Indicator (Yes/No)	Coverage[1]
		Sanitation coverage	% of population	No	C
	Technology development	R&D expenditures	% of GDP	Yes	C
		Rate of researchers	No. of researchers per one million inhabitants	Yes	C
		Access to electricity	% of population	Yes	C
		Access to internet	% of population	Yes	C
	Education and Upskilling opportunities	Illiteracy rate, female	% of female population 15+ years	No	C
		Illiteracy rate, male	% of male population 15+ years	No	C
		Illiteracy rate, total	% of total population 15+ years	No	C
		Public expenditure on education	% of GDP	No	C
		Youth illiteracy rate, female	% of female population 15-24 years	No	C
		Youth Illiteracy rate, male	% of male population 15-24 years	No	C
		Youth illiteracy rate, total	% of total population 15-24 years	No	C
		Youth Unemployment	% of youth not in employment, education or training	Yes	C

Stakeholder	Subcategory	Indicator	Unit of measurement	New Indicator (Yes/No)	Coverage[1]
	Gender equalities and empowerment	Gender inequalities	Score	Yes	C
		Female genital mutilation 15-49	% of youth	Yes	C
		Female with account at a financial institution	% of population ages 15+ female	Yes	C
	Local Employment	Unemployment rate in the country	% of population ages 15-64 in reference year	No	C
	Migration	Emigration rate	% of population in reference year	No	C
		Immigration rate	% of population in reference year	No	C
		International migrant stock	% of population	No	C
		Net migration rate	% (per 1,000 persons)	No	C
		Asylum seekers rate	% of population in the time frame (2 years)	No	C
		International migrant workers in the sector	% of international migrant workers in total employed population	No	S
	Safe and healthy living conditions	Pollution level of the country	Pollution Index in reference year	No	C

Stakeholder	Subcategory	Indicator	Unit of measurement	New Indicator (Yes/No)	Coverage[1]
Value Chain Actors	Corruption	Active involvement of enterprises in corruption and bribery	% of sector-related cases out of all registered foreign bribery cases in the time frame (15 years)	No	S
		Public sector corruption	Index score	No	C
	Fair competition	Presence of anti-competitive behaviour or violation of anti-trust and monopoly legislation	Cases per 10,000 employees in the time frame (5 years)	No	S
	Promoting social responsibility	Social responsibility along the supply chain	Number of companies	No	S
Workers	Child labour	Children in employment, female	% of female children ages 5-17	No	S
		Children in employment, male	% of male children ages 5-17	No	S
		Children in employment, total	% of male children ages 5-17	No	S
	Discrimination	Gender wage gap	% difference male and female wages in reference year	No	S
		Men in the sectoral labour force	% man	No	S
		Women in the sectoral labour force	% female	No	S
	Fair salary	Living wage, per month	USD/ month	No	C

Stakeholder	Subcategory	Indicator	Unit of measurement	New Indicator (Yes/No)	Coverage[1]
		Minimum wage, per month	USD/ month	No	C
		Sector average wage, per month	USD/month	No	S
	Forced labour	Frequency of forced labour	Cases per 1000 inhabitants in the country in reference year	No	C
		Goods produced by forced labour	Score	No	S
		Trafficking in persons	Tier placement	No	C
	Freedom of association and collective bargaining	Freedom of association and collective bargaining	Scale from 1 to 10	Yes	C
		Number of strikes	Number of strikes	Yes	S
		Trade union density	% of employees	No	C
	Health and safety	Presence of sufficient safety measures	OSHA cases per 100,000 employees and year	No	S
		Rate of fatal accidents at workplace	cases per 100,000 employees	No	S
		Rate of non-fatal accidents at workplace	cases per 100,000 employees	No	S
		Violations of mandatory health and safety standards	ratio number of cases/available labour force in reference year	No	C

Stakeholder	Subcategory	Indicator	Unit of measurement	New Indicator (Yes/No)	Coverage[1]
	Social benefits, legal issues	Evidence of violations of laws and employment regulations	cases per 1,000 employees in the time frame (5 years)	No	S
		Paid maternity leave	Days of paid leave for childbirth and early childcare for the mother	Yes	C
	Working time	Weekly hours of work per employee male	Mean weekly hours	Yes	S
		Weekly hours of work per employee female	Mean weekly hours	Yes	S
Children	Children Welfare	Child marriage, female	% of women	Yes	C
		Child marriage, male	% of male	Yes	C
		Female genital mutilation 0-14	% of girls	Yes	C
	Education	Mean years of schooling, total	years	Yes	C
		Mean years of schooling, female	years	Yes	C
		Mean years of schooling, male	years	Yes	C
	Health and Safety	Under-five mortality rate	Deaths per 1,000 live births	Yes	C
Consumer		Online Consumer Protection Legislation	Legislation exits (Yes/No)	Yes	C

Stakeholder	Subcategory	Indicator	Unit of measurement	New Indicator (Yes/No)	Coverage[1]
	Consumer protection	Data protection and privacy	Legislation exits (Yes/No)	Yes	C

2.3 Sources, data collection and refactoring

The development of the initial PSILCA database involved more than three years of dedicated data collection and analysis, drawing on a wide range of publicly available and reputable sources. Given the complexity and diversity of social topics, the data gathering process incorporated both international organizations and specialized databases to ensure adequate sectoral and geographic coverage.

Primary sources include major statistical and intergovernmental institutions such as the World Bank (World Bank, 2015), the International Labour Organization (ILO, 2019), the World Health Organization (WHO, 2015), and various branches of the United Nations (UN, 2017). These were complemented by additional private, governmental, and research-based sources.

All data sources used in PSILCA are transparently documented within the database, and users can trace each indicator back to its respective source. While some indicators could be measured directly using available data, others required the use of proxy variables to represent complex or less directly observable social phenomena.

2.4 Normalisation, extrapolation and attribution of indicator values

2.4.1 Normalisation

Some social indicators inherently depend on the size of the sector or economy in which they are measured, while others are independent of scale. Drawing an analogy from thermodynamics, these can be loosely compared to extensive and intensive properties: extensive indicators vary with system size (e.g. total number of incidents), while intensive indicators are scale-independent (e.g. incidents per 100,000 employees).

To facilitate more meaningful comparisons across countries and sectors, PSILCA provides indicator values in a format that aims to approximate intensive representations. This is done through normalization, where extensive values are adjusted based on a reference unit such as the number of employees, total sector output, or population size. This approach does not eliminate all context-dependency or uncertainty, but it supports a more consistent interpretation of indicator values across regions and industries. All normalization methods and assumptions are documented within the database for transparency.

2.4.2 Attribution and extrapolation

Differences in data resolution between the PSILCA framework and available data sources often require additional processing in the form of attribution and extrapolation. These steps are necessary when the sectoral detail in the Eora database does not match the level of granularity provided by the raw data sources, or vice versa.

In particular, three general situations may arise:

1. The Eora database contains more detailed sectoral resolution than the available data source.
2. The data source provides more granularity than Eora.
3. No raw data are available for the country or sector in question.

To address these gaps, PSILCA applies a set of structured, yet flexible, approaches to ensure that each indicator has a value for every country-sector combination. The method chosen depends on the specific indicator, data availability, and contextual fit. All procedures and assumptions are documented per indicator and further reflected in the data quality assessment (see Chapter 3.6).

The following cases illustrate how attribution and extrapolation are handled:

Case 1: Complete coverage

For a given indicator, raw data are available for all sectors within an Eora country. In this case, no attribution or extrapolation is required. Values are used as-is.

Case 2: Partial sectoral coverage

Raw data are available for a country but only for some of its sectors. In this case, values need to be attributed to the remaining sectors using a hierarchical and context-informed process:

- **Step 1: Sector mapping**

  All Eora country-sector combinations are mapped to those available in the raw data. Where there is a direct match, the raw data value is assigned.

- **Step 2: Inference based on hierarchy**

  Where direct matches are missing, values may be inferred through hierarchical relationships within sectors of the same country:

a) Parent-to-child attribution:

If data are available for a broader (parent) sector but missing for its sub-sectors, the parent value is assigned to each child sector, with a lower data quality for the technological conformance and completeness (see Figure 6).

Country	Sector	Indicator value	
USA	MANUFACTURE OF DAIRY PRODUCTS	3,25	← Original value
USA	Fluid milk and butter manufacturing	3,25	← Extrapolated values
USA	Ice cream and frozen dessert manufacturing	3,25	← Extrapolated values
USA	Cheese manufacturing	3,25	← Extrapolated values

Figure 6: Attribution of the original value from a parent sector to child sectors.

b) Child-to-parent aggregation:

If data are available for sub-sectors but missing for the parent, and one sub-sector clearly aligns with the parent sector, its value may be used. Otherwise, an average (arithmetic mean) of all available child sector values is assigned to the parent, with a lower data quality for the technological conformance and completeness (see Figure 7 and Figure 8).

Country	Sector	Indicator value	
Cyprus	EDUCATION; HEALTH AND OTHER SERVICES	8,62	← Extrapolated value
Cyprus	Education	8,62	← Original value
Cyprus	Health care		
Cyprus	Nursing homes	7,43	← Original value

Figure 7: Attribution of the original value from a child sector to parent sector.

c) Same-level averaging:

If data are missing for sectors at the same hierarchy level, and no parent-child relationship applies, the average value of the available peer sectors is used, with a lower data quality for the technological conformance and completeness (see Figure 8).

Country	Sector	Indicator value	Mean value
Cyprus	EDUCATION; HEALTH AND OTHER SERVICES	8.025	
Cyprus	Education	8.62	
Cyprus	Health care	8.025	8.025
Cyprus	Nursing homes	7.43	

Figure 8: Assigning mean value of different sectors to other sectors on the same and higher level

Case 3: No country-level data

Where no raw data are available for a given country, one of the following extrapolation strategies is applied, a lower data quality is accordingly assigned to the geographical conformance:

a) Similarity-based substitution:
Values are borrowed from a country with a similar economic structure, geographic proximity, or regulatory context.

b) Group-based mean extrapolation:
Countries are grouped based on geographic or economic characteristics (e.g. South America, high-income economies, OPEC countries). Each group's mean value is calculated, and the target country is assigned the mean value of the group to which it belongs.

c) Multi-group averaging:
If a country fits into multiple relevant groups, the indicator value may be assigned as the average of the means of all applicable groups.

The application of these methods varies by indicator and is contingent upon data availability and contextual fit. Where applied, the selected method is transparently documented in the indicator metadata and reflected in the data quality assessment.

2.5 Indicator assessment

In PSILCA, each indicator is assigned an ordinal risk or opportunity level based on its underlying data. These levels provide a simplified yet structured way to interpret the indicator values across different countries, sectors, and supply chains. The type of scale and its categories depend on the nature of the specific indicator.

For most indicators, PSILCA applies a six-level ordinal risk scale, which includes the following categories:

No risk	Very Low Risk	Low Risk	Medium Risk	High Risk	Very High Risk

For a smaller set of indicators, particularly those aimed at capturing positive social impacts, an opportunity-based scale is used. This includes the categories:

No risk	Low opportunity	Medium opportunity	High opportunity

In the latest release of PSILCA, all indicators are assigned to a risk (or opportunity) level by default. This step standardizes their interpretation and enables faster and more consistent result generation when using LCA software. The approach follows established practices in social LCA, as seen in previous work by Ciroth and Franze (2011), Prosuite (2013), and Goedkoop et al. (2020), among others.

However, as is common in social LCA, these assessments involve subjective and culturally influenced judgments. Interpretations of what constitutes "high risk" or "low opportunity" may vary depending on normative assumptions, societal values, or project-specific priorities. Recognizing this, PSILCA allows users to adapt the assessments in accordance with the goal and scope of their study.

To support this flexibility, the database provides:

- The raw indicator values
- The assigned ordinal levels, and
- The default performance reference points and classification rules used for assigning risk or opportunity levels (see Figure 9).

Users can choose to modify these default assignments in case-specific applications to better reflect their context or stakeholder expectations. There is a script now accompanying the database

For transparency, the reference points and assessment rules used for each indicator are documented individually and can be found in the indicator metadata and in Chapter 3. Default assessments are not intended to be definitive or universally valid, but rather to offer a starting point for consistent modelling.

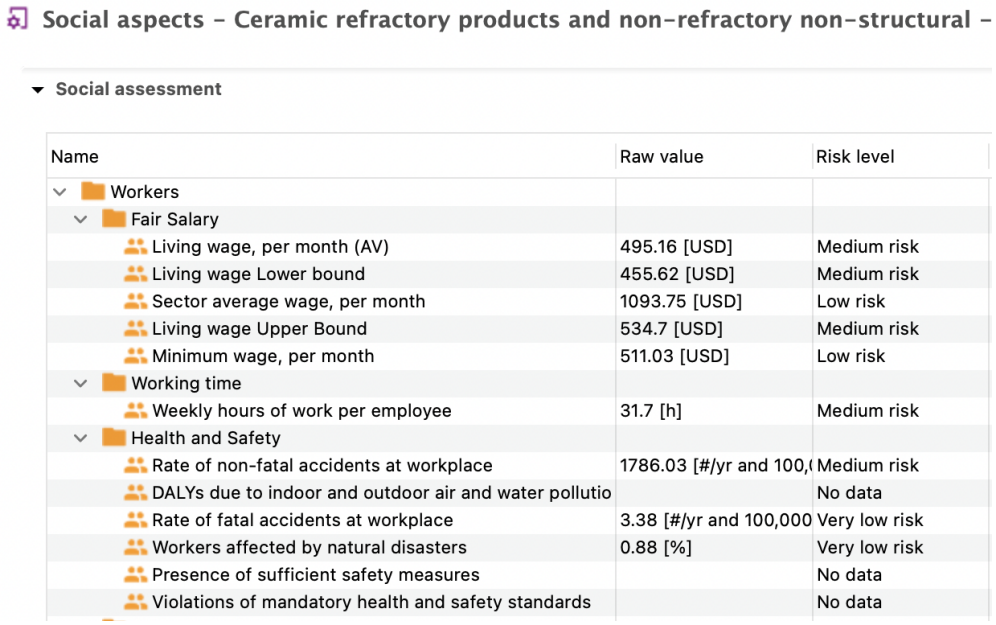


Figure 9: Example of documentation of raw values and risk levels for indicators in an example PSILCA sector ("social aspects" tab in openLCA)

2.6 Data documentation and data quality assessment

Transparent data documentation and quality assessment are essential for a database of the scale and ambition of PSILCA, especially given the dynamic and context-dependent nature of social data. As PSILCA aims to cover the entire global economy and a wide spectrum of social issues, systematic documentation is critical to maintain transparency, support user interpretation, and inform responsible decision-making.

To that end, information on data sources, collection and attribution methods, original (raw) values, and default risk or opportunity levels is documented either in this manual or within the datasets embedded in LCA software platforms where PSILCA is implemented. Documentation is provided at both the indicator level and the process/sector level, depending on availability and relevance.

To assess data quality, PSILCA adopts a pedigree matrix approach, adapted specifically for social LCA. This builds on the well-established pedigree matrix originally introduced into LCA practice by Weidema and Wesnæs (1996) and further developed for social applications by Ciroth et al. (2013). The matrix is designed to support structured, qualitative evaluation of each indicator's data quality.

The PSILCA pedigree matrix assesses five dimensions:

1. **Reliability** – evaluating the credibility and methodological rigor of the data source (e.g., whether data come from peer-reviewed statistical studies or less formal reports)
2. **Completeness** – assessing the extent to which the data reflect the scope and content of the indicator
3. **Temporal conformance** – indicating how current the data are relative to the reference year of the model
4. **Geographical conformance** – indicating how closely the data match the country or region of interest
5. **Technical conformance** – indicating how well the data match the sector, activity, or process of interest

Each of these dimensions is rated on a five-point ordinal scale, where 1 indicates high data quality (very good conformance or reliability), and 5 indicates low data quality (very poor conformance or reliability). Table 2 provides a summary of the scoring criteria used.

Table 4: The pedigree matrix for data quality assessment of social data, used in PSILCA

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

To clarify the distinction between technical and geographical conformance, often interrelated but conceptually different, consider the following example:

Suppose data are needed on mango production in Vietnam. If information is compiled from datasets on related crops (e.g., banana, coconut, or citrus) within Vietnam, the deviation is primarily technical, since the product category does not fully match. Conversely, if data are aggregated from mango production in other countries such as India, Thailand, or Brazil, the deviation is primarily geographical, due to the country mismatch.

In this way, the pedigree matrix allows users to identify key uncertainties or mismatches in the dataset and to weigh these appropriately during interpretation. While not a statistical tool, the matrix provides a structured and transparent method for assessing the qualitative robustness of data inputs.

It is important to note that statistical studies, in the context of the pedigree matrix, refer to those that apply random sampling and quantitative analysis to produce representative results. However, many social indicators are derived from institutional or observational data, which may not meet strict statistical criteria. This does not automatically imply poor quality but highlights the need for contextual judgment.

All data quality scores are included in the PSILCA dataset, for PSILCA professional and developer variants only, and are visible to users within LCA software implementations, supporting traceability and critical assessment of results. Below are screenshots of a result of data quality assessment per social indicator in a dataset under the process tab ‘social aspects’.

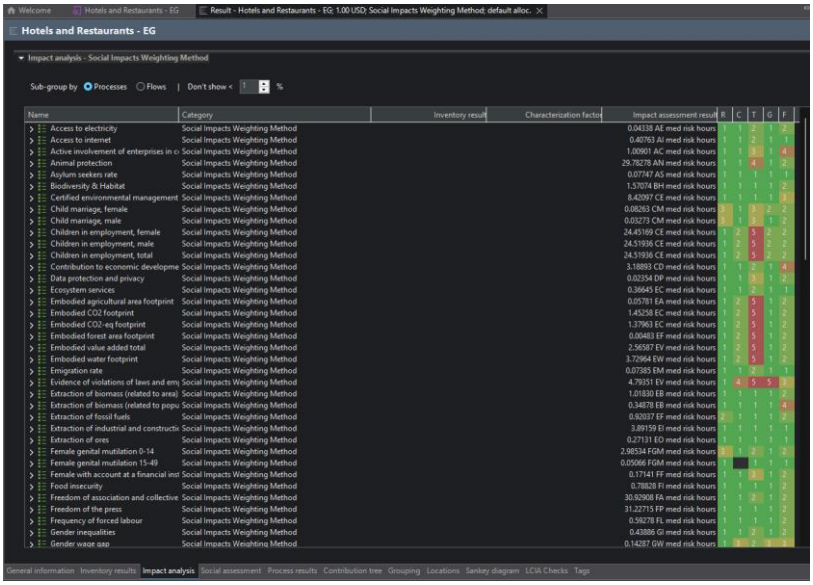




Figure 10 Data quality calculation in openLCA for social impact categories with a breakdown of processes

N.B. Users should note that calculating data quality system could require even a larger memory space than what’s mentioned under section 4.2.1.

2.7 Activity variable

In Social LCA, activity variables are used to express the scale or relevance of social impacts associated with a process in a product system. As described by Norris (2006), they represent a measure of process activity or scale that can be linked to output. According to UNEP (2020, p. 63), an activity variable is defined as "a measure of process activity or scale which can be related to process output," thereby allowing social indicators to be quantified in relation to a product's life cycle.

The most commonly used activity variable in PSILCA is worker hours, that is, the number of hours worked to produce a specific output in a given process or sector. This measure is well-suited for indicators related to the stakeholder group workers, as it directly reflects the scale of Labour involvement in production.

However, worker hours are less directly relevant for indicators associated with other stakeholder groups, such as local communities, society at large, value chain actors, consumers, or children. Despite this, worker hours are currently applied as the default activity variable for all indicators in PSILCA. This approach ensures consistency across the database and simplifies modelling, even though it may not fully reflect the causal relationship between certain indicators and process outputs.

Recognizing these limitations, PSILCA is actively exploring alternative or complementary activity variables that may be more appropriate for specific stakeholder groups or types of impact. These developments remain under assessment and will be documented as part of future methodological updates, as appropriate.

2.7.1 Worker hours

In the PSILCA database, worker hours serve as the core activity variable. They quantify the amount of labour time required to generate 1 USD of output in each process or sector. While not directly sourced from a single dataset, worker hours are derived using a combination of internationally recognized economic statistics and consistent modelling assumptions, enabling a standardized application across all countries and sectors in the Eora database.

The calculation follows this basic formula:

$$\textbf{Worker hours} = \frac{\textbf{Unit labour costs}}{\textbf{Mean hourly labour cost (per employee)}}$$

Equation 1

This equation expresses the labour time embedded per unit of output as the ratio of labour compensation per unit of output (**unit labour cost**) to the average hourly cost of labour.

Step 1: Calculating Unit Labour Cost

Unit labour cost is defined as:

$$\textbf{Unit labour costs} = \frac{\textbf{Compensation of employees (in USD per country} - \textbf{specific sector and year)}}{\textbf{Gross output (in USD per country} - \textbf{sector and year)}}$$

Compensation of employees data are taken from the Eora satellite accounts (Eora, 2015). According to the Eora developers (Moran, 2015), this variable adheres to the United Nations System of National Accounts (UN SNA) definitions (UN et al., 2009), which define compensation as:

"[...] compensation of employees is defined as the total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done by the latter during the accounting period."

From this definition, it becomes clear that compensation of employees consists of two main components:

"a. Wages and salaries payable in cash or in kind;

b. Social insurance contributions payable by employers, which include contributions to social security schemes; actual social contributions to other employment-related social insurance schemes and imputed social contributions to other employment-related social insurance schemes." (ibid.)

This includes two main components:

Both components are considered in PSILCA's worker hour calculation to reflect the full labour-related cost.

- **Gross output**, as defined by the UN SNA, includes both intermediate consumption and value added. These figures are extracted from Eora and are available per year for almost 10,000 country-sector combinations. While the data are not updated uniformly across all countries, the most recent available values are used for each case.

These two variables together yield the unit labour cost for each country and sector.

Step 2: Estimating Mean Hourly Labour Cost per Employee

The second element, **mean hourly labour cost per employee**, is based on data from the International Labour Organization (ILO, 2023a). This dataset provides disaggregated information by country and sector, based on the latest ISIC classification.

According to the ILO, this broad definition aligns well with the purpose of the activity variable in PSILCA, capturing the full cost of employing labour in monetary terms.

However, data coverage varies by country and year. For countries where mean hourly labour cost was not available, PSILCA substituted average hourly earnings as a proxy. Since earnings represent only part of the total labour cost, a correction factor was applied to estimate full labour cost from earnings data. This factor was developed based on comparisons in countries where both variables were available.

Step 3: Mapping to Eora Sectors and Addressing Data Gaps

After deriving hourly labour cost estimates, these were mapped to Eora sectors at the country level. Where a specific Eora sector lacked a direct match in the ILO dataset:

- The arithmetic mean of all other sectors' labour costs in the same country was used.
- For countries entirely lacking labour cost data, values were extrapolated from similar countries. Similarity was based on social and economic context, GDP per capita, wage levels, and the structure and number of sectors in Eora.

Judgment was used cautiously in these cases to select reference countries that best reflected the social and economic conditions of the data-poor country. Supporting indicators such as monthly wage levels, GDP per capita, and sector diversity were used to triangulate these choices.

Figure 11 (on the next page) shows the results, for all the sectors in PSILCA, ordered by amount.

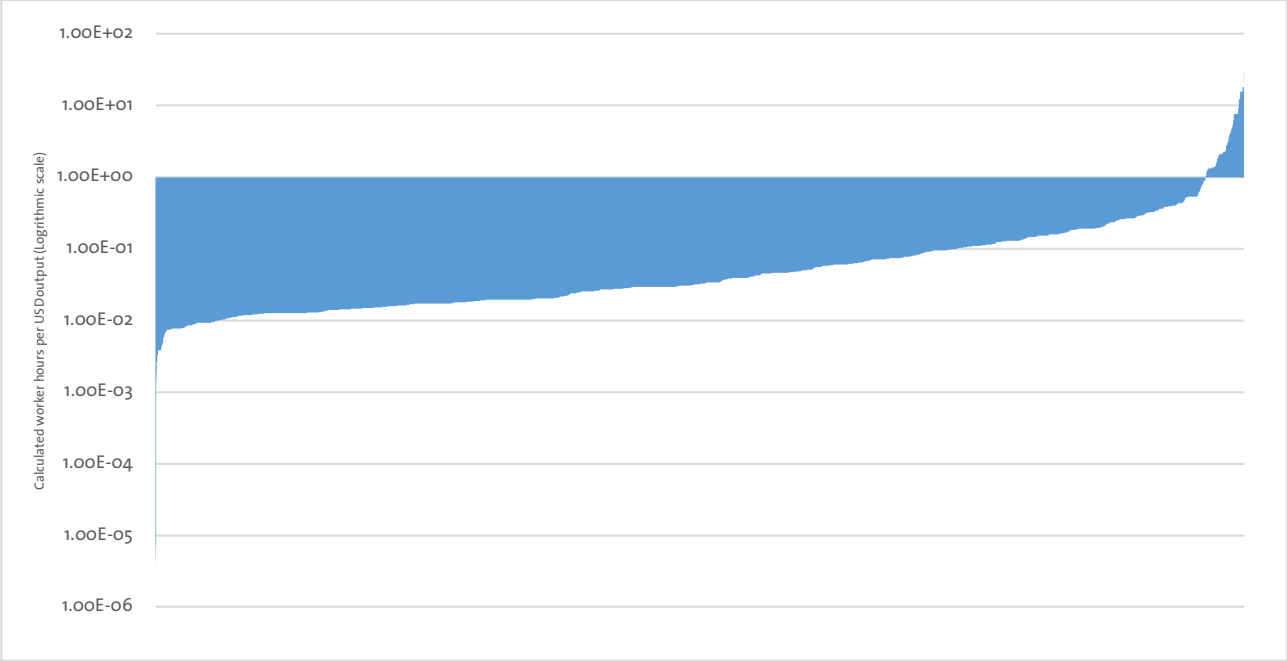


Figure 11: Calculated worker hours per USD output, for all country-specific sectors in Eora, ordered by amount; logarithmic scale.

Table 3 below showcases detail comparison for selected countries/sectors in terms of worker hours. PSILCA v3.1.1 was built on datasets reflecting roughly 2010 conditions, whereas PSILCA v4.0 updated its framework to capture variables (compensation, output, wages) from around 2019 onward. In many countries, including Uruguay, no sector-specific "mean hourly labour cost" in the ILO database was recorded for those earlier years, so v3.1.1 necessarily relied on broader regional-average wage coefficients rather than actual, country-level data. As a result, Uruguay's v3.1.1 "worker hours per USD" figures likely represented an extrapolation from a Latin America or "rest of world" average, not empirical observations of local wage rates.

Because of these data gaps, users should treat any reported "worker hours" with caution. In sectors where detailed, disaggregated employment or wage surveys were unavailable, PSILCA simply defaults to higher-level averages, meaning that some v3.1.1 values may understate or misrepresent true on-the-ground labour intensity. Even in v4.0, where more granular data exist, the degree of disaggregation (and the inclusion or exclusion of informal/unpaid work) can vary sharply by country and sector. In other words, whenever a "worker hours per USD" metric seems surprisingly low or high, it may simply reflect limitations in how thoroughly each country's wage and output data could be disaggregated.

Table 5 Comparison of PSILCA v4.0 worker hours to PSILCA v3.1.1

Country	Entity	Sector	Worker hours PSILCA v4.0	Worker hours PSILCA v3.1.1
Uruguay	Industries	Processing of fish and fish products	29.631	0.030
Sao Tome and Principe	Industries	Private Households	21.134	0.001
Cape Verde	Industries	Private Households	21.134	0.030
Uruguay	Industries	Basic chemicals except fertilizers, plastics and synthetic rubber	18.162	0.008
Uruguay	Industries	Malt beverage	18.162	0.016

2.7.2 A direct quantification of indicators in PSILCA's life cycle calculation

Since version 3 of the PSILCA database, a new calculation method has been made available that allows for the **direct quantification of social risks** based on the initial (raw) values of each indicator, without the need for intermediary normalization steps. This method is now fully implemented in the current version of PSILCA and is supported natively by LCA software interfaces, eliminating the need for external scripts (e.g., in Python).

In earlier versions, the social indicator results were normalized across the full product system. This meant dividing the indicator values by the total amount of product contributions, reflected in the **diagonal of the technology matrix**, so that each process's contribution to impact was proportional to its output within the system. The normalization formula was:

$$r_k = \frac{g_k}{\sum_{i=1}^{n} a_{ii} \cdot s_i};$$

where r_k is a normalized result, g_k is the raw impact score, a_{ii} is a process outputs in the technology matrix and s_i is a scaling factor;

While effective, this approach required custom processing and was not fully transparent to users. It has now been replaced with a direct impact assessment method, which calculates social impacts by scaling and aggregating raw indicator values directly using the activity variable.

The new method dissects social impact calculation into three core components, seen in Figure 11:

1. Activity variable (e.g., worker hours or another user-defined unit, such as cost)
2. Raw value of the indicator for a given process
3. Ordinal risk or opportunity level assigned to that value

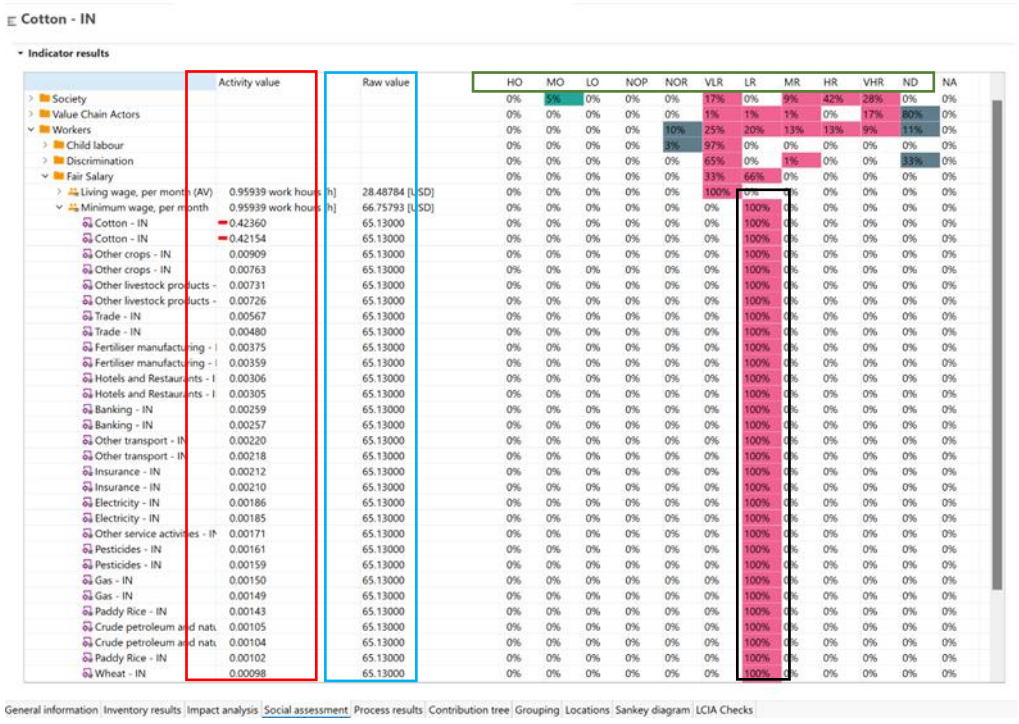


Figure 12: Direct raw values calculation in result analysis. Screenshot from openLCA software

The defined activity variable, shown in the red box in Figure 12, for each social indicator in the social aspects tab of the processes that comprise of it, is aggregated to calculate the activity value per social indicator. The activity variables can be worker hours or another variable that the user prefers, such as cost. The activity variable is scaled

by the process quantitative reference in the overall results. If a process *j* is scaled similar to normal LCA calculations by a factor s_j and the activity variable is (worker hour) *q*, the scaled activity value *w* for process *j* is calculated as:

$$w_j = s_j \times q_j$$

The overall worker hours value for the social indicator k is calculated as,

$$w_k = \sum_{i=1}^{n} (s_j \times q_j)$$

For each process, the raw value (shown in blue box) of a social indicator r_k is scaled by the activity variable. For example, for process i,

$$r_{scaled,k} = r_i \times w_i$$

Then, under each social indicator, an aggregated raw value is finally calculated as the weighted average where the scaled activity variables are used as weights. For example, in a system with 2 processes i and j, the aggregated raw value for a social indicator k_1 is calculated as:

$$raw\ value_{i,j} = \frac{r_i \times w_i + r_j \times w_j}{w_i + w_j}$$

Thus, for an entire system, for any social indicator, the aggregated raw values are calculated as:

$$\frac{\sum_{i=1}^{n}(r_i \times w_i)}{\sum_{i=1}^{n}(w_i)}$$

The same logic is applied to aggregate risk or opportunity levels, which are encoded as Boolean values for each indicator level and process. For example, if a process is categorized under "medium risk" for a given indicator, this level receives a value of 1, and all others are assigned 0. These values are then multiplied by the scaled activity variable, and aggregated similarly across the entire system.

This enables the model to report, for each stakeholder and indicator, the weighted distribution of risk or opportunity levels, providing a transparent link between input data and final social impact characterization.

The full disaggregation of, seen in Figure 11:

- Activity variable (highlighted in red),
- Raw values (blue),
- and Risk/opportunity levels (as Boolean-scaled aggregates, green)

allows users to better interpret how each component contributes to the overall result, and offers the possibility to adapt or test alternatives for sensitivity analysis or case-specific contexts.

2.8 Life Cycle Impact Assessment

In PSILCA, the Life Cycle Impact Assessment (LCIA) phase quantifies the overall social impacts associated with a product system by aggregating the scaled social risks of all contributing processes across the life cycle.

Social risks are weighted and aggregated using a combination of:

- Activity variables (typically worker hours or alternative user-defined variables)
- Monetary scaling (input values expressed in USD)
- Characterisation factors, which relate ordinal risk levels to a common reference unit

This approach ensures that both the scale of a process and the severity of its associated social indicators are reflected in the final results.

To support aggregation across different indicators and stakeholder groups, PSILCA includes a built-in characterisation method known as the Social Impacts Weighting Method. This method introduces non-linear factors to reflect the increasing social concern associated with higher risk levels.

- For risk indicators, the characterisation factor for medium risk is set to 1, which defines the reference unit of measurement as "medium risk hours."
- Other risk levels are assigned factors greater or smaller than 1 based on an exponential function, reflecting increased or decreased severity.
- For positive indicators (i.e., opportunity-based), characterisation factors are defined on a separate scale to reflect beneficial social contributions.

Table 6 summarises the characterization logic used for different risk and opportunity levels.

Table 6: Characterization factors for the impact assessment method in PSILCA

Risk/opportunity level	Factor
Very low risk	0.01
Low risk	0.1
Medium risk	1
High risk	10
Very high risk	100
No risk/ opportunity	0
Low opportunity	0.1
Medium opportunity	1
High opportunity	10
No data	0.1

Characterization factors are assigned for each ordinal risk level within each impact category. These impact categories represent broader thematic groupings of related social indicators. For example, the impact category “Fatal accidents” aggregates several underlying indicators associated with occupational safety and workplace mortality. Figure 12 illustrates how different risk levels within this category are weighted using the assigned characterization factors.

Characterization factors – Fatal accidents

Characterization factors

Flow	Category	Factor	Unit	Uncertainty
Rate of fatal accidents at workplace; high risk	Social flows/Workers/Health and Safety	10.0	FA med risk hours/h	none
Rate of fatal accidents at workplace; low risk	Social flows/Workers/Health and Safety	0.1	FA med risk hours/h	none
Rate of fatal accidents at workplace; medium risk	Social flows/Workers/Health and Safety	1.0	FA med risk hours/h	none
Rate of fatal accidents at workplace; no data	Social flows/Workers/Health and Safety	0.1	FA med risk hours/h	none
Rate of fatal accidents at workplace; very high risk	Social flows/Workers/Health and Safety	100.0	FA med risk hours/h	none
Rate of fatal accidents at workplace; very low risk	Social flows/Workers/Health and Safety	0.01	FA med risk hours/h	none

Figure 13: Impact assessment method in PSILCA

The characterization factors enable the aggregation of disparate social indicators into comparable and interpretable units. Because the reference unit is defined as one medium risk hour, final impact results are expressed as a weighted sum of hours, adjusted for both the severity (risk level) and the extent (activity variable) of each process’s contribution.

In the current version of PSILCA, each social indicator is treated as its own impact category. This approach replaces the previous system of predefined impact categories, which grouped multiple indicators under broader thematic headings. While such grouping facilitated aggregation, it also introduced the risk of having high medium risk hours that would not be interpreted fairly.

By treating each indicator as a standalone impact category, the **Social Impacts Weighting Method** now provides a more transparent and disaggregated representation of social performance. This structure ensures that results reflect the specific characteristics and severity of each social issue independently, and that no interpretive weighting is imposed through pre-grouping.

3 Individual indicators: definition, data collection, refactoring, and risk assessment

In the following chapter, data collection and risk assessment rules for indicators that have been prepared so far for the PSILCA database in openLCA are outlined. The list will be expanded with the progress of the database. The discussion is organised by stakeholders and subcategories.

3.1 Stakeholder Workers

The stakeholder group "Workers" is central to evaluating the ethical and social performance of a system. According to Di Xu et al. (2020), workers correspond to “those who work in the investigated system.” This stakeholder includes critical subcategories such as child labour, discrimination, fair salary, forced labour, and health and safety, among others. Indicators like gender wage gaps, workplace accident rates, union density, and evidence of legal violations provide insights into the conditions and rights of workers throughout the value chain. Assessing these aspects ensures that labour practices are equitable, safe, and compliant with international standards, promoting human dignity and sustainable livelihoods.

Subcategory	Indicator
Child Labour	Children in employment, female
	Children in employment, male
	Children in employment, total
Forced Labour	Frequency of forced labour
	Goods produced by forced labour
	Trafficking in persons
Fair Salary	Living wage
	Minimum wage
	Sector Average wage
Working Time	Weekly hours of work per employee, male
	Weekly hours of work per employee, female
Discrimination	Women in the sectoral labour force
	Men in the sectoral labour force
	Gender wage gap
Health and Safety	Rate of fatal accidents at workplace

Subcategory	Indicator
	Rate of non-fatal accidents at workplace
	Presence of sufficient safety measures
	Violation of mandatory health and safety standards
Social Benefits, Legal Issues	Evidence of violations of laws and employment regulations
	Paid maternity leave
Freedom of Association and Collective Bargaining	Trade union density
	Number of strikes
	Freedom of association and collective bargaining

3.1.1 Subcategory Child labour

Overview

The subcategory child labour includes the indicators "Children in employment, male", "Children in employment, female" and "Children in employment, total". Data for all indicators was mainly taken from ILOSTAT, where child labour is defined as:

"*Work in both formal and informal economy, inside and outside family settings, for pay or profit (cash or in-kind, part-time or full-time) and domestic work outside the child's own household for an employer (paid or unpaid).*" (ILO 2023h)

This is a broad definition that neither considers the severity or the danger of the work, nor if children are deprived of the opportunity to attend school. Living conditions that might require the additional income of a child, or cultural convictions or local laws that allow a certain amount of child labour are also not considered. It is planned to consider these facts in future versions of the database.

3.1.1.1 Children in employment, female

The indicator is measured by the estimated proportion of female children aged 5 to 17 engaged in any form of employment, as the International Labour Organization (ILOSTAT) reported. Here, "employment" is defined as:

"[...] any activity performed for at least one hour during the reference period for pay or profit, or as unpaid family work, which includes work in a family business, farm, or other enterprise." (ILO source)

This definition encompasses a broad range of economic activities, regardless of whether the work is formal or informal, paid or unpaid, and includes both hazardous and non-hazardous forms of work. It does not, however, distinguish whether the child's employment is legal, voluntary, or exploitative.

Data collection and attribution

Data on the extent, nature, and driving factors of child labour are collected through the Statistical Information and Monitoring Programme on Child Labour (SIMPOC), managed by the ILO. This program supports countries in gathering, documenting, processing, and analysing child labour-related data. For PSILCA, the values were compiled, and the ILO sector names were mapped to the EORA structure. Data are expressed as a percentage of the female child population aged 5 to 17 and are based on available national statistics. Where recent data are unavailable, regional estimates or modelled data have been used in alignment with regional attribution and data from neighbouring countries.

Risk assessment: Risk of Children in employment, female

The recorded cases of child labour among female children aged 5 to 17 per 1,000 population range from 0 to over 3.13. The risk scale is based on an equal distribution of these values across defined intervals.

Indicator value y, cases per 1000 habitants	Risk level
0	no risk
$0 < y < 0.36$	very low risk
$0.36 \leq y \leq 0.65$	low risk
$0.65 < y \leq 1.82$	medium risk
$1.82 < y \leq 3.13$	high risk
$y \geq 3.13$	very high risk
-	no data

3.1.1.2 Children in employment, male

This indicator reflects the prevalence of employment among male children aged 5 to 17, based on data from the International Labour Organization (ILOSTAT). It follows the same definition and methodological approach as the corresponding indicator for female children:

"[...] any activity performed for at least one hour during the reference period for pay or profit, or as unpaid family work, which includes work in a family business, farm, or other enterprise." (ILO source)

This includes both hazardous and non-hazardous work, whether paid or unpaid, formal or informal, without distinguishing between legal or exploitative forms of employment.

Data collection and attribution

As with the female indicator, data are collected through the ILO's SIMPOC program, which supports countries in compiling, processing, and analysing child labour-related data. For PSILCA, values were adapted to the EORA sector structure and expressed as a percentage of the male child population aged 5 to 17. Where national data were missing, regional or modelled estimates were used, drawing on data from neighbouring countries where appropriate.

Risk assessment: Risk of Children in employment, male

The recorded cases of child labour among male children aged 5 to 17 per 1,000 population range from 0 to over 3.29. The risk scale is based on an equal distribution of values across defined intervals.

Indicator value y, cases per 1000 habitants	Risk level
0	no risk
$0 < y < 0.98$	very low risk

Indicator value y, cases per 1000 habitants	Risk level
0.98 ≤ y ≤ 1.90	low risk
1.90 < y ≤ 2.20	medium risk
2.20 < y ≤ 3.29	high risk
y ≥ 3.13	very high risk
-	no data

3.1.1.3 Children in employment, total

This indicator reflects the prevalence of employment among children aged 5 to 17, regardless of gender, based on data from the International Labour Organization (ILOSTAT). It follows the same definition and methodological approach as the gender-specific indicators:

"[...] any activity performed for at least one hour during the reference period for pay or profit, or as unpaid family work, which includes work in a family business, farm, or other enterprise." (ILO source)

This includes both hazardous and non-hazardous work, whether paid or unpaid, formal or informal, without distinguishing between legal or exploitative forms of employment.

Data collection and attribution

As with the male and female indicators, data are collected through the ILO's SIMPOC program, which assists countries in compiling, processing, and analysing child labour-related data. For PSILCA, values were adapted to the EORA sector structure and expressed as a percentage of the total child population aged 5 to 17. Where national data were unavailable, regional or modelled estimates were used, drawing on data from neighbouring countries when relevant.

Risk assessment: Risk of Children in employment, total

The recorded cases of child labour among children aged 5 to 17 per 1,000 population range from 0 to over 3.16. The risk scale is based on an equal distribution of values across defined intervals:

Indicator value y, cases per 1000 habitants	Risk level
0	no risk
0 < y < 0.63	very low risk
0.63 ≤ y ≤ 1.23	low risk
1.23 < y ≤ 2.18	medium risk
2.18 < y ≤ 3.16	high risk
y ≥ 3.16	very high risk
-	no data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 408-1**

3.1.2 Subcategory Forced Labour

Overview

Forced labour was already defined by the ILO Forced Labour Convention, 1930 (No. 29), Article 2.1 (ILO 2012, p.19) as

"all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily".

Thus, according to ILO (ibid.), the definition contains three main elements:

"*first, some form of work or service must be provided by the individual concerned to a third party; second, the work is performed under the threat of a penalty, which can take various forms, whether physical, psychological, financial or other; and third, the work is undertaken involuntarily, meaning that the person either became engaged in the activity against their free will or, once engaged, finds that he or she cannot leave the job with a reasonable period of notice, and without forgoing payment or other entitlements."*

Forced labour is thus predominantly defined by

> *"the nature of the relationship between the person performing the work and the person exacting the work."*

Further, ILO also considers trafficking in persons for exploitation as a form of forced labour (ibid., p.19).

According to ILO, forced labour is still very difficult to detect due to a *"lack of reliable national estimates based on specialized data collection instruments"* (ibid., p. 21). As a consequence, quantitative data for the frequency of forced labour in different sectors and countries is hard to receive. On the one hand, ILO provides numbers of "reported cases" (ibid.) of forced labour per 1,000 persons in macro regions and, on the other hand, qualitative reports about labour conditions in selected sectors and countries are available.

However, on its website, ILO states that:

> *"A future priority of the ILO will be to study the economics of modern forced labour in greater depth. This will include an analysis of certain industries or economic sectors that seem to be more vulnerable to forced labour practices than others. It will also include research into the prevalence of forced labour in global supply chains. By the end of this year [2012, remark of author], we aim to produce a new study on the profits generated by forced labour. Based on an initial assessment of the data, we can already say that the sectors most frequently cited are agriculture, domestic work, construction and manufacturing." (ILO 2015b)*

It was decided to assess the subcategory forced labour by three different indicators:

1. the regional values for frequency of forced labour complemented by
2. numbers of goods produced by forced labour in the sector and
3. national data on trafficking in persons.

They will be explained in more detail in the following.

3.1.2.1 Frequency of forced labour

The indicator is measured by the estimated proportion of a country´s population in modern slavery by

the Walk Free Foundation (WFF). Here, the term is defined as:

> *"[...] modern slavery refers to situations of exploitation that a person cannot refuse or leave because of threats, violence, coercion, abuse of power or deception, with treatment akin to a farm animal."* (WFF 2016, p. 12)

The approach includes *"concepts such as human trafficking, forced labour, debt bondage, forced or servile marriage, and the sale or exploitation of children"* (ibid.). Hence, data comprises broader concepts than only forced labour.

Data collection and attribution

The data was produced by the International Labour Organization (ILO), Walk Free, and the International Organization for Migration (IOM), as the starting point for the national estimates of modern slavery for 160 countries that form the Global Slavery Index 2023 (WFF 2023). Data is based on nationally representative surveys and anonymised data from the Counter Trafficking Data Collaborative that is collected by IOM and its partners.

The values are provided as estimated number of persons facing modern slavery per 1,000 population. In PSILCA, values are shown in permille – number of cases per 1000 inhabitants – and are available for 160 countries. The other countries remain without data.

Risk assessment: Risk of forced labour in the country

The counted cases of persons in modern slavery per 1,000 inhabitants' range between 0.49 (in industrialized western countries) and 104 (in North Korea). The risk scale is based on quantile ranges of the dataset.

Indicator value y, Cases per 1000 inhabitants	Risk level
0	no risk
$0 < y < 2.95$	very low risk
$2.95 \leq y < 4.56$	low risk
$4.56 \leq y < 6.58$	medium risk
$6.58 \leq y < 8.04$	high risk
$y \geq 8.04$	very high risk
-	no data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 409-1**

3.1.2.2 Goods produced by forced labour

The United States Department of Labor's (DOL) Bureau of International Labour Affairs (ILAB) provides a list of goods and specific products produced by forced labour (and child labour) per country (USDOL 2024). Based on a wide range of publicly available sources, as surveys carried out by foreign governments and ILO, site visits, studies by governmental and non-governmental institutions, information by civil

society organizations etc. (ibid., p.19), ILAB collected data on forced labour according to ILO´s definition (see above). The authors state that the list

> *"includes only those goods for which ILAB is able to document that there is reason to believe that child or forced Labour is used in their production."* (ibid.)

Therefore,

> *"it is likely that many more goods are produced through these forms of Labour abuse."* (ibid., p. 3).

Yet still, the list is considered as a good auxiliary indicator in order to assess forced labour on a sector level.

Data collection and attribution

Goods and products produced by forced labour in a country were mapped to the sectors of the respective country in Eora. This way, some products were mapped to different Eora sectors (e.g. garments in Argentina fit to "Finishing of textiles", "Manufacture of textiles", "Yarns and threads for textile fibres", "Clothing, except fur" etc.) that are in potential risk of forced labour. The indicator is only measured by yes or no. According to the statement of ILAB claiming that the institution is not able to record all cases of forced labour (see above), countries and sectors that are not listed in the data sources are assigned a "no data" (and not a "no risk").

Risk assessment: Risk of forced labour in the sector

Risk levels for this indicator is attributed as "very high risk" for the sectors that are affected by forced and "no data" for the sectors that are not listed.

The risk is assessed by the following scale:

Indicator value y, score	Risk level
1	very high risk
0	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 409-1**

3.1.2.3 Trafficking in persons

"The Palermo Protocol defines trafficking in persons as the recruitment, transportation, harbouring or receipt of persons, by means of coercion, abduction, deception or abuse of power or of vulnerability, for the purpose of exploitation. It goes on to specify that exploitation shall, at a minimum, include sexual exploitation, forced labour, slavery and slavery-like practices." (ILO 2012, p. 20).

Hence, there is a clear link to forced labour which is why trafficking in persons is selected as an indicator

for the subcategory.

Data collection and attribution

Data is based on the Tier Placements of countries provided by the Office to Monitor and Combat Trafficking in Persons in the "Trafficking in Persons Report 2018" (U.S. Department of State, 2018). The tiers are available for almost every country in Eora, except for the miniature states. They are assigned a "no data" value. Tiers are defined as follows (ibid.):

> *"Tier 1*
>
> *Countries whose governments fully meet the Trafficking Victims Protection Act's (TVPA) minimum standards.*
>
> *Tier 2*
>
> *Countries whose governments do not fully meet the TVPA's minimum standards, but are making significant efforts to meet those standards.*
>
> *Tier 2 Watch List*
>
> *Countries whose governments do not fully meet the TVPA's minimum standards, but are making significant efforts to meet those standards AND:*
>
> a) *The absolute number of victims of severe forms of trafficking is very significant or is significantly increasing;*
>
> b) *There is a failure to provide evidence of increasing efforts to combat severe forms of trafficking in persons from the previous year, including increased investigations, prosecutions, and convictions of trafficking crimes, increased assistance to victims, and decreasing evidence of complicity in severe forms of trafficking by government officials; or*
>
> c) *The determination that a country is making significant efforts to meet the minimum standards was based on commitments by the country to take additional future steps over the next year.*
>
> *Tier 3*
>
> *Countries whose governments do not fully meet the minimum standards and are not making significant efforts to do so."*

Risk assessment: Risk that there are cases of trafficking in persons in the country

According to the definitions of the Tier placements referring to trafficking in persons, risk levels are assessed as follows:

Indicator value y, tier # and text	Risk level
1	Low risk
2	medium risk
2.1 (watch list)	high risk
3 and 3.1 (Special case)	very high risk
-	no data

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 409-1

3.1.3 Subcategory Fair Salary

Overview

> *"Fair wage means a wage fairly and reasonably commensurate with the value of a particular service or class of service rendered, and, in establishing a minimum fair wage for such service or class of service.*
>
> *Codes of conduct which deal with wages and benefits have focused on three standards when assessing level of wages:*
>
> - *the minimum wage required by law;*
> - *the local 'prevailing industry wage';*
> - *The 'living wage' (also sometimes designated as a 'floor wage' or 'non-poverty wage').*" (UNEP, 2021 p. 23)

Following this definition of UNEP, the three following indicators are taken into account in this subcategory: "Living wage, per month", "Minimum wage, per month", and "Sector average wage, per month".

3.1.3.1 Living wage, per month

This indicator is based on the Valuing Impact, Global Living Wages Dataset (2023). The indicator is defined according to the Global Living Wage Coalition (2025) as follows:

> *"A living wage is the remuneration received for a standard workweek by a worker in a particular place sufficient to afford a decent standard of living for the worker and her or his family."*

These needs include *"nutritious food, water, shelter, clothing, education, healthcare and transport"* (UNEP 2021).

Data collection and attribution

Data was taken from Valuing Impact (2023), where values are calculated based on cost-of-living cost prices collected from Numbeo (2025).

The data was available for only 218 countries, of which 103 were based on primary data. Averages across countries belonging to given economical regions (e.g. Middle-income counties, non-OECD countries) were calculated and assigned to the remaining countries.

Risk assessment: Risk that cost of living is high

Living wage values are a proxy to evaluate the other two indicators Minimum wage and Sector average

wage per month. Independently, living wages reflect the cost of living.

To define the risk levels, they are evaluated considering that the higher the living wage, the higher is the risk that it exceeds the minimum wage or the sector average wage- thus reflecting an unfair salary.

Indicator value y, USD	Risk level
y < 435	very low risk
435 < y ≤ 600	low risk
600 < y ≤ 801	medium risk
801 < y ≤ 1063	high risk
1063 < y	very high risk
-	no data

SDG	SPD (PCR)	GRI
	Applicable	GRI 201-1

3.1.3.2 Minimum wage, per month

Defining the minimum wage is, in principle, straightforward. According to the ILO, a minimum wage is:

> *"The minimum amount of remuneration that an employer is required to pay wage earners for the work performed during a given period, which cannot be reduced by collective agreement or an individual contract"* (ILO, n.d.).

However, in practice, not every country defines a minimum wage for all sectors. In some cases, multiple minimum wages are established based on factors such as skill level, age, region, or other criteria.

Minimum wages serve as important benchmarks for evaluating sectoral average wages or wages actually paid by companies. Alongside the living wage, the minimum wage is a key indicator for assessing whether salaries are fair and sufficient to enable workers to lead a dignified life. Although sector-specific minimum wages may be agreed upon through collective bargaining in some countries, available data are often limited to national-level figures.

Data collection and attribution

Data for minimum wages were primarily obtained from WageIndicator.org (WageIndicator, n.d.). The source provides information on the lowest and highest national minimum wages in local currency. For this indicator, the lowest national minimum wage was selected and converted into U.S. dollars using the respective exchange rates at the time of data access.

In countries where minimum wage data were unavailable, average values for the respective economic groups were assigned. Minimum wages are expressed in U.S. dollars per month. Where data were only available for a specific sector (typically the public sector), it was assumed to be representative of the entire country.

Risk Assessment: Risk that Minimum Wage Is Too Low to Permit a Dignified Life

The risk assessment compares minimum wage levels to living wage benchmarks by calculating the ratio x = Minimum Wage/Living Wage. A lower ratio indicates a higher risk that minimum wages are insufficient for dignified living standards. Additionally, the absolute value of the minimum wage, represented by the variable y is considered, based on the assumption that extremely low minimum wages worsen general living conditions, including the affordability of basic goods and services.

Variable y, USD	Logical connection	Variable x, ratio	Risk level
y > 300	And	x < 0.5	very low risk
y ≤ 300	And	x < 0.5	low risk
y > 300	And	0.5 ≤ x < 0.9	
y ≤ 300	And	0.5 ≤ x < 0.9	medium risk
y > 300	And	0.9 ≤ x < 1.3	
y ≤ 300	And	0.9 ≤ x < 1.3	high risk
y > 300	And	1.3 ≤ x < 1.8	
y ≤ 300	And	1.3 ≤ x < 1.8	very high risk
y > 300	And	x ≥ 1.8	
-		-	no data

SDG	SPD (PCR)	GRI
	Applicable	GRI 201-1

3.1.3.3 Sector average wage, per month

The sector average wage provides information about the mean monthly salaries in different industry sectors and countries and assesses if the salary is enough to afford a decent standard of living. The indicator is given as the mean of monthly earnings of all employees in the sector. These data are defined as follows:

"The earnings of employees relate to the gross remuneration in cash and in kind paid to employees, as a rule at regular intervals, for time worked or work done together with remuneration for time not worked, such as annual vacation, other type of paid leave or holidays. Earnings exclude employers' contributions in respect of their employees paid to social security and pension schemes and also the benefits received by employees under these schemes. Earnings also exclude severance and termination pay." (ILO, 2023d)

Values are provided in nominal terms and, therefore, provide no indication of the purchasing power of employees. The unit of measurement is USD.

Data collection and attribution

Data is based on the indicator "Mean nominal monthly earnings of employees by sex and economic activity (Local currency)" from the ILOSTAT database (ibid.). Depending on the country, information is provided for different years and industry sectors according to ISIC and is disaggregated by sex.

Values were converted into USD using current exchange rates calculated through Excel conversion functions. For salaries reported in historical currencies (e.g., those used before the introduction of the Euro), the appropriate historical exchange rates were applied.

After refactoring the data, the country-specific sectors from Eora were mapped to the ISIC sectors from the raw data as described in (see Chapter 2.4). So, first, all Eora sectors with a counterpart in the ILOSTAT data obtained the respective value. Second, sectors related to a more general (or detailed) sector were assigned the corresponding value. The remaining country-specific sectors received the "total" value provided by ILOSTAT. If this was not available, an average across all sectors from the same country was calculated.

In order to designate a value to the 60 countries without any raw data in ILOSTAT (ILOSTAT, 2023), these countries were assigned to data based on their sub-regional groups. For each group, an average was calculated for the respective (sometimes with attribution) sectors of the countries belonging to it. Then again, an average across all the sectors of all the sub-regional groups, to the country under study belongs to, was calculated and assigned to the sectors that were not matched (see Chapter 2.4).

Risk assessment: Risk that the salary is too low to permit a dignified life

To assess the risk levels, the ratio of the sector average wage divided by the (mean) living wage in the same country was used to assess the risk of the sectoral average wage being too low compared to living costs. For the countries without data, a mean living wage was calculated across all the corresponding country groups.

Since the selected living wages refer to the cost of living for an individual in the cheapest part of the country (see chapter 3.1.3.1) it is assumed that employees earning merely the living wage (i.e. a ratio lower than 1) face a very high risk of not being able to live a decent life. Only salaries that are at least twice as high as the living wage are supposed to permit a decent standard of living also for other family members and allow to cover increased or unexpected costs.

The following risk scale is used as the main performance indicator to assess the average monthly salaries. The sector average wage was preserved as a raw value for transparency and consistency with the minimum wage indicator.

For the risk assessment, in this case, a quintile-distribution based system was not followed, but rather the ratios were maintained from previous versions of PSILCA based on the definitions provided on the requirements for a decent standard of living.

Risk assessment of Indicator value y, ratio Salary/Living wage	Risk level
$y < 1$	very high risk
$1 \leq y < 1.5$	high risk
$1.5 \leq y < 2$	medium risk
$2 \leq y < 2.5$	low risk
$2.5 \leq y$	very low risk
n.a.	No data

SDG	SPD (PCR)	GRI
	Applicable	GRI 201-1

3.1.4 Subcategory Working time

Overview

This subcategory aims to assess if the number of hours that employees really work in different sectors and countries comply with the ILO standards, but also with national standards of working time. It addresses excessive working time that prohibits a sustainable work-life-balance as well as too little working hours limiting a satisfying professional life. Hence, the indicators chosen within this subcategory are "Weekly hours of work per employee".

3.1.4.1 Weekly hours of work per employee

"Whenever possible, on the basis of the mean number of hours of work per week, and with reference to hours worked in all jobs of employed persons and in all types of working time arrangements (e.g. full-time and part-time)" (ILO, 2023).

According to the ILO, the hours actually worked include:

> (a) 'direct hours' or the time spent carrying out the tasks and duties of a job,
>
> (b) 'related hours', or the time spent maintaining, facilitating or enhancing productive activities
>
> (c) 'down time', or time when a person in a job cannot work due to machinery or process breakdown, accident, lack of supplies or power or Internet access and
>
> (d) 'resting time', or time spent in short periods of rest, relief or refreshment, including tea, coffee or prayer breaks, generally practised by custom or contract according to established norms and/or national circumstances."

Data collection and attribution

Data for weekly hours of work per employee is based on the statistics for "Mean weekly hours actually worked per employed person, by sex and economic activity" by the ILOSTAT database (ILO, 2023). Data is provided by sex and ISIC sector for different years since 1969. However, in order to use rather current data, only values in the range of 2008-2023 were selected. Furthermore, it was not distinguished between men and women.

The Eora country-specific sectors were mapped to the available sectors of the data source (see chapter 2.4.2). First, all Eora sectors that had a counterpart in the raw data obtained the original value. Second, data from more general sectors was assigned to subordinate sectors, where available. In a third step, Eora sectors still without data got the value of one more detailed sector. By this extrapolation and interpolation procedure, more than 10,000 of all Eora country-sector-combinations got a value. For the remaining sectors without a counterpart in the raw data the average across all sectors within the respective country was used (if available, from the sector "Total", otherwise the calculated mean value).

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

All the sectors of countries without any raw data were assigned by the mean over the average values of all groups the country belongs to (see chapter 2.4.2, case 3c).

Risk assessment: Risk of improper working hours

The risk assessment of this indicator is based on the ILO conventions No. 1 "Hours of work (industries) Convention" (ILO, 1919) and No. 47 "Forty-Hour Week Convention" (ILO, 1935). The first one limits working time especially in the mining, construction, manufacturing and transportation sectors to 8 hours a day and 48 hours a week. It is ratified by 52 countries. Convention No. 47 defines the standard working week by 40 hours but is ratified by only 15 countries. Hence, both conventions were taken into account by setting the "normal" amount of weekly working hours between 40 and 48. However, apparently this is not accepted by every nation as the standard working time, and, therefore, this range is already assessed by "low risk" of improper working hours. The higher the amount of weekly working hours are, the higher is the risk level for the sector.

Furthermore, also exceptionally low numbers of working time are considered as improper because they might not permit the employee to realize his professional objectives or have enough professional social relations. Hence, also low values of weekly working hours are assessed by higher risk levels of improper working time.

Therefore, the risk is assessed by the following scale:

Indicator value y, hours of or work per employee and week	Indicator value y, hours of work per employee and week	Risk level
40 ≤ y <48		low risk
30 ≤ y < 40	48 ≤ y < 55	medium risk
20 ≤ y < 30	55 ≤ y < 60	high risk
20 ≥ y	60 ≤ y	very high risk

3.1.5 Subcategory Discrimination

Overview

Worker discrimination is a very multifaceted subcategory. The authors of UNEP (2021, p.34) describe it as follows:

> *"Equal opportunity or the principle of non-discrimination emphasizes that opportunities in education, employment, advancement, benefits and resource distribution, and other areas should be freely available to all citizens irrespective of their age, race, sex, religion, political association, ethnic origin, or any other individual or group characteristic unrelated to ability, performance, and qualification."*

Due to the variety of aspects and their mostly qualitative character, it becomes clear that it is difficult to

fully cover this subcategory in the database. Therefore, six indicators were chosen to assess the worker discrimination. The indicators "Women in the sectoral/ total labour force" and "Men in the sectoral/ total labour force" are supposed to verify whether there are gender discrimination issues related to equal employment opportunities. "Gender wage gap" assesses wage disparities between men and women.

3.1.5.1 Women in the sectoral labour force

The distribution of women and men in the labour force of different sectors is often quite unequal. In general, women are mostly engaged in service sectors such as human health activities, social work, education, or household services. In countries with high poverty levels, they are employed mostly in agriculture or manufacturing sectors. Most of these sectors do not require high professional skills, and especially social service activities, household services and agriculture, are typically low paid (see Chapter 3.1.3.3). Since women are as intelligent and capable of learning as men, "Women in the sectoral labour force" serves as an indication for structural discrimination of women, i.e. the systemic and institutionalized disadvantage faced by women regarding their participation in economic life.

"Structural discrimination refers to rules, norms, routines, patterns of attitudes and behaviour in institutions and other societal structures that represent obstacles to groups or individuals in achieving the same rights and opportunities that are available to the majority of the population." (Najcevska et al., 2010)

Data collection and attribution

Raw values for the share of women in the labour force are provided by the Key Indicators of the Labour Market (KILM) database (ILO, 2023). Here, data is provided for sectors defined by the latest revision of ISIC, Revision 4 (2008) tabulation category, as the percentage of women employed in a specific sector out of the total active female population in the country. Hence, this value defines how women are distributed across economic sectors in a country. However, this share is no sufficient basis to evaluate if women and men are equally involved in all sectors. Therefore, it is compared with the overall economic structure in a country by dividing it by the percentage of all employees in the same sector related to the total active population:

Women in the sectoral labour force =

$$\frac{Women\ employed\ in\ sector\ x\ (\%\ of\ active\ female\ population\ in\ the\ country)}{Men\ and\ women\ employed\ in\ sector\ x\ (\%\ of\ total\ active\ population\ in\ the\ country)}$$

Being a ratio between two percentages, this index is dimensionless. The ratio is used to define the risk evaluation scheme of this indicator and is provided as the "raw values" in PSILCA. The values of the shares of women employed in a sector out of the active female population is provided as a comparative value in the comments of each process in PSILCA.

Due to the different sector classification in the original source and Eora, the majority of the sectors had to be mapped the same way as for other indicators. Original data were provided by the most general classification of ISIC tabulation, hence in most cases data was assigned to subordinate sectors. When data for some sectors was missing, mean values were calculated across sectors for a specific country. Additionally, there were some countries without any data. In these cases, an average among similar countries was calculated and attributed to all the belonging sectors.

Risk assessment: Risk of women being underrepresented in specific sectors

The index is used to assess structural discrimination of women in a country´s economy by evaluating the gap between female and male employment in the country-specific sectors. For the risk assessment, it is assumed that an equal share of women working in a sector related to the active female population in the country and female and male workers in a sector related to all employees in the country, i.e. a ratio of 1, is ideal. The lower these ratios are, the higher the risk of female discrimination to be employed in a sector.

However, discrimination can also be represented by very high ratios, occurring especially in low-paid activities such as household or cleaning services. This additional qualitative fact cannot be entirely accounted for by the general risk scale below. Additionally, an "overrepresentation" of women in some sectors is not necessarily negative. However, the potential risk that sectors with very high shares of women employed are low paid (service) sectors, is still considered by low risk levels (instead of no risk).

Indicator value y, ratio	Risk level
$y > 1.5$	low risk
$1 < y \leq 1.5$	very low risk
$y = 1$	no risk
$0.8 \leq y < 1$	very low risk
$0.6 \leq y < 0.8$	low risk
$0.4 \leq y < 0.6$	medium risk
$0.2 \leq y < 0.4$	high risk
$y < 0.2$	very high risk

SDG	SPD (PCR)	GRI
	**Applicable**	**GRI 405-1**

3.1.5.2 Men in the sectoral labour force

This indicator is added in order to complete the assessment of gender discrimination. Unequal employment opportunities (with negative effects) can also be faced by men, e.g. in the health or education sectors. So, a more comprehensive picture of gender inequality can be drawn by comparing ratios of women and men in the sectoral labour force. Further, the sector coverage between the two indicators slightly differ so that this indicator can bring new insights.

Of course, the consideration of wage data, i.e. assessing wage gaps especially in those sectors with high shares of male or female workers, would complete the assessment. This can be realized by an adequate characterization factor in this subcategory.

Data collection and attribution

Indicator assessment and data collection are analogous to those of "Women in the sectoral labour force". Hence, provided values are the ratios of men in the sectoral labour force calculated with the following equation:

$$\text{Men in sectoral labour force} = \frac{Men\ employed\ in\ sector\ x\ (\%\ of\ active\ male\ population\ in\ the\ country)}{Men\ and\ women\ employed\ in\ sector\ x\ (\%\ of\ total\ active\ population\ in\ the\ country)}$$

Risk assessment: Risk of men being underrepresented in specific sectors

Also, the risk assessment follows the same logic as mentioned above. Again, high ratios equate less discrimination in terms of employment but do not say anything about the type of work, qualification or wages of the employees. Hence, lower ratios are basically associated with higher risks of employment discrimination.

Indicator value y, ratio	Risk level
y > 1.5	low risk
1 < y ≤ 1.5	very low risk
y = 1	no risk
0.8 ≤ y < 1	very low risk
0.6 ≤ y < 0.8	low risk
0.4 ≤ y < 0.6	medium risk
0.2 ≤ y < 0.4	high risk
y < 0.2	very high risk

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 405-1

3.1.5.3 Gender wage gap

Gender wage (or pay) gap can be calculated in different ways. Data in PSILCA follows the definition of OECD (OECD, 2015) describing it as the "difference between median earnings of men and women relative to median earnings of men" referring to full-time employees. However, this definition implies that wages of men are higher than wages of women which is not always the case. Therefore, the definition is extended as follows:

"Gender wage gap describes the difference between median earnings of men and women relative to median earnings of men if wages of men are higher. Otherwise, it is the difference between median earnings of men and women relative to median earnings of women."

Data collection and attribution

Values for gender wage gaps in different countries and sectors are based on the data for "Mean nominal monthly earnings of employees by sex and economic activity (Local currency)" by the International Labour organization statistics, (ILO, 2025).

If wages of men are higher than wages of women, values are calculated by:

$$\frac{Male\ wages - female\ wages}{Male\ wages} * 100$$

If wages of women are higher, values are calculated by:

$$\frac{Male\ wages - female\ wages}{Female\ wages} * (-100)$$

The negative factor is used to indicate that wages of women are higher than wages of men.

Due to the different sector classification of the raw data and Eora, sectors had to be mapped. First, all Eora sectors with a counterpart in the raw data obtained the original value. Second, where available, data from more general sectors was assigned to subordinate sectors, and third, Eora sectors still without data got the value of one more detailed sector. For those sectors without a matching economic activity, the value of the "Total" sector of the respective country was used.

Risk assessment: Risk of unequal wages

The risk levels were determined using a quintile-based distribution of the sector wage data, described in the previous section. For the risk assessment, it should be considered that data is unadjusted, i.e. factors as qualification, job position or working time, are not considered. Hence, values do not necessarily reflect if women or men are paid less only because of gender reasons or also due to lower job positions or shorter working times, etc. However, for some industries it can be discussed, as to whether missing qualifications, lower job positions or less working hours are already triggered by other forms of discrimination, e.g. unequal access to education, insufficient childcare institutions, etc.

Within the assessment of this indicator, these considerations cannot be completely considered. Nevertheless, a certain percentage of wage gap is "accepted" in order to consider the fact that values are unadjusted. Furthermore, higher wages of men or women are equally risk assessed and considered as discrimination. If the value of earnings of one sex is 0, and hence the gender wage gap ratio is 100, it can be assumed that there are no male or female employees in this economic activity. The following scale shows the assessment basis:

Indicator value y, %	**Risk level**
|y| = 0	no risk
0 < |y| < 12.8	very low risk
12.8 ≤ |y| < 15.3	low risk
15.3 ≤ |y| < 21.2	medium risk
21.2 ≤ |y| < 25.1	high risk
25.1 ≤ |y|	very high risk
-	no data
|y| = 100	not applicable

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 202-1 GRI 405-2

3.1.6 Subcategory Health and Safety

Overview

This subcategory is an essential one, contributing to the S-LCA of a product or industry. Here, occupational health and safety conditions in different sectors are assessed. Since 1950, ILO and WHO (Agius, 2010) define occupational health as follows:

> *"Occupational Health is the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations by preventing departures from health, controlling risks and the adaptation of work to people, and people to their jobs."*

Furthermore:

> *"The term health, in relation to work, indicates not merely the absence of disease or infirmity; it also includes the physical and mental elements affecting health, which are directly related to safety and hygiene at work."* (ILO, 1981)

Occupational health and safety and the risk of specific diseases and accidents depend on different factors that are to be assessed by the indicators of this subcategory. Two indicators assess the actual risk of accidents at workplace depending on their severity: "Rate of non-fatal accidents" and "Rate of fatal accidents". The indicator "DALYs due to indoor and outdoor air and water pollution" describes the risk of insidious health damages only notable after years of working in a specific working environment. To limit these industry-specific risks and protect workers companies should take prevention measures evaluated by the indicator and "Presence of sufficient safety measures". By the indicator "Violations of mandatory health and safety standards", health protection of workers is described at the whole country level. By all these indicators an overall picture of the level of occupational health and safety risks in general can be drawn.

3.1.6.1 Accident rates at workplace (non-fatal and fatal accidents)

Accident rates are the main indicator to reflect the state of safety conditions at a specific workplace or in a specific industry. While occupational non-fatal accidents cause injuries not leading to death, fatal accidents refer to those incidents *"where death occurred within one year of the day of the accident"* (ILO, 2024).

Apart from the fact that it is every employee´s right to work in a safe and healthy environment, it should be in the interests of employers to keep accident and injury rates as low as possible to avoid absence and a loss of efficiency and working time.

Data collection and attribution

Accident rates are taken from the indicators "Non-fatal occupational injuries per 100'000 workers by

economic activity" and "Fatal occupational injuries per 100'000 workers by economic activity" from ILOSTAT database (ibid.). They are expressed as the number of new cases of fatal or non-fatal occupational injuries during the reference period divided by the number of workers in the reference group and multiplied with 100,000(ibid.). Values are given for different years. The most recent value is selected per sector. Numbers may vary a little due to their reference base. Normally they refer to 100,000 employees, but in some cases, they relate to 100,000 persons insured or full-time workers etc.

As it is the case for most indicators, data had to be assigned to the "right" Eora sectors. Hence, mapping was done as described in chapter 2.4 and already for other indicators: First, mapping of identical sectors and countries was done. Second, where available, mapping of more general sectors to subordinate sectors, and third, Eora sectors still without data were mapped to a more detailed sector. All Eora sectors mapped this way were assigned the respective values. This extrapolation and interpolation procedure could be implemented for half of all the sectors in Eora. For the remaining sectors of the countries with any raw data available, the value of "Total" of the appropriate country (or the calculated mean value) was used. The remaining countries and their sectors were assigned "no data".

Especially regarding the indicator "non-fatal accidents", some raw values, were quite low or showed 0, although reality may show a different picture. This may be due to the fact that for most countries only accidents of insured employees are recorded. Possibly, in developing countries many accidents are not covered as carefully as in developed countries.

Risk assessment: Risk that workers suffer non-fatal accidents

The risk levels were determined using a quintile-based distribution of non-fatal accident rates per 100,000 employees worldwide, derived from available data.

Indicator value y, # per 100,000 employees and year	Risk level
y = 0.0	No risk
y ≤ 86	Very low risk
86 < y ≤ 598	Low risk
598 < y ≤ 1132	Medium risk
1132 < y ≤ 2293	High risk
y > 2293	Very high risk
-	no data

Risk assessment: Risk that workers suffer fatal accidents

The risk levels were determined using a **quintile-based distribution** of fatal accidents per 100,000 employees worldwide (calculated out of the data available).

Indicator value y, # per 100,000 employees and year	Risk level
y = 0.0	No risk
y ≤ 0.76	Very low risk
0.76 < y ≤ 1.42	Low risk
1.42 < y ≤ 2.60	Medium risk
2.60 < y ≤ 4.10	High risk
y > 4.10	Very high risk
-	no data

SDG	SPD (PCR)	GRI
	Applicable	GRI 403-2 GRI 403-9

3.1.6.2 Presence of sufficient safety measures

As described by former indicators, occupational health and safety depends on the one hand, on the hazards and risks that workers are directly exposed to in their working environment. On the other hand, these occupational health risks can be limited by appropriate measures taken by the employer. This is assessed by the indicator "Presence of sufficient safety measures".

Data collection and attribution

"To promote and to assure workplace safety and health, and to reduce workplace fatalities, injuries and illnesses" is the declared goal of the Occupational Safety and Health Administration (OSHA) by the US Department of Labour (USDOL, 2014a). Conducting programmed and un-programmed workplace inspections in the U.S., OSHA detects violations of safety and health standards and takes enforcement actions.

Proxy data for this indicator is taken from the OSHA enforcement DATA (USDOL, 2014b). Datasets are provided for U.S. companies and their NAICS (North American Industry Classification Systems) classification for over four decades. All "severe violation cases" between 2015 and 2019 (ibid.), and "severe work-related injuries" between January 2015 and February 2019 were selected. The first accident types are defined as "serious, wilful, repeat and other-than-serious violation" cases, referring to violations leading to deaths or hospitalizations of employees (ibid.). Severe work-related injuries are defined as "an amputation, inpatient hospitalization, or loss of an eye", i.e. injuries which do not lead to deaths (USDOL, 2017).

All cases were aggregated per 3-digit NAICS code and related to the number of employees in the respective sectors derived from USDOL (ibid.). Final values for "Presence of sufficient safety measures" are provided as number of OSHA violations per year and 100,000 employees.

Due to a lack of international data, it is assumed that safety risks are similar in the same industries in different countries. Therefore, provided values are extrapolated to suitable industry sectors worldwide. This is, of course, reflected in the data quality matrix.

To assign values to matching Eora sectors, these were mapped to the NAICS 3-digit-code sectors. All the sectors were mapped in a multi-stage process to Eora sectors (see 2.4). Remaining sectors were left without data.

It should be noted that the Time Data Quality (DQ) indicator was set to 5, reflecting the fact that the data were derived from the PSILCA 311 database, which is considered outdated.

Risk assessment: Risk of insufficient safety measures at workplace

The risk assessment scheme is based on the quintile distribution of the OSHA violations per 100,000 employees. Some of the sectors indicate relatively high number of violations, these sectors are monetary activities and retail trade. Such data peaks indicate hot spots and most exposed sectors which characterized with high number of accidents in compared to other sectors within a country. The following Figure 14 illustrates accident rates per sector in logarithmic scale.

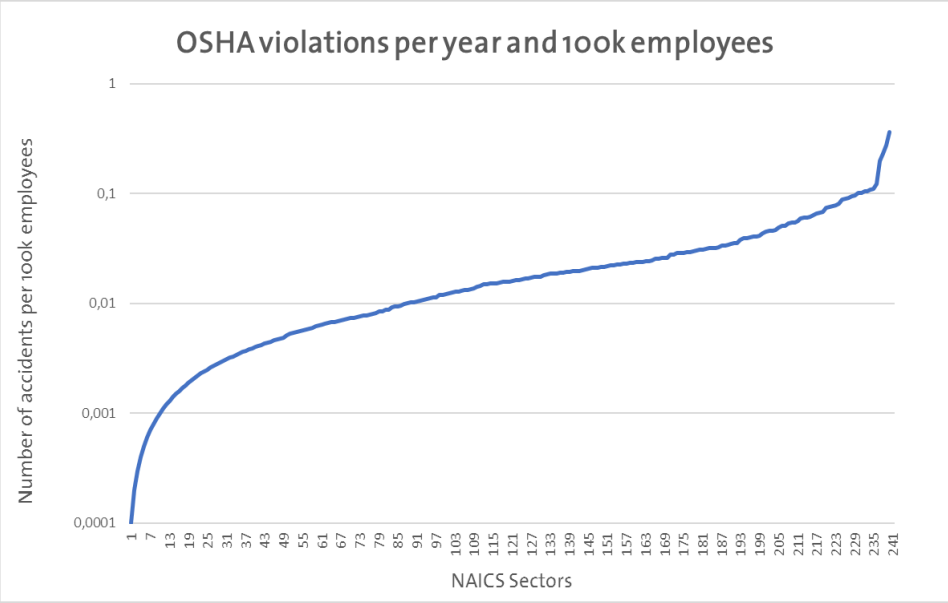


Figure 14: Number of severe violation cases and severe work-related injuries between 2015 and 2019, provided per year and 100,000 employees in 3-Digit NAICS sectors

Indicator value y, # per 100,000 employees and year	Risk level
y < 1.00E-03	Very high risk
1.00E-03 < y ≤ 4.80E-03	High risk
4.80E-03 < y ≤ 1.00E-02	Medium risk
1.00E-02 < y ≤ 2.00E-02	Low risk
y > 2.00E-02	Very low risk
y = 0.00E+00	No risk

SDG	SPD (PCR)	GRI
8 DECENT WORK AND ECONOMIC GROWTH	**Not Applicable**	**/**

3.1.6.3 Violations of mandatory health and safety standards

This indicator could be used to measure an overall country's compliance with mandatory health and

safety standards. It indicates occupational safety and health conditions which may reflect poor/good health protection of the workers in a country.

Data collection and attribution

The datasets have been obtained from the United States Consumer Product Safety Commission and contain information about violations in 57 countries (USCPSC, 2019). The datasets were not mapped to the EORA sectors as majority of violations were reported in children's toys and apparel sectors. Thus, only country related information was used for this indicator.

In order to establish a qualitative reference among different lands, the total number of violations were divided by the labour force in a country. It allowed to compare the available country level results and perform risk assessment. The labour force data were taken and adapted from "The World Factbook" (CIA, 2017).

Risk assessment: High risk of injury on the production site and poor safety standards

The risk levels were determined using a quintile-based distribution of the number of cases per country in relation to the available labour force. The more cases of violations per total number of workers, the higher the risk of getting injured. It might also indicate insufficient precaution measures in the production sector (ibid.). The risks were evaluated according to the following scale based on the initial range of raw values:

Indicator value y, ratio	Risk level
$y > 10.69$	Very high risk
$5.48 < y \leq 10.69$	High risk
$4.09 < y \leq 5.48$	Medium risk
$0.28 < y \leq 4.09$	Low risk
$y < 0.28$	Very low risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 403-2** **GRI 403-9**

3.1.7 Subcategory Social benefits, legal issues

Overview

This subcategory assesses the legal status and social security of workers which is considered as a basic human right in the Universal Declaration of Human Rights, Art. 22 (UN 1948). Social benefits are understood as non-monetary employment compensations paid in addition to wages. They basically refer to retirement, disability, dependents`, and survivors` benefits but can also include medical insurance, paid parental leave, education and training etc. (UNEP 2021 p.43). Hence, this subcategory can be assessed on its own but can also be used to relativize wages or working time.

The indicators within this subcategory are “Social security expenditures” and “Evidence of violations of laws and employment regulations”.

3.1.7.1 Evidence of violations of laws and employment regulations

Violations of employment regulations, by the employer, are a threat to employees’ well-being and therefore a potential social impact. Information about these violations is taken from a public source in the United States – U.S. Department of Labour (USDOL 2014b).

Data collection and attribution

These data sets report violations for specific enterprises in the U.S., from early cases in the 2015 until end of 2019. From the source, OSHA violation cases were removed since these are considered already in another indicator in the database (see chapter 3.1.6.2 Presence of sufficient safety measures). The remaining cases were aggregated to NAICS 3-tier sections, and afterwards, cases per 1,000 employees were calculated. Missing sectors were imported from the previous version of the database and contains cases from 2007 to 2014. Finally, these cases were mapped to the Eora sectors, and “extrapolated” to other countries worldwide. The difference in country and regarding the sector was considered in the data quality assessment.

The results show that most sectors report very few cases per 1,000 employees, with some sectors having a high probability of law violations. These extremes are represented by monetary services and retail trade (see Figure 15).

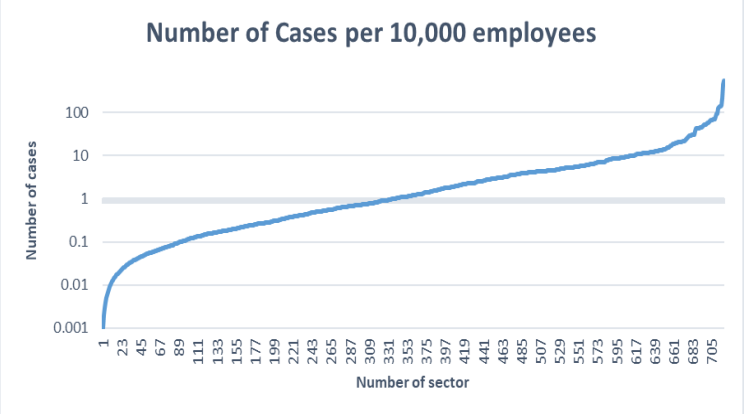


Figure 15: Number of cases regarding violations of laws and employment regulation, per 1,000 employees, for NAICS 3-tier sectors, OSHA violations are excluded from the figure

Risk assessment: Risk that worker-related laws and employment regulations are violated

Indicator value y, cases per 1,000 employees	Risk level
0.1 > y	very low risk
0.1 ≤ y < 1	low risk
1 ≤ y < 10	medium risk
10 ≤ y < 100	high risk
100 < y	very high risk
-	no data

SDG	SPD (PCR)	GRI
 	**Not Applicable**	**/**

3.1.7.2 Paid Maternity Leave

Paid maternity leave refers to the number of days of leave granted to mothers around the time of childbirth, as established by national legislation or policy. It is a critical component of social protection for workers, helping ensure income security, job retention, and the health and well-being of both mothers and infants (World Bank, 2023).
Access to adequate paid maternity leave reflects a country's commitment to gender equality in the workplace, as well as to broader principles of family support and social justice.

Data Collection and Attribution

Data for this indicator are sourced from the World Bank's *Women, Business and the Law 2023* database. This dataset compiles legally mandated durations of paid maternity leave in days, based on national laws and regulations. The data reflect the most recent available information per country and do not account for informal practices or discrepancies in enforcement.
National-level data are used directly for risk assessment. Countries without available data are assigned a "no data" value.

Risk Assessment: Opportunity for Social Benefits through Paid Maternity Leave

The risk assessment is based on the number of days of legally mandated paid maternity leave, following the scale below:

Indicator value y (days of paid maternity leave)	Opportunity Level
$y \geq 451$	High opportunity
$112 \leq y < 451$	Medium opportunity
$90 \leq y < 112$	Low opportunity
-	No data

SDG	SPD (PCR)	GRI
	Applicable	GRI 201-4 GRI 401-3

3.1.8 Subcategory Freedom of association and collective bargaining

Overview

According to the Universal Declaration of Human Rights, Art. 20 (UN 1948) every individual has the right to assembly peacefully and to form and join organizations of their choice without being compelled to belong to any association.

By several conventions and principles this right is explicitly applied to workers. ILO (ILO, 1998) *names "freedom of association and the effective recognition of the right to collective bargaining"* as one of the four principles concerning the fundamental rights at work. Also, UN Global Compact (UNGC, 2017) lists freedom of association in its "Ten Principles of the UN Global Compact" to promote corporate sustainability.

Apart from being a fundamental right, freedom of association is a "prerequisite for sound collective bargaining and social dialogue" and, hence, essential for a pleasant and progressive working environment which assures a sustainable and efficient economic development (ILO, 2016).

In particular, employers and workers must have the right to strike, the right to draw up their constitutions and rules within an organization, to elect their representatives in full freedom, to organize their activity freely and to formulate their programmes (UNEP, 2021 p.15). This subcategory aims to verify to what extent these conditions are met within different industries and countries. This is measured by the indicators "Trade union density", "Right of Association", "Right of Collective bargaining" and the "Right to Strike".

3.1.8.1 Trade union density

This indicator serves to assess how liberal and vivid trade union culture is, and, in the end, to what degree the right to organize freely is assured in different sectors. It is defined by ILO (2019[2]) as follows:

> *"A trade union is defined as a workers' organization constituted for the purpose of furthering and defending the interests of workers. This trade union density rate conveys the number of union members who are employees as a percentage of the total number of employees."*

Hence, the indicator can be used to evaluate the degree of workers´ organization. Nevertheless, Hayter, Fashoyin and Kochan (2011) state:

> *"Union density only measures the extent of unionisation and tells us very little about the influence or bargaining power of unions [...] In some countries, such as France, trade union*

[2] Indicator "Trade union density rate"

density rates may be considered comparatively low, however collective bargaining plays a significant role in regulating terms and conditions of employment and the coverage of workers by collective agreements is high. On the other hand, in countries such as those of the former Soviet Union and in regimes where a single union system prevails, trade union density rates may be comparatively high, but this is neither a reflection of the strength of the union nor a measure of freedom of association."

Trade union density, therefore, can only be seen as a proxy to get an overall impression of association culture in different industries and countries. To evaluate the actual freedom of association in countries "trade union density rates should always be interpreted within their particular political and social context" (ibid.). For a more comprehensive picture of the freedom of association and collective bargaining, the latter – considered as significant to regulate working conditions (ibid.) – is measured by separate indicators (see chapter 3.1.8.3).

Data collection and attribution

Data is collected from the indicator "Trade union density rate" from ILOstat database (2019). The data is provided for years 2013-2016. ILO´s measurement procedure is specified as follows:

"For the purpose of this indicator in particular, trade union membership excludes union members who are not in paid employment (self-employed, unemployed, retired, etc.), unless otherwise stated in the notes. The statistics presented in this table result from a collaboration between the ILO (ibid.) and the AIAS ICTWSS database (AIAS 2013).

Always the most current data points per country were selected. Updated values are available for 79 countries. The remaining countries were assigned an average across all countries within adequate country groups (see chapter 2.4.2, case 3c). In these cases, mean values were also calculated for years. All mapping procedures and the temporal conformance are reflected in data quality assessment.

Risk assessment: Risk that employees are not allowed to organise in trade unions

Since the right to organise in trade unions is fundamental to defend workers´ interests and rights collectively, higher density rates are basically considered as an indication for better or more liberal association conditions. Of course, this assumption is restricted by the claims made in the introductory part of this chapter.

The risk levels are based on an equal distribution of values between 0 and 100%.

Indicator value y, % of employees organised in trade unions	Risk level
$20 \geq y$	very high risk
$20 < y \leq 40$	high risk
$40 < y \leq 60$	medium risk
$60 < y \leq 80$	low risk
$80 < y$	very low risk

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 407-1**

3.1.8.2 Number of Strikes

The rate of strikes measures the frequency of industrial disputes resulting in work stoppages due to disagreements between employers and workers, typically over wages, working conditions, or employment terms. It reflects the level of labour unrest and the effectiveness of industrial relations systems. High strike rates may indicate strained employer–employee relations, weak collective bargaining, or unmet worker demands (ILO, 2023).

Data collection and attribution

The International Labour Organization (ILO) compiles data on strikes and lockouts from national statistics offices through its ILOSTAT database, where figures were often expressed in number of strikes per sector per year. The data was normalized by considering the size of the working population and dividing the number of strikes per sector by the total number of employees per sector also taken from ILOSTAT.

Risk assessment: Rate of strikes in a sector

The risk level definition was based on the quintile distribution of data across the different countries. A zero-strike rate (y = 0) may mask underlying issues (e.g., absence of unions, fear of retaliation), which also poses risk, and therefore a medium risk level was assigned to alert users to the possibility of suppression of strikes.

Indicator value y, number of strikes per 10,000 employees	Risk level
$0 < y \leq 1$	Very low risk
$1 < y \leq 4.7$	Low risk
$4.7 < y \leq 11.4$ or $y = 0$	Medium risk
$11.4 < y \leq 79$	High risk
$y > 79$	Very high risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 407-1**

3.1.8.3 Freedom of association and collective bargaining

Freedom of association and collective bargaining (FACB) refer to workers' rights to form and join organizations of their own choosing and to negotiate collectively with their employers. These rights are considered fundamental under international labour standards (ILO, n.d.).

Data Collection and Attribution

The indicator used to assess compliance with FACB rights is SDG Indicator 8.8.2. It measures the level of national compliance on a scale from 0 to 10, where 0 indicates full compliance and 10 indicates severe non-compliance. The indicator is compiled from six ILO supervisory body textual sources and national legislation.
Neither national laws nor ILO supervisory texts were originally developed to serve as statistical measures, and reporting obligations vary between ratifying and non-ratifying ILO Member States. Data are available at the national level for a wide range of countries. Countries without available data were assigned a "no data" value.

Risk Assessment: Risk of Non-Compliance with Freedom of Association and Collective Bargaining Rights

The risk assessment is based on the value of SDG Indicator 8.8.2, following the scale below:

Indicator value y – Level of national compliance	Risk Level
$y = 0$	No risk
$0 < y < 0.5$	Very low risk
$0.5 \leq y < 1.1$	Low risk
$1.1 \leq y < 2.1$	Medium risk
$2.1 \leq y < 4.2$	High risk
$y \geq 4.2$	Very high risk
–	No data

SDG	SPD (PCR)	GRI
	**Applicable**	**GRI 407-1**

3.2 Stakeholder Local Communities

According to Di Xu et al. (2020), the stakeholder group "Local Communities" corresponds to "those who live in the area where the system locates in". This group encompasses various subcategories such as access to material resources, environmental and GHG footprints, respect for indigenous rights, and secure living conditions. Evaluating these dimensions and their associated indicators allows practitioners to assess how local populations are impacted by, and contribute to, the sustainability of production systems, thereby supporting socially responsible decision-making.

Subcategory	Indicator
Access to material resources	Level of industrial water use
	Extraction of fossil fuels
	Extraction of ores
	Extraction of industrial and construction minerals
	Extraction of biomass (related to population)
	Extraction of biomass (related to area)
	Certified environmental management systems
	Waste Management
Environmental Footprints	Embodied agricultural area footprint
	Embodied forest area footprint
	Embodied water footprint
	Embodied CO_2-eq footprint
GHG Footprints	Embodied CO_2 footprints
Respect of Indigenous Rights	Presence of indigenous population
	Indigenous people rights protection index
Secure Living Conditions	Homicides
	Internally Displaced People

3.2.1 Subcategory Access to material resources

Overview

The idea behind this subcategory is to assess whether the access of local communities to material resources is restricted because of commercial or industrial activities in their regions. Reason is that "expanding operations carry the potential for depletion of and conflict over natural material resources (e.g. water, forest land, homelands), especially in emerging or unstable countries." (UNEP 2021 p.56). Therefore, organizations and industries should, on the one hand, respect and protect community access to local material resources (i.e. water, land, mineral and biological resources) by preventing, mitigating and controlling environmental damage. On the other hand, they should work to facilitate access for communities, e.g. by building new infrastructure (see ibid.).

To describe this subcategory the level of industrial water use, the extraction of other material resources and the presence of certified environmental management systems are assessed.

3.2.1.1 Level of industrial water use

Food and Agriculture Organization defines the level of industrial water use as the quantity of freshwater, desalinated water and treated wastewater withdrawn for industrial purposes related to *total water withdrawal* (for agricultural, industrial and municipal use) and to *total actual renewable water resources*, which includes groundwater aquifers, rivers and lakes regenerated through hydrological cycles (FAO, 2024).

While the first sub-indicator describes the importance of industrial water use compared to other water uses, the second, is an indication of the pressure on the renewable water resources. (ibid.). Furthermore, it can be assumed that high levels of water withdrawal are accompanied by high levels of water pollution. Therefore, high values of industrial water use are associated with different risks for local communities, e.g. health risks, destruction of local economic structures (e.g. agricultural practices) and an overall deterioration of quality of life. Values in the database are provided in percentages per year.

Data collection and attribution

The AQUASTAT database from the FAO (FAO, 2024) provides comprehensive water statistics for 200 countries. The two sub-indicators are calculated according to the following formulas:

$$level\ of\ industrial\ water\ use, \%\ of\ total\ withdrawal\ = \frac{Total\ Industial\ Water\ Withdrawal}{Total\ Water\ Withdrawal} \cdot 100\%\ ;$$

$$level\ of\ industrial\ water\ use, \%\ of\ total\ actual\ renewable = \frac{Total\ Industial\ Water\ Withdrawal}{Total\ Renewable\ Water\ Resources} \cdot 100\%\ ;$$

Data was added to al the sectors of a country when available; and for the remaining countries or regions, data was attributed based on the combination of best fitting economic-geographical groups. This way, data could be gathered for 171 countries/regions for 'level of industrial water use as a % of total withdrawal'; and 169 countries for the indicator 'level of industrial water use as a % of total actual renewable water resources.

Risk assessment: Risk that industry accounts for a large share of water withdrawal

The risk levels scale was determined using a **quintile-based distribution** of the data for the indicator "Level of industrial water use (related to total withdrawal)". According to the definition of water stress, extreme water stress occurs when total withdrawal exceeds 40% of the total renewable water resources (Climate Service Center, 2015). However, in this scale, a lower value of 32.9% was used, based on the quintile distribution, since this value is also more conservative than the 40% value, above which the country received a very high-risk level, in PSILCA 3.1.

The risks were evaluated according to the following scale based on the initial range of raw values:

Indicator value y, % per year	Risk level
y <= 1.6	Very low risk
1.6 < y ≤ 4.8	Low risk
4.8 < y ≤ 12.5	Medium risk
12.5 < y ≤ 32.9	High risk
y > 32.9	Very high risk
n.a.	No data

Risk assessment: Risk of high pressure on renewable water resources

The risk levels scale was determined using a quintile-based distribution of the data. The following risk scale is used for the indicator "Level of industrial water use (related to renewable water resources)".

The risks were evaluated according to the following scale based on the initial range of raw values:

Indicator value y, % per year	Risk level
y <= 0.217	Very low risk
0.217 < y ≤ 0.61	Low risk
0.61 < y ≤ 1.94	Medium risk
1.94 < y ≤ 5.89	High risk
y > 5.89	Very high risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 303-1** **GRI 303-5**

3.2.1.2 Extraction of material resources (other than water)

Besides water, there are other material resources directly or indirectly important for local communities and organizations, mainly fossil fuels, biomass, ores and minerals. They play a vital role because they can be communities' base of life and economy. Consequently, the exploitation and destruction of natural resources can cause resettlements, poverty, cultural uprooting and, in the end, conflicts with local people.

For this indicator, the total extraction of fossil fuels, biomass, ores and minerals on a country level was chosen. Values are given in tons per capita, and for biomass, additionally, in tons per km².

Data collection and attribution

Data was taken from the "Global Material Flows Database" from the International Resource Panel, an online portal that provides comprehensive data about material flows and human´s material consumption (International Resource Panel, 2024). Data for the total extraction of the above-mentioned resources in 2024 was used. It is provided for several countries between 120 and 182 depending on the indicators. Countries without any data did not get a value.

Risk assessment: Risk of conflicts due to a restricted access of local communities to material resources

The risk assessment for the individual indicators is not straightforward. To really assess the exhaustion of raw materials, information about the criticality of the resources is missing, i.e. extraction levels should be related to available reserves. Furthermore, it is not always clear how to evaluate high values of resource extraction per capita. They can either result from relatively small populations dispersed on huge areas or from elevated resource extractions.

The following examples illustrate this discrepancy: Australia and China have similar normalized levels of extraction of minerals in 2015 (8.35 t/cap and 12.73 t/cap respectively) while the population of China is almost 60 times higher than the population of Australia (on nearly the same area).

For Australia, the risk for communities to be affected by resource extraction is rather low because people not necessarily live close to deposits of raw materials. On the contrary, in China, many more persons are – at least potentially – affected. Hence, normalization with the population density might make more sense.

In addition to this, it can be discussed whether high levels of resource extraction only harm local communities because of environmental destruction, or if they considerably contribute to local economic development through infrastructure such as schools, or roads.

As these reflections cannot be answered with the currently available data, it was decided, for the risk assessment, that the higher the extraction levels the higher the risk for local communities to be negatively affected.

Risk assessment: Extraction of fossil fuels

In the following tables, the risk scales based on a quintile-based distribution of data, for each sub-indicator are presented.

Extraction of fossil fuels includes the extraction of coal (bituminous, sub-bituminous, coking and brown coal), petroleum (crude oil and natural gas liquids), natural gas as well as oil shale and tar sands.

Indicator value y, annual t/cap	Risk level
$y \leq 0.02$	Very low risk
$0.02 < y \leq 0.28$	Low risk
$0.28 < y \leq 1.13$	Medium risk
$1.13 < y \leq 3.63$	High risk
$y > 3.63$	Very high risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	/

Risk assessment: Extraction of ores

The resources extracted can be ferrous ores such as iron ores, or non-ferrous ores, for example copper, gold and zinc ores.

Indicator value y, annual t/cap	Risk level
y > 2.500	Very high risk
0.205 < y ≤ 2.50	High risk
0.914 < y ≤ 2.500	Medium risk
0.0002 < y ≤ 0.205	Low risk
y < 0.0002	Very low risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	/

Risk assessment: Extraction of industrial and construction minerals

Industrial and construction minerals are non-metallic minerals which are used mostly for construction, industrial or agricultural purposes. Typical resources are sand gravel and crushed rock for construction, limestone, and structural clays.

Indicator value y annual t/cap	Risk level
y < 0.9	Very low risk
0.9 < y ≤ 2.5	Low risk
2.5 < y ≤ 4.6	Medium risk
4.6 < y ≤ 8.3	High risk
y > 8.3	Very high risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

Risk assessment: Extraction of biomass (related to population)

This material group includes crops (cereals, vegetables, oil bearing crops, fruits, rice,...), crop residues such as straw, grazed biomass and fodder crops, as well as wood, mostly shared between wood fuel and timber.

Indicator value y, annual t/cap	Risk level
$y < 0.9$	Very low risk
$0.9 < y \leq 1.9$	Low risk
$1.9 < y \leq 3.0$	Medium risk
$3.0 < y \leq 4.9$	High risk
$y > 4.9$	Very high risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

Risk assessment: Extraction of biomass (related to area)

On the contrary to *Extraction of biomass (related to population),* in annual tonne per capita, this indicator evaluates the extraction of biomass related to the area, that is expressed in annual tonne per square meters.

Indicator value y, annual t/km²	Risk level
$y < 63.8$	Very low risk
$63.8 < y \leq 153.3$	Low risk
$153.3 < y \leq 281.7$	Medium risk
$281.7 < y \leq 550.0$	High risk
$y > 550.0$	Very high risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.2.1.3 Certified environmental management systems

This indicator assesses the number of certified environmental management systems (EMS or CEM) per sector, in relation to the number of employees in the same sector. The idea behind the inclusion of this indicator, is to take the existence of certified EMS as a proxy for the commitment of companies in a sector to environmental protection. ISO 14001 certifications are considered as certified EMS. Values are given in numbers of ISO certifications per 10,000 employees.

Data collection and attribution

Data were taken from the ISO Survey of Management System Standard Certifications and the ISO Survey of Management System Standard Certifications 2018 – Industrial Sectors (ISO, 2023). The documents provide the numbers of different ISO certifications for 185 countries (relevant for PSILCA) and 40 industry sectors. Only the number of ISO 14001 certifications were selected and divided by the number of employees in the respective sector and country. Data on employment are provided by ILOSTAT (2023b), "Employees by sex and economic activity (Thousands)"). In case no information about the number of employees was available for a specific sector, the number of certified EMS was divided by the mean number of employees over all sectors in the country. For 19 of the countries with data regarding ISO certifications, no information was available for the number of employees to normalize. Hence, the information on risk levels was taken from the previous version of the database.

After normalising the values, sector-specific data were mapped to matching sectors and countries in Eora (see Chapter 2.4.) Countries without any value were assigned a "no data".

Risk assessment: Risk of environmental damage

In the following table, the risk scales based on a quintile-based distribution of the data, based on the normalised values (except for those countries without values for employees). These missing values are not adjusted, i.e. facts like the potential of the sector to pollute the environment and, therefore, the need for environmental management systems, are not considered.

The following risk scale is used to assess the risk levels:

Indicator value y, # per 10,000 employees	Risk level
y <= 0.0036	Very high risk
0.036 < y ≤ 0.155	High risk
0.155 < y ≤ 0.53	Medium risk
0.53 < y ≤ 1.98	Low risk
y > 1.98	Very low risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.2.1.4 Waste Management

Effective waste management is essential for ensuring public health, environmental protection, and sustainable access to material resources. It encompasses the collection, treatment, and disposal of waste, aiming to minimize adverse impacts on the environment and human health. Inadequate waste management can lead to pollution, resource depletion, and increased greenhouse gas emissions, thereby affecting the well-being of local communities and the sustainability of material resources.

Data Collection and Attribution

This indicator utilizes data from the 2024 Environmental Performance Index (EPI), which assesses countries' performance in various environmental areas, including waste management. The waste management component of the EPI evaluates countries based on three sub-indicators:

- **Waste Generated per Capita:** Measures the amount of waste produced per person, indicating consumption patterns and efficiency in resource use.
- **Controlled Solid Waste:** Assesses the proportion of waste that is properly managed through environmentally sound methods.
- **Waste Recovery Rate:** Evaluates the percentage of waste that is recycled or otherwise recovered, reflecting efforts toward a circular economy.

Each sub-indicator contributes to the overall waste management score, with specific weightings assigned to reflect their relative importance. The combined score provides a comprehensive view of a country's waste management performance.

Risk Assessment: Risk of Inadequate Waste Management Impacting Access to Material Resources

The risk assessment is based on the national waste management score, following the scale below:

Indicator value y (EPI Waste Management Score)	Risk Level
$y > 45$	Very low risk
$35 < y \leq 45$	Low risk
$29 < y \leq 35$	Medium risk
$24 < y \leq 29$	High risk
$y \leq 24$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 306-2

3.2.2 Subcategory GHG Footprints and Environmental Footprints

All the indicators below are extracted directly from the EORA database[3] and attributed as they are to PSILCA sectors. No further documentation is available from the EORA database.

Data collection and attribution

The data are reported for scope 1 coefficients, "for every one unit ($1) of a good or service sold, the direct intensity of how much of various nonmonetary factors were used to produce that output, e.g. CO_2 emitted, land occupied, or labour used"[3]. For example, influence of a chemical production sector on the blue water per one dollar of output.

The data for the Red List Index was obtained from the OECD Environment (2022), with the most recent data available for 2021. A total of 237 countries and states were included in the dataset, which corresponded to 186 PSILCA countries. The values for Taiwan and Macao were mapped from Hong Kong. For the former USSR, an average was calculated from the data of the 15 former USSR countries. Regarding the Netherlands Antilles, a regional average of Caribbean countries was assigned. The indicator data was taken from EORA from the year 2019, and therefore it should be noted that the Time Data Quality (DQ) indicator was set to 5.

3.2.2.1 Embodied agricultural area footprint

The embodied agricultural area footprint indicates the ratio between hectares of affected agricultural land in relation to 1 dollar of product output.

Risk assessment

The risk levels were determined using a quintile-based distribution of the data. The higher the embodied agricultural area footprint per USD, the higher the risk. The risk levels are as in the table below:

[3] EORA multipliers. Available at: https://worldmrio.com/multipliers/. Accessed: 28/12/22

Indicator value y, ha/$1	Risk level
y > 1.87E-03	Very high risk
3.60E-04 < y ≤ 1.87E-03	High risk
9.00E-05 < y ≤ 3.60E-04	Medium risk
2.00E-05 < y ≤ 9.00E-05	Low risk
y < 2.00E-05	Very low risk
y = 0.00E+00	No risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	/

3.2.2.2 Embodied forest area footprint

The embodied forest area footprint indicates the ratio between hectares of affected forest land in relation to 1 dollar of product output.

Risk assessment:

The risk levels were determined using a **quintile-based distribution** of the data. The higher the embodied forest area footprint per USD, the higher the risk. The risk levels are as in the table below:

Indicator value y, ha/$1	Risk level
y > 0.010	Very high risk
0.003 < y ≤ 0.010	High risk
0.001 < y ≤ 0.003	Medium risk
0.000 < y ≤ 0.001	Low risk
y < 0.000	Very low risk
y = 0.000	No risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	/

3.2.2.3 Embodied water footprint

The embodied water footprint indicates the ratio between cubic meters of affected blue water in relation to 1 dollar of product output.

Risk assessment:

The risk levels were determined using a **quintile-based distribution** of the data. The higher the embodied water footprint, the higher the risk. The risk levels are as in the table below:

Indicator value y, Mm3/$	Risk level
y > 1.00E-06	Very high risk
2.40E-07 < y ≤ 1.00E-06	High risk
8.00E-08 < y ≤ 2.40E-07	Medium risk
3.00E-08 < y ≤ 8.00E-08	Low risk
y < 3.00E-08	Very low risk
y = 0.00E+00	No risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.2.2.4 Embodied CO2 footprint and Embodied CO2-eq footprint

The embodied CO_2 and Embodied CO_2-eq footprint as a ratio of tons CO_2 and CO_2-eq of total greenhouse gases per 1 dollar of output respectively.

Risk assessment: Embodied CO2 footprint

The risk levels were determined using a **quintile-based distribution** of the data. The higher the embodied carbon dioxide footprint per USD, the higher the risk. The risk levels are as in the table below:

Indicator value y, t per $	Risk level
y > 3.80E-04	Very high risk
1.90E-04 < y ≤ 3.80E-04	High risk
1.00E-04 < y ≤ 1.90E-04	Medium risk
2.00E-05 < y ≤ 1.00E-04	Low risk
y < 2.00E-05	Very low risk
y = 0.00E+00	No risk
n.a.	No data

Risk assessment: Embodied CO2-eq footprint

The risk levels were determined using a **quintile-based distribution** of the data. The higher the embodied carbon dioxide equivalents footprint per USD, the higher the risk. The risk levels are as in the table below:

Indicator value y, t per $	Risk level
y > 5.40E-04	Very high risk
2.61E-04 < y ≤ 5.40E-04	High risk
1.28E-04 < y ≤ 2.61E-04	Medium risk
3.10E-05 < y ≤ 1.28E-04	Low risk
y < 3.10E-05	Very low risk
y = 0.00E+00	No risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 305-1**

3.2.3 Subcategory Respect of indigenous rights

Indigenous peoples have been living in many territories of the world long before colonialization. Contrary to common practices in past and present, their human rights must be respected in order to ensure peaceful coexistence and conserve important cultural heritage. Regarding indigenous rights, UNEP authors (UNEP, 2021 p.73) state the following:

> *"Respect of indigenous rights includes the right to lands, resources, cultural integrity, self-determination and self-government. Historically, states have denied many indigenous populations these rights."*

Therefore, "organizations [companies and governments] should engage with indigenous peoples to obtain consent for actions that may affect their rights." (ibid.).

This subcategory assesses the risk of undermining indigenous rights by specific sectors and countries. First it is verified if indigenous peoples exist in the country and, based on that, the general situation of their human rights and companies' respect of indigenous rights are assessed.

3.2.3.1 Presence of indigenous population

This indicator serves to verify if the subcategory is relevant for the country and its industry sectors. It is measured on a country level by yes or no.

Data collection and attribution

Information was gotten from the list of indigenous peoples (Indigenous World, 2024) It lists all indigenous peoples as officially defined by international organizations by regions and countries. Countries with at least one indigenous tribe are assigned a yes. Countries not appearing in this list but

that have ratified the "Indigenous and Tribal Peoples Convention" (ILO, 1989a) are also assumed to have indigenous population. Furthermore, if there is a report available about the rights of native peoples in a specific country (Office of the United Nations High Commissioner for Human Rights (OHCHR) 2015) it also got a "yes".

The indicator was not updated as presence of indigenous people is a quite stable parameter, thus the sub-indicator was not updated in the version 3.1.

Risk assessment: Relevance of subcategory

As mentioned before, "risk levels" for this indicator are rather a basis for decision-making if the subcategory is relevant for a country.

Indicator value y, yes/no	Risk level
no	No risk
yes	Medium risk

SDG	SPD (PCR)	GRI
	**Applicable**	**GRI 411-1**

3.2.3.2 Indigenous People Rights Protection Index

This indicator is supposed to describe and assess the legal situation of indigenous peoples. In fact, this is a qualitative indicator that is difficult to assess, which calls for a careful investigation not yet carried out. For the time being, the indicator is assessed by three proxies: ratification of the "*Indigenous and Tribal Peoples Convention, 1989 (No. 169)*" (ILO, 1989b), availability of a UN report on the rights of indigenous peoples (OHCHR, 2015), and adoption of the UN "*Declaration on the rights of indigenous peoples*" (UN Department of Economic and Social Affairs, 2007). Based on these proxies a score was calculated in order to define risk levels.

Data collection and attribution

First of all, only the countries with indigenous population (section 3.2.3.1) were considered, for the remaining ones, the indicator is not applicable. Countries that ratified ILO convention No. 169 (ILO 1989) got one point, countries that didn´t 0 points. If a UN report was available (OHCHR 2015), for a country it also got 1 point, otherwise 0 points. Regarding the adoption of the Declaration on the rights of indigenous peoples (UN-DESA 2007), there were several options: countries that voted for the adoption received 3 points, countries abstaining from voting and those that are not members of the UN General Assembly received 2 points, absent countries got 1 point, and countries voting against the adoption received 0 points. The final score for each country was calculated by summing up the individual.

Risk assessment: Risk of a precarious legal situation regarding human rights of indigenous peoples

According to the score the following risk scale was developed.

Indicator value y, score	Risk level
y ≥ 5	very low risk
y = 4	low risk
y = 3	medium risk
y = 2	high risk
y = 1 or 0	very high risk
–	no data

SDG	SPD (PCR)	GRI
	**Applicable**	**GRI 411-1**

3.2.4 Subcategory Secure living condition

3.2.4.1 Homicides

This indicator measures the prevalence of intentional homicides per 100,000 population, reflecting the level of violence and safety experienced by local communities. Homicide rates are considered a key proxy for the overall security of living conditions, as they represent the most severe form of interpersonal violence and can undermine social cohesion, economic development, and human rights (UNODC, 2023). While homicides are only one aspect of broader crime and violence patterns, they provide a critical baseline for assessing the risk of violence in a country or region.

Data Collection and Attribution

Data for this indicator are sourced from the *Global Study on Homicide 2023* by the United Nations Office on Drugs and Crime (UNODC). The report compiles data from national statistical offices, law enforcement records, public health systems, and international databases. Homicide rates are typically reported as the number of intentional homicides per 100,000 inhabitants per year. The data reflect the most recent available year per country, and while definitions and reporting practices may vary slightly, the UNODC harmonizes data across sources to allow for international comparisons. Countries without available data were assigned a "no data" value.

Risk Assessment: Risk of Insecure Living Conditions Due to Homicide Rates

The risk assessment is based on the national homicide rate, following the scale below:

Indicator value y (homicides per 100,000)	Risk Level
0	No risk
0 < y < 1	Very low risk
1 ≤ y < 2	Low risk
2 ≤ y < 4	Medium risk
4 ≤ y < 9	High risk
y ≥ 9	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.2.4.2 Internally Displaced People

This indicator measures the number of people per 100,000 population who have been forcibly displaced within their own country due to conflict, violence, disasters, or other human rights violations. High levels of internal displacement are a significant threat to secure living conditions, as they often result in loss of housing, livelihoods, community networks, and access to basic services (Internal Displacement Monitoring Centre [IDMC], n.d.). Internally displaced people (IDPs) are among the most vulnerable populations, facing heightened risks of poverty, food insecurity, and exploitation, while also straining the capacities of host communities and governments.

Data Collection and Attribution

Data for this indicator are sourced from the Internal Displacement Monitoring Centre (IDMC) Global Internal Displacement Database, which compiles information from national governments, UN agencies, NGOs, and academic research (IDMC, n.d.). The indicator reflects the annual number of internally displaced people per 100,000 inhabitants. Where national data are unavailable, IDMC applies estimation techniques based on regional trends, historical data, and reports from partner organizations. Countries without sufficient data were assigned a “no data” value.

Risk Assessment: Risk of Insecure Living Conditions Due to Internal Displacement

The risk assessment is based on the number of internally displaced people per 100,000 population, following the scale below:

Indicator value, y (IDPs per 100,000)	Risk Level
0	No risk
0 < y < 6	Very low risk
6 ≤ y < 33	Low risk
33 ≤ y < 213	Medium risk
213 ≤ y < 2547	High risk
y ≥ 2547	Very high risk
-	No data

SDG	SPD (PCR)	GRI
 	**Not Applicable**	**/**

3.3 Stakeholder Society

According to Di Xu et al. (2020), the stakeholder group Society corresponds to "both the national and global society affected by the system." This stakeholder encompasses a wide range of subcategories, including health and safety, governance, poverty alleviation, education, and environmental justice. Indicators such as life expectancy, access to education, political stability, and pollution levels help assess how a system supports or undermines social well-being across various dimensions. Considering society's perspective ensures that S-LCAs reflect not only localized effects but also systemic and far-reaching social consequences.

Subcategory	Indicator
Contribution to Economic Development	Contribution to economic development
	Embodied value-added total
	Labour productivity
	Informal employment, total
	Informal employment, male
	Informal employment, female
Health and Safety	Health expenditure, total
	Health expenditure, domestic general government

Subcategory	Indicator
	Health expenditure, out-of-pocket
	Health expenditure, external resources
	Life expectancy at birth
	Household air pollution attributable DALYs, female
	Household air pollution attributable DALYs, male
Secure Living Condition	Global peace index
	Global terrorism index
	Social protection expenditures
Censorship and Oppression	Internet freedom scores
	Freedom of the press
Access to Immaterial Resources	Global freedom Scores
Ethical Treatment of Animals	Animal protection
Nature	Biodiversity & Habitat
	Ecosystem services
	Number of threatened species
Governance	Political stability and absence of violence
	State of democracy
Poverty Alleviation	Population below national poverty line
	Food insecurity
	Safe access to drinking water coverage
	Sanitation coverage
Technology development	R&D expenditures
	Rate of researchers
	Access to electricity

Subcategory	Indicator
	Access to internet
Education and Upskilling opportunities	Illiteracy rate, female
	Illiteracy rate, male
	Illiteracy rate, total
	Public expenditure on education
	Youth illiteracy rate, female
	Youth illiteracy rate, male
	Youth illiteracy rate, total
	Youth unemployment

3.3.1 Subcategory Contribution to economic development

Overview

This subcategory strives to draw a picture of the overall economic (and educational) situation in a country, assess the contribution of organizations and industries to it, and to provide ways for companies to foster economic development. The latter can be realized by creating jobs, providing education and training, making local investments, or forwarding research (see UNEP 2022 p. 117).

The subcategory is evaluated by the indicators “Contribution of the sector to economic development”, “Public expenditure on education”, illiteracy rates disaggregated by age and sex, and “Embodied value-added total”.

3.3.1.1 Contribution of the sector to economic development

The indicator assesses to what extent the sectors contribute to the economic development of the country. It is measured as the monetary contribution to a country´s Gross Domestic Product (GDP). This metric can be understood as an indication for other types of contributions to economic development, e.g. the creation of jobs, education and training, investments in businesses/ infrastructure etc.

Values are expressed as a sector´s share of the GDP or Value added at current prices in percent.

Data collection and attribution

Data is mainly derived from the United Nations Statistics Division (UNSTAT 2023) that provides the shares of different sectors classified by ISIC of the total GDP for the year 2022. Values were added to the equivalent sectors in PSILCA, with attribution being performed for missing data.

Opportunity assessment: Extent of a sector contribution to the national economic – hence social – development

This is the first indicator determined to measure positive impacts on a society. The extent of a sector contribution to economic development is expressed by opportunity levels. The opportunity levels evaluation is based on the quintile distribution of the data.

Indicator value y, % of GDP	Opportunity level
n.a.	No data
0 = y < 1	No opportunity
1 ≤ y <10	Low opportunity
10 ≤ y < 25	Medium opportunity
25 ≤ y	Very High opportunity

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 201-1**

3.3.1.2 Embodied value-added total

The embodied value-added total reflects an average value of the difference between the sale price and the production cost in relation to 1 dollar of the output product within various sectors. The indicator is extracted directly from the EORA database **3** and attributed as it is to PSILCA sectors. No further documentation is available from the EORA database.

The indicator data was taken from EORA from the year 2019, and therefore it should be noted that the Time Data Quality (DQ) indicator was set to 5.

Risk assessment: Embodied value-added total

The risk levels were determined using a quintile-based distribution of the data. The higher the value added per USD, the higher the opportunity. The risk levels are as in the table below:

Indicator value y, $/$	Risk level
y > 0.59	Very high opportunity
0.46 < y ≤ 0.59	High opportunity
0.35 < y ≤ 0.46	Medium opportunity
0.24 < y ≤ 0.35	Low opportunity
0.24 > y	Very low opportunity
0.00	No opportunity
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 201-1**

3.3.1.3 Labour Productivity

Labour productivity measures the value of goods and services produced per unit of labour input, typically expressed as output per worker or per hour worked. It reflects the efficiency and competitiveness of an economy, as well as its capacity to generate income and support social well-being (ILO, 2023f). Higher labour productivity indicates greater potential for economic growth, job creation, and poverty reduction. Conversely, low productivity is associated with stagnating economies, limited opportunities, and greater vulnerability to external shocks.

Data Collection and Attribution

Data for this indicator are sourced from the International Labour Organization (ILO) Labour Productivity Statistics, which compile national accounts data from official statistical offices, harmonized for international comparability (ILO, 2023f.).
Labour productivity is typically measured as gross domestic product (GDP) per person employed, expressed in constant 2017 international dollars at purchasing power parity (PPP). Country-level values are used directly, with countries without sufficient data assigned a "no data" value.

Risk Assessment: Risk of Limited Economic Development Due to Low Labour Productivity

The risk assessment is based on national labour productivity levels, following the scale below:

Indicator value y (GDP per person employed)	Risk Level
$y > 46$	Very low risk
$22 < y \leq 46$	Low risk
$12 < y \leq 22$	Medium risk
$5 < y \leq 12$	High risk
$y \leq 5$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 201-1**

3.3.1.4 Informal employment

Overview

In many countries, the informal economy accounts for a large share of the labour market and plays a vital role in production, job creation, and income generation. However, informal work often exposes workers to greater vulnerability and insecurity. It negatively affects income adequacy, occupational safety and health, and overall working conditions. Reducing informality is a central aim of both the Decent Work Agenda and the 2030 Agenda for Sustainable Development. Informality is tracked through Sustainable Development Goal (SDG) indicator 8.3.1. Tackling informal employment is also crucial for advancing women's economic empowerment and promoting gender equality.

To better reflect today's realities of work and align with recent measurement standards, the 21st International Conference of Labour Statisticians (ICLS) in 2023 (ILO, 2023p) adopted a resolution updating statistical definitions for the informal economy. These changes also incorporate earlier standards developed by the 19th and 20th ICLS on all forms of work and work relationships.

The updated standards acknowledge that informality exists in all countries, regardless of income level, and across all sectors, including informal, formal, and household-based activities. The resolution introduces the term "informal productive activities," which refers to any work carried out by individuals or economic units that are not, in law or in practice, governed by formal rules. It also recognizes that activities can be partly informal. The informal economy indicator framework was designed to support policymaking, monitoring, research, and analysis.

Informal work includes all remunerative work (both self-employment and wage employment) that is not regulated or protected by legal or formal arrangements.

This includes:

- Employees working without legal or social protection or employment benefits (e.g., paid leave, health insurance, pension), even if the employer is part of the formal sector.
- Self-employed workers in informal enterprises, typically small or unregistered businesses, including own-account workers, unpaid contributing family workers, and informal employers.
- Workers in households, such as domestic workers without formal contracts or protections.

Key Characteristics:

- Lack of social protection (e.g., health insurance, pensions)
- No written contract or job security
- Work in unregistered or small-scale enterprises
- Not covered by Labour legislation

Data collection and attribution

Data for the indicator was taken from the ILOSTAT database for the dataset 'SDG indicator 8.3.1 – Proportion of informal employment in total employment by sex and sector (%) - Annual'. The data was provided as a percentage.

Due to the different sector classification in the original source and Eora, the majority of the sectors had

to be mapped the same way as for other indicators. Original data were provided by the most general classification of ISIC tabulation, hence in most cases data was assigned to subordinate sectors. When data for some sectors was missing, mean values were calculated across sectors for a specific country. Additionally, there were some countries without any data. In these cases, an average among similar countries was calculated and attributed to all the belonging sectors.

Risk assessment

The risk levels were determined using a quintile-based distribution of the data. The higher the number of informal workers in the sector, the higher the risk. The risk levels are as in the table below:

Indicator value y, % per year	Risk level
y <= 3	Very low risk
3 < y ≤ 16	Low risk
16 < y ≤ 41	Medium risk
41 < y ≤ 74	High risk
y > 74	Very high risk
n.a.	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 201-3** **GRI 401-1**

3.3.2 Subcategory Health and Safety

Overview

This subcategory examines the overall health status of a society measured by the "Health expenditures" and the "Life expectancy at birth". It assesses the overall health conditions under that a company or sector is operating and points out the potential of improving the health system. The latter can be done by investments in health facilities, better health information systems, or better trained human resources.

3.3.2.1 Health expenditure

Health expenditure is one of the key indicators to assess the health systems of countries which in turn are essential to combat disease and improve the health of populations. Health systems are defined as "the combined arrangements of institutions and actions whose primary purpose is to promote, restore, or maintain health" (World Bank 2015). Effective health systems are considered as important for human and economic development.

This indicator is divided into four sub-indicators defined in the following.

Health expenditure, total

The indicator *"Current health expenditures (as a percentage of GDP)" from the World Bank (2022a) is*

used. It represents "healthcare goods and services consumed during each year, [excluding] capital health expenditures such as buildings, machinery, IT and stocks of vaccines." (World Bank 2022a).

It is an indication for the overall health status of a society. Total health expenditure is provided in % out of the national GDP.

These expenditures can be covered by domestic or external resources. The domestic resources can be broken down in two elements: the general government health expenditures and the private health expenditures.

Health expenditure, domestic general government

"Share or current health expenditures funded from domestic public sources for health. Domestic public sources include domestic revenue as internal transfers and grants, subsidies to voluntary health insurance beneficiaries, no-profit serving households or enterprise financing schemes as well as compulsory prepayment and social health insurance contributions." (World Bank 2022b)

It is an indication of the importance given by the government to allocate public resources to health spending. This indicator is expressed as a percentage of the current health expenditures.

Health expenditure, out-of-pocket

As stated earlier, a share of the current health expenditures is funded from domestic private sources. These sources include funds from households, corporations, and non-profit organizations. The payments by households are referred as out-of-pocket expenditure, defined by the World Bank as:

"Out-of-pocket expenditure is any direct outlay by households, including gratuities and in-kind payments, to health practitioners and suppliers of pharmaceuticals, therapeutic appliances, and other goods and services whose primary intent is to contribute to the restoration or enhancement of the health status of individuals or population groups. It is a part of private health expenditure." (World Bank 2022d)

Generally, in low-income countries "out-of-pocket expenditure makes up the largest proportion of private expenditures" (ibid.) showing that public health expenditures are not sufficient to cover health issues. Therefore, impoverished households are greatly put at a disadvantage because they are discouraged to access needed preventive or curative care (see ibid.). The indicator is provided in % of the total health expenditure.

Health expenditure, external resources

"External resources for health are funds or services in kind that are provided by entities not part of the country in question. The resources may come from international organizations, other countries through bilateral arrangements, or foreign nongovernmental organizations. These resources are part of total health expenditure." (World Bank 2014c)

High external resources for health are normally an indication of very poor health systems. The indicator is measured in % of the total health expenditure.

Data collection and attribution

Data were drawn from the World Development Indicators about health systems (World Bank 2017)

which in turn are based on the Global Health Expenditure Database by the WHO[4] where the respective percentage values were provided for 2016. The data are available for 214 countries; values for health expenditure from external resources were provided for 163 EORA countries. For the remaining countries, values from one adequate country group were used.

Risk assessment: Risk of unfair health systems and a poor health status of the population

The basic idea behind the risk assessment for health expenditure indicators is that a relatively high share of public expenditure and relatively low shares of private expenditures indicate strong and fair health systems being "key to combating disease and improving the health status of populations" (World Bank 2017) (of course, there are exceptions like specific diseases in industrialized countries, e.g. obesity). There is no need to say that healthy people are one condition for a strong workforce, better economic development and less emigration.

In the following, risk scales for each sub-indicator are presented. They are all oriented roughly at the respective mean values.

Health expenditure, total

By this indicator, rather the overall health status of the population can be assumed. Since it combines public and private expenditures, it does not say anything about the fairness of the health system. Given as the percentage of the GDP, it is not a straightforward indication for the effectiveness of health systems neither because the need for health investments does not grow with a growing GDP. This is illustrated by the fact that among the 10 countries with the highest shares there are Germany, Switzerland and the Netherlands as well as Lesotho, Sierra Leone and Liberia. Therefore, this indicator might only provide an orientation for the risk of a poor health status.

Indicator value y, % of GDP	Risk level
$0 \leq y < 2.5$	very high risk
$2.5 \leq y < 5$	high risk
$5 \leq y < 10$	medium risk
$10 \leq y < 15$	low risk
$15 \leq y$	very low risk
-	no data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 403-1**

[4] WHO. Global Health Expenditure Database. Available at: http://apps.who.int/nha/database. Accessed: 28/12/22

Health expenditure, domestic general government

As mentioned above, high shares of public health expenditures are generally an indication for a rather fair health system. Considering that they are accompanied by low shares of private health expenditures, also a rather effective health system can be assumed.

It is thus assumed that higher shares imply a lower risk of poor health states.

Indicator value y, % of total health expenditure	Risk level
0 ≤ y < 20	very high risk
20 ≤ y < 40	high risk
40 ≤ y < 60	medium risk
60 ≤ y < 80	low risk
80 ≤ y	very low risk
-	no data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 403-1**

Health expenditure, out-of-pocket

As mentioned above, high shares of out-of-pocket health expenditures indicate that the public health system is not enough to cover needed health care and, hence, discriminates poor population groups. Therefore, the following risk scale is selected:

Indicator value y, % of total health expenditure	Risk level
0 ≤ y < 10	very low risk
10 ≤ y < 20	low risk
20 ≤ y < 35	medium risk
35 ≤ y < 50	high risk
50 ≤ y	very high risk
-	no data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 403-1**

Health expenditure, external resources

High shares of external resources for health usually imply a very poor local health system. Therefore, high shares are considered as an urgent need for health expenditure, indicating a high risk of a poor health status of the population.

Indicator value y, % of total health expenditure	Risk level
0 ≤ y < 2.5	very low risk
2.5 ≤ y < 5	low risk
5 ≤ y < 10	medium risk
10 ≤ y < 20	high risk
20 ≤ y	very high risk
-	no data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 403-1**

3.3.2.2 Life expectancy at birth

This indicator is useful to reveal critical living conditions in different countries. It can further be an indication of a good/ bad national health system.

A definition of "Life expectancy at birth" is provided by World Bank (2022g):

"Life expectancy at birth indicates the number of years a new born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life."

Measured in years, the values of life expectancy at birth can be easily compared between several countries.

Data collection and attribution

Data were drawn from the World Bank database and values are provided for years between 2011 and 2014. For each country, most recent data were taken. For six countries, averages over countries with similar conditions were calculated and assigned.

Risk assessment: Risk of bad living conditions (and poor healthcare)

The risk evaluation scale is based, on the one hand, on the "Programme of Action" for the world´s population and development (UN 2014, p. 81):

"Countries should aim to achieve by 2005 a life expectancy at birth greater than 70 years and by 2015 a life expectancy at birth greater than 75 years. Countries with the highest levels of mortality should aim to achieve by 2005 a life expectancy at birth greater than 65 years and by 2015 a life expectancy at birth greater than 70 years."

A life expectancy of at least 70 or 75 years (for developed countries and those with still high mortality rates, respectively) is recommended. Therefore, life expectancies between 70 and 75 years are considered as a low risk of bad living conditions.

The final risk evaluation scale, on the other hand, is built after checking the distribution of the data. This is shown in Figure 16.

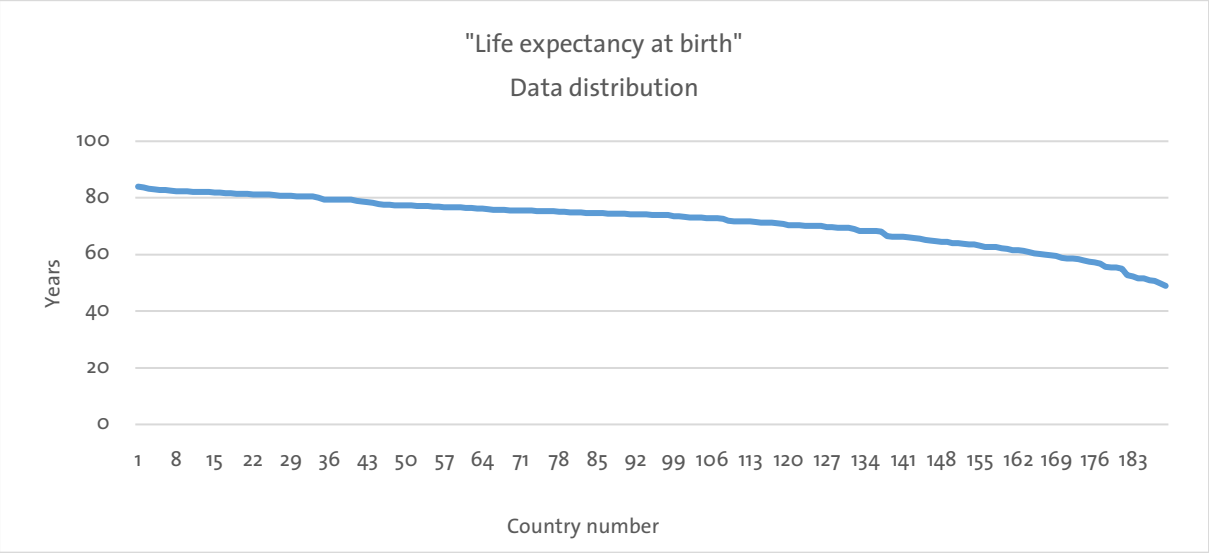


Figure 16: Life expectancy at birth in years for all 189 countries in PSILCA

Indicator value y, years	Risk level
80 ≤ y	No risk
75 ≤ y < 80	very low risk
70 ≤ y < 75	low risk
65 ≤ y < 70	medium risk
60 ≤ y < 65	high risk
60 ≥ y	very high risk

SDG	SPD (PCR)	GRI
3 GOOD HEALTH AND WELL-BEING	**Not Applicable**	**GRI 403-1**

3.3.2.3 Household Air Pollution Attributable DALYs

Household air pollution attributable disability-adjusted life years (DALYs) measure the burden of disease caused by exposure to air pollution from household sources, such as the use of polluting fuels and technologies. The burden is expressed as the number of DALYs per 100,000 population, age-

standardized to account for differences in population structures (WHO, 2024). DALYs represent the combined years of life lost due to premature mortality and years lived with disability resulting from exposure to pollutants, particularly fine particulate matter, which has the strongest known health impact.

Data Collection and Attribution

Data for this indicator are derived from comparative risk assessment methods applied by the World Health Organization (WHO, 2024). These estimates combine epidemiological evidence on exposure-disease relationships with data on population exposure levels. The estimates are disaggregated by sex (female and male) and consider specific diseases such as lower respiratory infections, stroke, ischaemic heart disease, chronic obstructive pulmonary disease, and lung cancer. The primary sources include the WHO Global Health Estimates and the UN World Population Prospects. DALY rates are age-standardized to allow for meaningful comparisons across countries with different demographic profiles. Countries without available data were assigned a "no data" value.

Risk Assessment: Risk of Health Burden from Pollution

The risk assessment is based on the age-standardized DALY rate per 100,000 population, following the scale below:

Indicator value y (cases per 1000 inhabitants)	Risk Level
0	No risk
$0 < y < 434$	Very low risk
$434 \leq y < 1182$	Low risk
$1182 \leq y < 2278$	Medium risk
$2278 \leq y < 4872$	High risk
$y \geq 4872$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.3 Subcategory Secure Living conditions

3.3.3.1 Global Peace Index

The Global Peace Index (GPI) measures the relative peacefulness of countries and regions by assessing the presence or absence of violence, conflict, and fear of violence. It provides a comprehensive analysis of a country's security situation based on 23 qualitative and quantitative indicators across three domains:

- Societal Safety and Security,

- Ongoing Domestic and International Conflict, and
- Degree of Militarization (Institute for Economics and Peace [IEP], 2024).

The GPI score reflects factors such as crime rates, political instability, conflicts, and access to weapons, which directly impact the security and well-being of individuals and communities.

Data Collection and Attribution

Data for this indicator are sourced from the Global Peace Index, compiled by the Institute for Economics and Peace (IEP). The index is updated annually and provides standardized scores ranging from 1 (most peaceful) to 5 (least peaceful). Scores are calculated based on publicly available data from international organizations, governments, and research institutions. National-level data were used directly for risk assessment. Countries without available data are assigned a "no data" value.

Risk Assessment: Risk of Insecure Living Conditions Due to Lack of Peace

The risk assessment is based on the national GPI score, following the scale below:

Indicator value y (GPI score)	Risk Level
$y < 1.69$	Very low risk
$1.69 \leq y < 1.99$	Low risk
$1.99 \leq y < 2.17$	Medium risk
$2.17 \leq y < 2.6$	High risk
$y \geq 2.6$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.3.2 Global Terrorism Index

The Global Terrorism Index (GTI) measures the impact of terrorism in a country by evaluating the number of terrorist incidents, fatalities, injuries, and property damage. The index captures the relative risk that communities face from terrorism-related violence, which can threaten security, undermine social cohesion, and disrupt access to basic services (Institute for Economics and Peace [IEP], 2024). Terrorism affects not only direct victims but also the broader population through fear, displacement, and economic instability, making it a critical indicator of secure living conditions.

Data Collection and Attribution

Data for this indicator are sourced from the Global Terrorism Index, compiled annually by the Institute for Economics and Peace (IEP). The GTI is based on data from the Global Terrorism Database (GTD), which includes systematically coded information on terrorist incidents worldwide.

The index provides standardized scores ranging from 0 (no impact of terrorism) to 10 (highest impact). Country-level data are used directly for risk assessment. Countries without available data are assigned a "no data" value.

Risk Assessment: Risk of Insecure Living Conditions Due to Terrorism

The risk assessment is based on national GTI scores, following the scale below:

Indicator value y (GTI score)	Risk Level
0	No risk
$0 < y < 0.62$	Very low risk
$0.62 \leq y < 1.72$	Low risk
$1.72 \leq y < 2.95$	Medium risk
$2.95 \leq y < 5.63$	High risk
$y \geq 5.63$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Applicable**	**GRI 414-2**

3.3.3.3 Social Protection Expenditures

Social protection encompasses a broad set of policies and programmes designed to reduce poverty and vulnerability throughout the life cycle, including support for children, mothers, persons with disabilities, the unemployed, older persons, and others in need (ILO 2024). It includes both contributory schemes, such as social insurance, and non-contributory schemes, such as social assistance and universal transfers. The coverage and adequacy of social protection vary widely across countries, reflecting differing institutional capacities, fiscal space, and political priorities. To monitor progress, data on social protection coverage, expenditure, and adequacy are collected on a country-by-country basis and typically expressed as a share of GDP.

Data collection and attribution

Data are taken from the ILO World Social Protection Data Dashboards (ILO2023). The sub-indicator "Social protection expenditure" was selected as basis for data collection. The dataset gives the public social protection expenditures per country, as a percentage of GDP.

Data for 2023 or the latest available year was used. Information was available for most countries, with the exception of 22 countries for which no data was reported.

Risk assessment: Risk that workers are not socially protected if they are unable to work

The following risk scale is based on average social security expenditures related to GDP worldwide. For interpreting the indicator values, it should be mentioned that countries with the same value can face

totally different situations of social security. For example, if GDP of a country is quite high, lower percentages can already be sufficient to provide a sound social security system (e.g., Switzerland and New Zealand). Especially in developing countries, GDP is rather low, but medical or living costs can be very high, which in turn would require higher social security expenditures. However, these issues are not considered in the current version of PSILCA.

Indicator value y, % of GDP	Risk level
19 < y	very low risk
11 < y ≤ 19	low risk
7 < y ≤ 11	medium risk
3 < y ≤ 7	high risk
3 > y	very high risk
-	no data

SDG	SPD (PCR)	GRI
	**Applicable**	**GRI 414-2**

3.3.4 Subcategory Censorship and Oppression

3.3.4.1 Internet Freedom Scores

Internet freedom measures the extent to which individuals enjoy rights to access, express, and share information freely online without undue restrictions or repercussions. The Freedom on the Net index developed by Freedom House assesses the state of internet freedom in each country, considering factors such as access barriers, censorship, surveillance, and violations of user rights (Freedom House, 2024). The methodology is grounded in international human rights standards, particularly Article 19 of the Universal Declaration of Human Rights, emphasizing free expression, access to information, privacy protection, and safeguards against illegitimate restrictions.

Data Collection and Attribution

Data for this indicator are drawn from Freedom House's *Freedom on the Net 2024* report, which scores countries across 21 primary questions and nearly 100 sub questions divided into three categories: Obstacles to Access, Limits on Content, and Violations of User Rights. Each country receives an overall internet freedom score between 0 and 100, with higher scores indicating greater freedom. Although Freedom House applies its own thresholds (Free, Partly Free, Not Free), for consistency within the PSILCA database, risk levels were reassigned based on the reference scale familiar in PSILCA. Countries without available data were assigned a "no data" value.

Risk Assessment: Risk of Restricted Internet Freedom

The risk assessment is based on the adjusted national internet freedom score, following the scale below:

Indicator value y,	Risk Level
100	No risk
74 < y ≤ 100	Very low risk
60 < y ≤ 74	Low risk
48 < y ≤ 60	Medium risk
29 < y ≤ 48	High risk
y ≤ 29	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.4.2 Freedom of the Press

Freedom of the press measures the extent to which journalists, media organizations, and citizens can operate free from censorship, legal restrictions, harassment, and violence. It reflects a country's commitment to fundamental civil liberties, democratic accountability, and the right to information (RSF], 2025).
A free and independent press is critical for a healthy society, fostering transparency, informed public debate, and civic engagement. Conversely, restrictions on press freedom indicate the presence of censorship, propaganda, and oppression, undermining democratic institutions.

Data Collection and Attribution

Data for this indicator are sourced from the World Press Freedom Index, compiled annually by Reporters Without Borders (RSF). The index is based on a detailed methodology combining expert assessments and quantitative data across five categories: political context, legal framework, economic context, sociocultural context, and security. Scores are normalized on a scale from 0 to 100, where higher scores indicate greater press freedom.
For risk assessment in PSILCA, these scores are mapped into risk levels based on standardized thresholds. Countries without available data were assigned a "no data" value.

Risk Assessment: Risk of Press Censorship and Suppression

The risk assessment is based on national press freedom scores, following the scale below:

Indicator value (Press Freedom Index Score)	Risk Level
0	No risk
85 < y ≤ 100	Very low risk
70 < y ≤ 85	Low risk
55 < y ≤ 70	Medium risk
40 < y ≤ 55	High risk
y ≤ 40	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.5 Subcategory Access to Immaterial resources

3.3.5.1 Global Freedom Scores

Global freedom scores measure the extent to which individuals in a given country enjoy fundamental civil liberties and political rights. Freedom House's *Freedom in the World* index assesses each country's political environment and protection of civil rights, evaluating the ability of people to participate freely in political processes, exercise freedom of expression and belief, associate freely, and enjoy rule of law and personal autonomy (Freedom House, 2024). These scores reflect not only the behavior of governments but also the broader conditions that affect democratic participation and human rights protections.

Data Collection and Attribution

Data for this indicator are based on Freedom House's *Freedom in the World 2024* methodology. Countries are scored on 25 indicators across two main categories: political rights and civil liberties. Each country or territory receives a total score ranging from 0 (least free) to 100 (most free). For consistency with PSILCA's risk framework, national scores were mapped to adjusted risk categories based on a standardized reference scale. Countries without available data were assigned a "no data" value.

Risk Assessment: Risk of Limited Civil Liberties and Political Rights

The risk assessment is based on the adjusted national global freedom score, following the scale below:

Indicator value y (%)	Risk Level
$y > 90$	Very low risk
$68 < y \leq 90$	Low risk
$44 < y \leq 68$	Medium risk
$18 < y \leq 44$	High risk
$y \leq 18$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.6 Subcategory Ethical Treatment of Animals

3.3.6.1 Animal Protection

Animal protection scores measure the extent to which countries have adopted and implemented legislation, policies, and practices that promote the welfare and humane treatment of animals. The scores are developed by World Animal Protection, based on a comprehensive assessment across several categories including farm animal welfare, companion animal welfare, working animals, wildlife protection, and animals used in research (World Animal Protection, n.d.). Higher grades reflect stronger national commitments to animal welfare standards, while lower grades indicate weak or absent protection measures.

Data collection and attribution

Data for this indicator are sourced from the *World Animal Protection Global Index*, which evaluates countries based on legal frameworks, enforcement mechanisms, and practical actions in favor of animal welfare (World Animal Protection, n.d.). Countries are assigned a score from A to G, with A representing the highest level of animal protection and G the lowest. For risk assessment in PSILCA, these letter grades were translated into numeric categories (1–5) to allow for standardized risk evaluation. Countries without available data were assigned a "no data" value.

Risk Assessment: Risk of Poor Animal Welfare Protections

The risk assessment is based on the adapted scoring categories, following the scale below:

Indicator value y, Score	Risk Level
Score A (1)	very low risk
Score B (2)	low risk
Score C (3)	medium risk
Score D, E (4)	high risk
Score F, G (5)	very high risk
-	no data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.7 Subcategory Nature

3.3.7.1 Biodiversity & Habitat

The Biodiversity and Habitat indicator measures a country's efforts to conserve ecosystems, protect critical habitats, and safeguard species diversity. It captures how effectively national policies maintain and restore biodiversity through protected areas, habitat preservation, and species protection initiatives (Block et al., 2024). Healthy biodiversity is essential for ecosystem resilience, climate adaptation, food security, and overall planetary health. Loss of biodiversity weakens ecosystem services, increases

extinction risk, and threatens sustainable development.

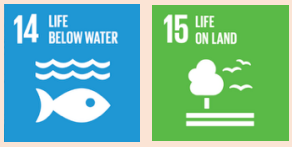
Data collection and attribution

Data for this indicator are derived from the 2024 Environmental Performance Index (EPI) compiled by Yale University. The Biodiversity and Habitat (BDH) score is a composite measure based on twelve subindicators, including Marine and Terrestrial Key Biodiversity Area Protection, Species Protection Index, Terrestrial Biome Protection, Protected Area Representativeness and Effectiveness, Red List Index, Species Habitat Index, and Bioclimatic Ecosystem Resilience Index, among others (Block et al., 2024). Each sub-indicator is weighted according to its importance within the BDH category, and national scores are aggregated into a single percentage score from 0 (worst) to 100 (best). Countries without available data for one or more subcomponents were still assigned a BDH score where possible, otherwise assigned a "no data" value.

Risk Assessment: Risk of Biodiversity Loss and Habitat Degradation

The risk assessment is based on the national Biodiversity and Habitat score, following the scale below:

Indicator value y (score)	Risk Level
$y > 64$	Very low risk
$53 < y \leq 64$	Low risk
$45 < y \leq 53$	Medium risk
$30 < y \leq 45$	High risk
$y \leq 30$	Very high risk

SDG	SPD (PCR)	GEI
	**Not Applicable**	**GRI 201-2**

3.3.7.2 Ecosystem Services

The Ecosystem Services indicator measures how well countries protect and manage critical terrestrial ecosystems that provide essential services such as carbon sequestration, biodiversity support, water regulation, and climate resilience (Wolf et al., 2022). Healthy ecosystems are vital for mitigating the impacts of climate change, supporting livelihoods, and maintaining ecological stability. Degradation of these services can significantly increase vulnerability to natural disasters and diminish agricultural and water resources.

Data collection and attribution

Data for this indicator are sourced from the 2022 Environmental Performance Index (EPI) compiled by Yale University. The Ecosystem Services (ECS) score is a composite index based on three core sub indicators: Tree Cover Loss; Grassland Loss and Wetland Loss.

Each sub indicator captures the state of key ecosystems, with scores weighted according to their importance in preserving ecosystem functions (Wolf et al., 2022). Country-level scores are normalized on a scale from 0 (worst) to 100 (best), reflecting performance in maintaining natural ecosystem integrity. Some countries did not have complete data and, where necessary, values were approximated using data

from countries with similar ecosystem landscapes. Countries without sufficient basis for approximation were assigned a "no data" value.

Risk Assessment: Risk of Ecosystem Services Degradation

The risk assessment is based on the national Ecosystem Services score, following the scale below:

Indicator value y, Score	Risk Level
y > 41	Very low risk
30 < y ≤ 41	Low risk
23 < y ≤ 30	Medium risk
17 < y ≤ 23	High risk
y ≤ 17	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 201-2**

3.3.7.3 Number of Threatened Species

The indicator reflects number of threatened species as a ratio of affected animals per 1 dollar of output in respect to different production sectors. The Red List Index is a measure of the aggregate extinction risk across species groups, based on changes in the number of species in each extinction risk category on The IUCN Red List of Threatened Species. It is expressed as an index ranging from 0 to 1, where a value of 1 represents no extinction risk, and a value of 0 represents all species being extinct.

Data collection and attribution

The index value for a specific country or region indicates the aggregate extinction risk for species within that country or region relative to its potential contribution to global species extinction risk, measured on a scale of 0 to 1. The Index is relevant as an indicator towards Sustainable Development Goals, specifically target 15.5, which aims to protect and prevent the extinction of threatened species by 2020.

Risk assessment

The risk levels were determined using a quintile-based distribution of the data. The higher the number of threatened species per USD, the higher the risk. The risk levels are as in the table below:

Indicator value y, # species/$1	Risk level
y > 6.53E-03	very low risk
9.70E-08 < y ≤ 6.53E-07	low risk
2.60E-08 < y ≤ 9.70E-08	medium risk
7.00E-09 < y ≤ 2.60E-08	high risk
7.00E-09 ≥ y	very high risk
0.00E+00	no risk
-	no data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.8 Subcategory Governance

3.3.8.1 Political Stability and Absence of Violence

This indicator measures perceptions of the likelihood that a government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. It reflects the degree of political stability and the absence of violence or terrorism in a country. The indicator is part of the World Bank's Worldwide Governance Indicators (WGI) project, which assesses governance performance across six dimensions.

Data collection and attribution

The Political Stability and Absence of Violence indicator is derived from a composite of various data sources, including surveys of households and firms, assessments by commercial risk-rating agencies, and reports from non-governmental organizations. These sources provide perception-based data on the likelihood of political instability and violence. The indicator is expressed in standard normal units, ranging from approximately -2.5 (weak) to 2.5 (strong) governance performance.

For PSILCA, country-level scores are assigned and mapped to the EORA sector structure. In cases where recent or complete data are unavailable, regional estimates or modelled values are utilized, drawing on data from comparable countries.

Risk Assessment: Risk of Political Instability and Violence

Lower scores on this indicator signify higher perceived risks of political instability and violence, which can adversely affect economic development, investment, and the well-being of citizens. The following risk scale is based on the standard normal distribution of scores:

Indicator value y, political stability and absence of violence (score)	Risk level
$y \leq -1.5$	very high risk
$-1.5 < y \leq -1.0$	high risk
$-1.0 < y \leq 0.0$	medium risk
$0.0 < y \leq 1.0$	low risk
$y > 1.0$	very low risk

SDG	SPD (PCR)	GRI

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.8.2 State of Democracy

This indicator measures the overall quality of democracy in a country, based on the Economist Intelligence Unit's (EIU) Democracy Index. The index evaluates countries on a scale from 0 (authoritarian) to 10 (full democracy), using 60 indicators grouped into five categories: electoral process and pluralism, functioning of government, political participation, political culture, and civil liberties. The resulting score provides a composite view of the strength and stability of democratic institutions.

Data collection and attribution

The Democracy Index is published annually by the EIU and combines expert assessments with data from public opinion surveys. It covers 167 countries and territories. For PSILCA, values are assigned at the country level and mapped to the EORA sector structure. Where recent or complete data are unavailable, regional estimates or modelled values are used, based on similar political and geographic profiles.

Risk assessment: Risk of democratic deficits and institutional instability

Lower scores reflect weaker democratic institutions, limitations in political rights and civil liberties, and higher risks of authoritarian practices. These conditions can affect human rights, social stability, and long-term governance effectiveness. The following thresholds are used to classify risk levels:

Indicator value y, Democracy Index score	Risk level
$y \leq 4.81$	very high risk
$4.81 < y \leq 5.59$	high risk
$5.59 < y \leq 6.50$	medium risk
$6.50 < y \leq 7.67$	low risk
$y > 7.67$	very low risk

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.9 Subcategory Poverty Alleviation

3.3.9.1 Population Below National Poverty Line

This indicator measures the percentage of a country's population living below the national poverty line, as defined by each nation's authorities. The national poverty line reflects the minimum income or consumption level deemed necessary to meet basic living standards within a specific country. It accounts for the cost of essential goods and services, and its determination varies across countries based

on economic, social, and cultural contexts.

Data collection and attribution

Data are primarily sourced from national household surveys, including the Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS), among others. These surveys are compiled and harmonized by international organizations such as the United Nations Development Programme (UNDP) and the World Bank. For PSILCA, country-level values are integrated into the EORA sector structure. In instances where recent or complete data are unavailable, regional estimates or modelled values are utilized, drawing on data from neighbouring countries and relevant economic-geographical groupings.

Risk assessment: Risk of poverty prevalence in the country

Higher percentages of the population living below the national poverty line indicate greater prevalence of poverty, which can lead to adverse outcomes such as limited access to education, healthcare, and employment opportunities, as well as increased vulnerability to economic shocks. The following thresholds are used to classify risk levels:

Indicator value y, % of population below national poverty line	Risk level
$y \leq 19.06$	very low risk
$19.06 < y \leq 25.16$	low risk
$25.1600 < y \leq 38.22$	medium risk
$38.22 < y \leq 46.62$	high risk
$y > 46.62$	very high risk

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 201-1**

3.3.9.2 Food Insecurity

Food insecurity measures the extent to which individuals lack reliable access to sufficient, safe, and nutritious food to meet their dietary needs. It reflects both the immediate risks of hunger and malnutrition, as well as long-term challenges to poverty alleviation and sustainable development (Global Hunger Index [GHI], n.d.).

Food insecurity undermines human health, economic productivity, and social stability, with severe consequences for vulnerable populations, including children and low-income households.

Data collection and attribution

Data for this indicator are derived from the Global Hunger Index (GHI), which combines four weighted components:

- Undernourishment,
- Child stunting,

- Child wasting, and
- Child mortality

These components are measured using data from sources such as the Food and Agriculture Organization (FAO), UNICEF, and the World Health Organization (WHO), and are aggregated into a single score on a 100-point scale, where higher scores indicate greater levels of hunger and food insecurity (GHI, n.d.). National-level GHI scores are used directly for risk assessment. Countries without available data are assigned a "no data" value.

Risk Assessment: Risk of Food Insecurity Impacting Poverty Alleviation

The risk assessment is based on national GHI scores, following the scale below:

Indicator value y (GHI score)	Risk Level
0	No risk
0 < y < 5	Very low risk
5 ≤ y < 10	Low risk
10 ≤ y < 17	Medium risk
17 ≤ y < 26	High risk
y ≥ 26	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.9.3 Safe Access to Drinking Water Coverage

This indicator serves to assess the availability and accessibility of uncontaminated water for domestic use. Data for drinking water coverage is based on information about the share of population with access to a safely managed improved water source:

"'Improved' sources are those that are potentially capable of delivering safe water by nature of their design and construction. These include piped water, boreholes or tube wells, protected dug wells, protected springs, and rainwater." (WHO 2017, p. 13)

Now, to meet the threshold for a "safely managed" service, the improved water source must comply with the three following conditions:

"• source should be located on premises (within the dwelling, yard or plot),

• water should be available when needed, and

• water supplied should be free from faecal and priority chemical contamination." (ibid.)

If any of the three criteria is not fulfilled and a roundtrip to the next available improved water source is less than 30 minutes roundtrip away from home, the service is classified as "basic access" (see ibid.).

Although data coverage for the basic service is much broader, it was decided to use values for "safely managed" because it refers to a water supply free from faecal and priority chemical contamination. According to the above cited definition, "basic access" is no indication for uncontaminated water.

As the indicator also indirectly shows the share of the population without access to an improved drinking water source, it serves to assess the vulnerability of populations and local communities to water pollution and water shortages. Hence, people's exposure to diseases can be derived. Vice versa, the indicator provides information about the potential for companies to engage in improving water treatment and water supply.

Data collection and attribution

The indicator consists of 3 sub-indicators namely Urban, Rural and the total percentage of drinking water coverage. If one of the sub-indicators does not fit into the range of 85-100%, then the indicator does not comply with the overall threshold for the drinking water coverage and was marked as a failed one. That is why some of countries with relatively high level of the drinking water coverage were given a high risk of possible social impacts.

Data was gathered from WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (WHO/UNICEF 2017) which provides comprehensive data about water infrastructure for several years in urban, rural and national areas worldwide. The most current values, from 2015 were selected.

Due to the new and more specific definition, values for "safely managed" drinking water cover only 88 countries. Countries without this specific information received data from "at least basic" drinking water provision. Since this coverage is usually better for basic water supply, i.e. the values are higher, the risk assessment was adapted. Hence, risk levels given in the table below are valid for the next lower range of values. Only Former USSR and Taiwan remained without data.

Risk that people do not have access to safely managed drinking water

According to the definition of "safely managed", the given values theoretically only refer to a water supply free from any contamination located on premises. This means that the share of people with basic access to an improved water source, or even limited or no access, are either potentially in danger of using contaminated water, or safe drinking water is not always available or accessible. The latter implies that water might be stored for several hours or days because of convenience which in turn can hold the risk of diseases. Therefore, only very high percentages of drinking water coverages are considered as very low risk.

These risk scales are adapted if data for "at least basic" drinking water coverage were used (see explanation above for "basic coverage").

Indicator value y, % of population	Risk level
100 = y	no risk
95 < y < 100	very low risk
90 < y ≤ 95	low risk
85 < y ≤ 90	medium risk
80 < y ≤ 85	high risk
y ≤ 80	very high risk
-	no data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**GRI 303-1**

3.3.9.4 Sanitation Coverage

For this indicator, values for the proportion of the population using improved and safely managed sanitation facilities were selected. This indicator also follows a definition by the World Health Organization where "safely managed" means:

> *"Use of improved facilities which are not shared with other households and where excreta are safely disposed in situ or transported and treated off-site [...] Improved facilities include: flush/pour flush to piped sewer system, septic tanks or pit latrines [sic!]; ventilated improved pit latrines, composting toilets or pit latrines with slabs"* (WHO/UNICEF 2017)

Populations with lower sanitation coverage are exposed to a higher risk of infectious diseases and epidemics. Assuming that low access to improved and safely managed sanitation facilities is accompanied by lower water treatment rates, the indicator also provides information about general water quality (e.g. because wastewater might be piped directly into rivers). This should motivate companies to improve sanitation facilities.

Data collection and attribution

As for "Drinking water coverage" data was also gathered from WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (WHO/UNICEF 2017). Values are generally from 2015. Countries without raw values got an average over similar countries.

Risk assessment: Risk that population does not have access to facility safely managed sanitation service

Considering that the percentage values also include pit latrines and composting toilets, the remaining population indeed has no access to an appropriate sanitation facility. Therefore, only very high percentages of sanitation coverage are considered as very low risk of insufficient sanitation facilities.

Indicator value y, % of population	Risk level
100 = y	no risk
95 < y < 100	very low risk
90 < y ≤ 95	low risk
85 < y ≤ 90	medium risk
80 < y ≤ 85	high risk
y ≤ 80	very high risk
-	no data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.10 Subcategory Technology Development

3.3.10.1 R&D expenditures

This indicator measures a country's gross domestic expenditure on research and development (GERD) as a percentage of its gross domestic product (GDP). It captures the relative priority given to R&D within national economies and is a key measure of innovation capacity and long-term competitiveness. GERD includes expenditures on R&D activities by business enterprises, government, higher education, and private non-profit institutions.

Data collection and attribution

Data are collected through national R&D surveys following international standards outlined in the OECD's Frascati Manual. The UNESCO Institute for Statistics (UIS) compiles this information, drawing from national sources and regional partners such as OECD, Eurostat, and RICYT. For PSILCA, country-level values are mapped to the EORA sector structure. Where national data are missing or outdated, regional averages or modelled estimates are used.

Risk assessment: Risk of insufficient investment in research and development

Low R&D intensity is associated with weak innovation ecosystems, lower productivity growth, and reduced technological capacity. The following thresholds classify countries by the level of risk associated with insufficient R&D expenditure:

Indicator value y, R&D expenditure as % of GDP	Risk level
$y \leq 0.25$	very high risk
$0.25 < y \leq 0.28$	high risk
$0.28 < y \leq 0.64$	medium risk
$0.64 < y \leq 1.42$	low risk
$y > 1.42$	very low risk

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.10.2 Rate of Researchers

This indicator measures the number of researchers (in full-time equivalents) per one million inhabitants. Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods, and systems, as well as in the management of these projects. The indicator reflects

a country's capacity for scientific research, innovation, and technological advancement.

Data collection and attribution

Data are compiled by the UNESCO Institute for Statistics (UIS), based on national R&D surveys and following international standards as outlined in the OECD's Frascati Manual. The UIS harmonizes data from national statistical offices and partners such as the OECD, Eurostat, and RICYT. For PSILCA, values are assigned at the country level and mapped to the EORA sector structure. Where national data are missing or outdated, regional estimates or modelled values are used based on similarity in economic and geographic characteristics.

Risk assessment: Risk of insufficient research personnel

A low number of researchers per million inhabitants may indicate limited national capacity for knowledge production and innovation, hindering technological development, competitiveness, and sustainable growth. The following thresholds are used to classify risk levels:

Indicator value y, researchers per million inhabitants	Risk level
$y \leq 79.8$	very high risk
$79.8 < y \leq 520.02$	high risk
$520.02 < y \leq 1061.66$	medium risk
$1061.66 < y \leq 4153.43$	low risk
$y > 4153.43$	very low risk

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.10.3 Access to Electricity

Access to electricity refers to the proportion of individuals in a country or region who have electricity available in their homes. It is a key indicator of infrastructure development, energy availability, and overall socioeconomic progress (World Bank, n.d.). Electricity access enables essential activities such as lighting, refrigeration, communication, and the operation of household appliances, directly affecting health, education, and economic opportunity. Conversely, lack of access is associated with poor social outcomes and limited economic growth.

Data collection and attribution

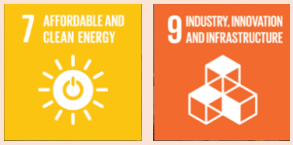
Data for this indicator are sourced from the World Bank's Global Electrification Database (GED), which compiles nationally representative household surveys, censuses, and regional datasets such as SEDLAC, MNAPOV, and ECAPOV (World Bank, n.d.).

Access rates are reported as the percentage of the population with electricity access at the national level. For countries where no current data are available, a "no data" value is assigned.

Risk Assessment: Risk of Infrastructure Limitations due to Low Electricity Access

The risk assessment is based on the national percentage of the population with electricity access, following the scale below:

Indicator Value, y (% of population with electricity access)	Risk Level
y > 98	Very low risk
91 < y ≤ 98	Low risk
67 < y ≤ 91	Medium risk
49 < y ≤ 67	High risk
y ≤ 49	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.10.4 Access to Internet

Access to the internet refers to the proportion of individuals who can connect to and use internet services through any device, whether mobile, fixed broadband, or other technologies. Internet access is a critical enabler of the digital economy, education, healthcare services, innovation, and social participation (International Telecommunication Union [ITU], 2023).

The digital revolution has expanded opportunities across sectors, but disparities in internet access continue to reflect and reinforce existing socioeconomic inequalities, particularly between high-income and low-income regions.

Data collection and attribution

Data for this indicator are sourced from the International Telecommunication Union (ITU), which collects national-level statistics on internet access through household surveys, telecommunications operator data, and administrative sources (ITU, 2023).

While operator data provide broad coverage, more recent efforts include household and business survey data to improve the accuracy of measuring internet use. Discrepancies may arise due to differences in definitions, data collection methods, and the end dates of reporting periods across countries. Country-level internet access rates are reported as the percentage of the total population with access. Countries without available data were assigned a "no data" value.

Risk Assessment: Risk of Limited Internet Access Impacting Development Opportunities
The risk assessment is based on the national percentage of individuals with internet access, following the scale below:

Indicator value y (% of individuals with internet access)	Risk Level
0	No risk
91 < y	Very low risk
82 < y ≤ 91	Low risk
72 < y ≤ 82	Medium risk
39 < y ≤ 72	High risk
y ≤ 39	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.11 Subcategory Education and Upskilling Opportunities

3.3.11.1 Illiteracy Rate

Generally speaking, illiteracy is the incapacity of a person to read or write properly. It is mainly distinguished between (primary) illiteracy – meaning that a person has never learned to read and write – and functional illiteracy occurring when a person´s reading and writing skills are insufficient to use them naturally and appropriately in daily social life (see Zeit online 2011 and Blumenfeld 2012).

For PSILCA, data are taken from the UIS that follows the concept of functional illiteracy, defined as:

> *„Adult illiteracy is defined as the percentage of the population aged 15 years and over who [cannot] both read and write with understanding a short simple statement on his/her everyday life."* (UIS 2023b)

Further, also the inability to make simple arithmetic calculations ("numeracy") is encompassed by illiteracy (ibid.).

Despite this internationally accepted definition, some countries follow slightly different concepts of illiteracy which distorts statistics. Therefore, UIS (ibid.) states:

> *"It has been observed that some countries apply definitions and criteria for literacy which are different from the international standards defined above, or equate persons with no schooling to illiterates, or change definitions between censuses. Practices for identifying literates and illiterates during actual census enumeration may also vary, as well as errors in literacy self-declaration can affect the reliability of literacy statistics."* (ibid.)

However, low illiteracy rates are an indication for an effective primary education system which is the basis for further education and profession. On the other hand, high illiteracy rates mean that more workers are not qualified for white collar jobs or higher positions which obstructs economic development of a region or a whole country.

Illiteracy rates are provided for female, male, and total population.

Data collection and attribution

Data is derived from UIS that provides information about literacy in different countries and macro regions (like Central and Eastern Europe, Lower Income countries, Western Asia...). For "Illiteracy rate" the indicators "Adult literacy rate, population 15+ years, both sexes (%)", "Adult literacy rate, population 15+ years, female (%)" and "Adult literacy rate, population 15+ years, male (%)" were selected. Values for the illiteracy rate were calculated by subtracting the literacy values from 100 and then assigned to the respective countries. Countries without data (around 40) were attributed the value of a matching macro region. After this procedure, only Former USSR was left that got the average over all countries.

Risk assessment: Risk of illiteracy

The risk assessment scale is based on the quintile distribution of rate of illiteracy across all countries. Considering the fact that values show functional illiteracy, the scale shifts a little further to higher rates. The following table shows the default risk levels.

Indicator value y, %	Risk level
$0 < y \leq 0.8$	Very low risk
$0.8 < y \leq 3.2$	Low risk
$3.2 < y \leq 5.5$	Medium risk
$5.5 < y \leq 16$	High risk
$16 < y$	Very high risk

SDG	SPD (PCR)	GRI
	**Not Applicable**	**/**

3.3.11.2 Public Expenditure on Education

This indicator is expressed as percentage of GDP. It is defined as follows:

> *„Total general (local, regional and central) government expenditure on education (current, capital, and transfers), expressed as a percentage of GDP. It includes expenditure funded by transfers from international sources to government."* (UIS 2023a)

The level of public expenditure on education is an indication for fair and equal access to education for all social strata. Values show the government priority given for education. If public expenditure is low, good and higher education might mainly be provided by private institutions reserved for wealthier groups of the society. Hence, government expenditure on education can be an indication for the overall educational level of societies. This in turn might prevent companies to settle or invest because of a possible lack of qualified and skilled labour force. To help the countries out of this vicious circle and foster economic development, organizations already established in these regions should promote education.

Data collection and attribution

Data comes from the UNESCO Institute for Statistics (UIS 2023a) providing statistics partly until 2021. Most current data for each country was selected. Data was available for 196 countries that corresponded to 191 PSILCA countries/regions. Regional averages were assigned to the remaining data regions.

Risk assessment: Risk of restricted access to education

The following risk scale is based on the quintile distribution of public expenditure on education data across the different countries.

Indicator value y, % of GDP	Risk level
$0 < y < 2.9$	Very high risk
$2.9 \leq y \leq 3.8$	High risk
$3.8 < y \leq 4.6$	Medium risk
$4.6 \leq y < 5.6$	Low risk
$5.6 \leq y$	Very low risk

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.11.3 Youth Illiteracy Rate

Youth illiteracy rate follows the same definition as illiteracy rate as the indicator 'Illiteracy rate' in section3.3.11.1, but refers only to people aged 15 to 24 years (UIS 2023b).

Youth illiteracy rates are even a stronger indication for the effectiveness of the current primary education system as they look only at the population that has just left (primary) school and should be able to read and write properly. This indicator can also provide information about potential young, qualified workers on the labour market. Data are also provided for female, male and total population, between 15 and 24 years.

Data collection and attribution

Information is again derived from the UIS. The indicators "Youth literacy rate, population 15-24 years, both sexes (%)", "Youth literacy rate, population 15-24 years, female (%)" and "Youth literacy rate, population 15-24 years, male (%)" were selected, the risk levels were applied to both genders, based on "Youth literacy rate, population 15-24 years, both sexes (%)".

Risk assessment: Risk of youth illiteracy

The risk assessment is based on the quintile distribution of the data for Youth literacy rate, population 15-24 years, both sexes (%)" across the countries. The following table shows the default risk levels:

Indicator value y, %	Risk level
0 ≤ y < 0.3	Very low risk
0.3 ≤ y < 0.9	Low risk
0.9 ≤ y < 3.4	Medium risk
3.4 ≤ y < 15	High risk
15 < y	Very high risk
n.a.	No data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.11.4 Youth Unemployment

Youth unemployment measures the percentage of the Labour force aged 15 to 24 who are unemployed, reflecting the ability of young people to access meaningful work opportunities after completing their education or training. High youth unemployment indicates challenges in transitioning from school to work, limited opportunities for skill application, and potential long-term impacts on income stability, social mobility, and overall well-being (ILO, 2024x).

Persistent youth unemployment exacerbates poverty, social exclusion, and inequality, and can fuel disillusionment, unrest, and migration.

Data collection and attribution

Data for this indicator are sourced from the ILO Labour Statistics, based on national Labour force surveys and harmonized for cross-country comparability (ILO, 2024x).

Youth unemployment is expressed as the percentage of the Labour force aged 15 to 24 who are actively seeking but unable to find work. Country-level data are used directly, and where no data is available, a "no data" value is assigned.

Risk Assessment: Risk of High Youth Unemployment Impacting Education and Upskilling Opportunities

The risk assessment is based on national youth unemployment rates, following the scale below:

Indicator value y (%)	Risk Level
y < 9.86	Very low risk
9.86 ≤ y < 15.59	Low risk
15.59 ≤ y < 21.59	Medium risk
21.59 ≤ y < 30.16	High risk
y ≥ 30.16	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.12 Subcategory Gender Equalities and Empowerment

3.3.12.1 Gender Inequalities

The Gender Inequality Index (GII) measures gender-based disparities in reproductive health, empowerment, and economic participation, reflecting the extent to which women and men have unequal access to key dimensions of human development (United Nations Development Programme [UNDP], 2023).

Higher GII values indicate greater gender inequality, with consequences for poverty reduction, social cohesion, and sustainable development. Gender inequality limits opportunities for women and girls, undermines economic productivity, and perpetuates cycles of exclusion and marginalization.

Data collection and attribution

Data for this indicator are sourced from the United Nations Development Programme (UNDP) *Human Development Report 2023–24*, which calculates the Gender Inequality Index (GII) based on three dimensions:

- Reproductive health (maternal mortality ratio and adolescent birth rate),
- Empowerment (share of parliamentary seats held by women and attainment in secondary and higher education), and
- Labour market participation (labour force participation rate for women and men aged 15 and older).

GII values range from 0 (full gender equality) to 1 (complete inequality). Country-level data are used directly for risk assessment. Countries without available data were assigned a "no data" value.

Risk Assessment: Risk of Gender Inequality Affecting Equality and Empowerment

The risk assessment is based on the national Gender Inequality Index (GII) score, following the scale below:

Indicator value y (GII score)	Risk Level
0	No risk
$0 < y < 0.11$	Very low risk
$0.11 \leq y < 0.27$	Low risk
$0.27 \leq y < 0.41$	Medium risk
$0.41 \leq y < 0.52$	High risk
$y \geq 0.52$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 202-1 GRI 405-2

3.3.12.2 Female Genital Mutilation 15-49

Female genital mutilation (FGM) refers to all procedures involving partial or total removal of the external female genitalia or other injury to the female genital organs for non-medical reasons. It is a violation of the rights of girls and women, often resulting in lifelong physical and psychological harm (UNICEF, n.d.). FGM reflects deeply entrenched gender inequalities and is widely recognized as a harmful practice that violates the right to health, security, and bodily integrity. The prevalence of FGM among women aged 15–49 serves as a key indicator of gender inequality and barriers to empowerment in society.

Data collection and attribution

Data for this indicator are sourced from UNICEF's global databases on child protection, primarily based on national household surveys such as the Multiple Indicator Cluster Surveys (MICS) and Demographic and Health Surveys (DHS) (UNICEF, n.d.).

The indicator measures the percentage of women aged 15–49 who have undergone any form of FGM. National data are used directly for risk assessment, with countries lacking data assigned a "no data" value.

Risk Assessment: Risk of FGM Impacting Gender Equality and Empowerment

The risk assessment is based on the national prevalence of FGM among women aged 15–49, following the scale below:

Indicator value y (% of women aged 15–49)	Risk Level
$y < 13$	Very low risk
$13 \leq y < 28$	Low risk
$28 \leq y < 43$	Medium risk
$43 \leq y < 83$	High risk
$y \geq 83$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.12.3 Female with Account at a Financial Institution

This indicator measures the percentage of women aged 15 and older who report having an account at a bank or other financial institution or who personally used a mobile money service in the past year (World Bank, n.d.).
Access to financial services is a critical enabler of women's economic empowerment, enhancing their capacity to save, invest, and manage financial risks. Gender disparities in financial inclusion reflect broader inequalities in access to economic opportunities, resources, and decision-making power. Increasing women's participation in the financial system is essential for advancing gender equality and promoting inclusive economic growth.

Data collection and attribution

Data for this indicator are sourced from the World Bank Global Findex database, which compiles nationally representative survey data collected through the Gallup World Poll. The indicator measures the percentage of women aged 15+ who have an account at a financial institution or use a mobile money service, based on self-reported responses (World Bank, n.d.). Values are reported as weighted averages at the national level. Countries without available data are assigned a "no data" value.

Risk Assessment: Opportunity for Gender Equality and Financial Empowerment

The risk assessment is based on the percentage of women aged 15+ with access to financial services, following the scale below:

Indicator value y (% of women aged 15+)	Opportunity Level
y > 74	High opportunity
43 < y ≤ 74	Medium opportunity
0 < y ≤ 43	Low opportunity
0	No opportunity
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.13 Subcategory Local Employment

Local employment improves the living conditions of communities, limits the risk of poverty and keeps people from emigrating. Cooperation with local suppliers further strengthens local economies, expands supply and promotes regional development. Besides advantages for local communities all these facts prevent the development of trans-regional or global problems, e.g. resulting from migration, high unemployment rates or poverty.

Within this subcategory, the unemployment rate of a country is taken as a basis for the evaluation.

3.3.13.1 Unemployment Rate in the Country

"The unemployment rate is the number of persons who are unemployed as a percent of the total number of employed and unemployed persons (i.e., the labour force)." (ILO 2023f, "Unemployment rate by sex, age and rural / urban areas")

The indicator serves to describe the employment situation in a country and to derive assumptions about the importance of local employment.

Data collection and attribution

Data were taken from the parameter "Unemployment rate by sex, age and rural / urban areas" provided for national, rural and urban areas per countries by ILOstat (ILO 2023f). The most current values for the total population (not distinguished between men and women), between 15 and 64 years, national coverage, were selected. In total, values are available for 71 countries. The remaining were not assigned any value.

Risk assessment: Risk of unemployment in the country

Full employment is the aim of every economy. However, due to always existing frictional and structural unemployment, full employment does not mean an unemployment rate of 0% but lies somewhere above. Recognised economists argue about the acceptable level of unemployment setting it between 2% and 7% or even 13% depending on the country (see Investopedia 2015, Wikipedia 2015b). For the risk assessment, the theory of the British economist William Beveridge is followed considering 3% unemployment as full employment (and therefore very low risk) (see ibid). The other risk levels are developed on this basis, also regarding the range of unemployment rates within the different countries.

Indicator value y, % population aged 15-64	Risk level
0 ≤ y < 3	very low risk
3 ≤ y < 8	low risk
8 ≤ y < 15	medium risk
15 ≤ y < 25	high risk
25 ≤ y	very high risk
-	no data

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 401-1

3.3.14 Subcategory Migration

Migration is a multi-faceted phenomenon. Reasons for emigration range from economic crises to political unrests or wars to climate hazards. Additionally, "involuntary resettlement may occur if organizations directly or indirectly dispossess individuals or groups of individuals of their land or resources." (UNEP 2021 p.63). The selection of countries for immigration depends on the economic and political situation, geography, legislation but also on cultural similarities with the country of origin.

Apart from the reasons for migration, consequences for countries and economies can vary at large, e.g. due to the demographic structure. Hence, migration involves challenges for governments and local companies, e.g.: Shall a government promote immigration, specifically labour migration? How can migrants be prioritized in the labour market? How is the health and legal situation of migrants? If operations require human relocation, concerns have to make sure that affected groups do not suffer from it. This is ensured by appropriate compensation, adequate relocation and the provision of legal remedies (ibid.).

Based on these reflections, for the moment, this subcategory assesses the overall situation of migrants per country in order to derive potential risks of conflicts or challenges for organizations. The indicators "International migrant workers in the sector", "International Migrant Stock", "Net migration rate", "Immigration rate", "Emigration rate" and "Asylum seekers rate" are selected to this end.

3.3.14.1 Emigration Rate

The emigration rate indicates social risks linked with an outflow of people. The more workers leave a certain country, the more they influence the external job market and create unhomogenized pressure on certain sectors locally. It might lead to brain drain and lack of specialist in high end sectors. It can also lead to social risks through slow economy development.

Data collection and attribution

Data comes from the OECD.Stat (OECD 2022) where values are available for the time range 2006-2022 (except for Turkey with a value for 2010), with the latest data being used in PSILCA. The data is available for 45 countries; other countries remained with no data.

Risk assessment: Possible preconditions to social risks due to high migration outflow

It is assumed that high emigration flows represent a risk for both the migrating community as well as the local communities, due to the labour pressures or possible discrimination as mentioned previously. Therefore, the following risk scale is created according to the quintile distribution of values.

Indicator value y, rate	Risk level
$0 < y \leq 0.13$	Very low risk
$0.13 < y \leq 0.23$	Low risk
$0.23 < y \leq 0.49$	Medium risk
$0.49 < y \leq 0.70$	High risk
$0.70 < y$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.14.2 Immigration Rate

The immigration rate evaluates the social risks linked with an inflow of people in a country. Fluctuation in the population is likely to cause changes in the labour market, as it influences both the offer and demand for work locally. Variations of salaries as a result of these dynamic flows can represent a risk for local communities. Moreover, the positions offered to migrants can also put them at risk. Indeed, migrant workers are often to be found in temporary, informal or unprotected jobs (ILO, 2023g) which make them particularly vulnerable.

Data collection and attribution

Data come from the OECD.Stat (OECD, 2023) where values are available from 2012 to 2022. Chile, Hungary, Latvia, Mexico, New Zealand and Slovak Republic have data from 2022. Costa Rica and the United Kingdom have data from 2019 and the rest have data from 2021. The data are available for 38 countries, other countries remained with no data.

Risk assessment: Social risks due to high migration inflows

It is assumed that the risk of discrimination and related social conflicts experienced by the foreign population is possible due to the rise of the immigrant population's share in a society. Therefore, the following risk scale is created according to the quintile distribution of values.

Indicator value y, ratio	Risk level
$y < 0.34$	Very low risk
$0.34 \leq y < 0.59$	Low risk
$0.59 \leq y < 0.78$	Medium risk
$0.78 \leq y \leq 1.05$	High risk
$1.05 < y$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.14.3 International Migrant Stock

"International migrant stock is the number of people born in a country other than that in which they live in relation to the population. It also includes refugees [...]" (World Bank 2022e)

On the one hand, this indicator serves to put into perspective the shares of migrant workers in the labour force (see 3.3.14.6). On the other hand, it can be an indication for the risk potential of discrimination, racism or social conflicts within a society.

Data collection and attribution

Data were taken from the Population Division under the United Nations (United Nations Department of Economic and Social Affairs (UNDESA), 2023). The indicator "International migrant stock (% of population)" was used selecting the most current value for 232 countries which was 2021. Only for the

"Eora countries" Former USSR, Netherlands Antilles, Macao and Taiwan, no data was available. The value for the Former USSR was averaged from the 15 former USSR countries. Data for the Netherland Antilles, Macao and Taiwan were unavailable.

Risk assessment: Risk of discrimination, racism and social conflicts due to high immigration

It is assumed that the risk of racial discrimination and related social conflicts rises with the share of immigrants in a society. Therefore, the following risk scale is created according to the quintile distribution of values.

Indicator value y, %	Risk level
y = 0	no risk
0 < y < 1.00	very low risk
1.00 ≤ y < 3.10	low risk
3.10 ≤ y < 7.00	medium risk
7.00 ≤ y < 15.96	high risk
15.96 < y	very high risk
-	no data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.14.4 Net Migration Rate

"Net migration is the net total of migrants during the period, that is, the number of immigrants minus the number of emigrants, including both citizens and noncitizens." (World Bank, 2023).

Therefore, a net migration close to 0‰ would imply stable labour markets, while high levels of migration, whether in or out of a country, might cause unemployment or a reduction of workers in a particular labour force. This, of course, might not be true for countries with an ageing population that need immigrants to fill vacancies. However, for the moment, this fact is not considered here.

Data collection and attribution

Data comes from the World Bank repository of 'World development indicators' (World Bank, 2023), where values are available for the year 1960 to 2023. Only the latest available data was used for every country. The source did not provide data for the countries Bahamas, Congo, North Korea, Laos, Netherlands Antilles, Gaza Strip, Taiwan, and Former USSR. No assumptions were made to fill in missing data fields.

Risk assessment: Risk of unemployment or excess of vacant positions

As mentioned above, high net migration rates can lead to disruption in labour markets or understaffing in the source and destination countries. Both situations limit economic development. Based on this assumption, the following risk scale is developed taking into account the dispersion of the values.

Indicator value y, % per 1000 people	Risk level
y = 0	No risk
0 < |y| < 0.44	Very low risk
0.44 ≤ |y| < 1.05	Low risk
1.05 ≤ |y| < 2.38	Medium risk
2.38 ≤ |y| < 3.68	High risk
3.68 ≤ |y|	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.14.5 Asylum Seekers Rate

Amnesty International[5] defines an asylum seeker as *"a person who has left their country and is seeking protection from persecution and serious human rights violations in another country"*. The asylum seekers rate indicates social risks linked with a high presence of people who yet have not undergone migration procedures, i.e. have not been legally acknowledged as refugees. If no effort to integrate migrants into the community are made, it can lead to radicalization among the migrating community due to social pressure, and to the creation or intensification of anti-immigration movements in the local community (UNHCR, 2018). Both could lead to the increased number of social conflicts and economic risks.

Data collection and attribution

Data come from the OECD.Stat (OECD 2022) where values are available for the time range 2012 to 2021. The data is available from the year 2021 for 38 countries, other countries remained with no data.

Risk assessment: Possible preconditions to social risks and economic risks due to high number of asylum seekers.

It is assumed that the risk of discrimination and social conflicts might be preconditioned by the increase of the asylum seekers presence at the border and within a certain country. Thus, the following risk scale is created according to the quintile distribution of values.

[5] Amnesty International. Available at: https://www.amnesty.org/en/what-we-do/refugees-asylum-seekers-and-migrants/. Accessed: 28/12/22

Indicator value y, ratio	Risk level
y ≤ 0.0001	Very low risk
0.0001< y ≤ 0.0003	Low risk
0.0003 < y ≤ 0.0008	Medium risk
0.0008< y ≤ 0.0016	High risk
0.0016< y	Very high risk
-	No data

SDG	SPD (PCR)	GRI
 	Not Applicable	/

3.3.14.6 International Migrant Workers in the Sector

The indicator provides information on the share of international migrant workers, amongst the total employed population. It can be seen as an indication for potential conflicts (e.g. religious, racial, or discrimination related).

Data collection and attribution

Data is based on ILOSTAT (ILO 2019) which provides international labour migration statistics disaggregated by economic activity according to the latest version of the International Standard Industrial Classification of All Economic Activities (ISIC Rev.4). "Employed migrants refer to individuals who changed their country of usual residence and were also employed during a specified brief period [...]" (ILO, 2024).

In the "International migrant stock" tables from ILOSTAT – the data is provided in terms of Employment by sex, status in employment and place of birth – the place-of-birth dimension is broken down into three groups:

- Native-born (individuals born in the country of measurement)
- Foreign-born (individuals born in another country)
- Unknown status

The "Unknown" category covers all persons for whom the survey or administrative source did not capture (or did not report) the place of birth. In other words, it is a residual "missing" class used when information on place of birth is unavailable or non-response prevents classification as either native- or foreign-born. Including "Unknown" ensures that published totals remain comparable (so that if some respondents skip the birthplace question, you still see the total population). High shares of "Unknown" in a given country may signal data-collection issues (e.g. poor survey design or non-response) or limitations in administrative registers.

The values in PSILCA, are calculated by dividing the sum of the number of employed migrants as well as employees of unknown status, by the total number of employees in the sector (ILOSTAT, 2024). Some of the countries have almost 100% of migrants in the sector.

Risk assessment: Risk of conflicts, discrimination etc. due to high share of migrant workers in the sector and large difference to international migrant stock

Due to the multiple reasons and effects of high shares of migrant workers in some countries and sectors, the risk assessment is not straightforward. So, there are countries with traditionally high rates of international migrant workers that are required and more or less well-integrated, as Luxembourg or Brazil. In other countries with similar shares of migrant workers, their working conditions might look very different, as in Qatar, Kuwait or Bahrain. Values also should be relativized with regards to the total amount of immigrants in a country. If the international migrant stock in a country (see 3.3.14.6) is very high, the share of international migrant employees in the labour force should also be rather high.

For the risk assessment, it is basically assumed that a high share of migrant workers holds a higher risk of discrimination, unfair working conditions and conflicts with local communities than lower shares. Additionally, it is supposed that a big difference to the migrant stock of a country can also trigger problems. This is considered by calculating the ratio between the migrant stock and the share of international migrant workers in the sector. The following table shows the risk levels for all sectors with international migration rates higher than zero.

Indicator value y, % per year	Risk level
$y \leq 0.0$	Very low risk
$0.0 < y \leq 0.2$	Low risk
$0.2 < y \leq 0.8$	Medium risk
$0.8 < y \leq 3.4$	High risk
$y > 3.4$	Very high risk
n.a.	No data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.3.15 Subcategory Safe and Healthy Living Conditions

This subcategory assesses the state of safety and health for communities, and it evaluates the influence of industries and organizations on living conditions. In PSILCA, the focus of this category is on contributions to healthy living conditions. Companies or industry sectors may increase the risk of diseases for surrounding communities such as cancer, through the release of hazardous material, emissions, or due to poor water drainage. Consequently, companies and organizations should control their operations to reduce health impacts to a minimum. “Organizations culpable for negative health effects should engage in remediation or compensation efforts” (UNEP 2021 p.69), e.g. by building hospitals or extending water supply and sanitation coverage.

Communities living in regions with high pollution levels and/or low water supply are much more vulnerable to health risks than people in regions with clean air and water. This is evaluated with the

indicators “Pollution level of the country”, “Drinking water coverage” and “Sanitation coverage”.

The indicator “Certified environmental management systems”, already described within the subcategory “Access to material resources” (see chapter 3.2.1) is an indication for the engagement of companies to mitigate environmental damage, and therefore, health impacts.

3.3.15.1 Pollution Level of the Country

This indicator assesses the overall level of pollution in a country in order to describe the situation in that a company or industry is operating. Hence, it provides information about the importance of clean economic activities and compensation efforts.

Data is based on the pollution index by Numbeo (Numbeo.com 2025). The index refers to different types of contamination in cities.

“The biggest weight is given to air pollution, than [sic!] to water pollution/accessibility, two main pollution factors. Small weight is given to other pollution types.” (ibid.)

Some other pollution types are:

- Garbage disposal
- Cleanliness and tidiness of the city
- Noise pollution and light during the night in the city
- Green and parks in the city (see ibid.)

This index is based on a survey carried out among visitors of the website, and official data from WHO and other institutions (ibid.). This makes it possible to include the actually perceived pollution by inhabitants and its impacts on their living conditions.

It was assumed that the extrapolation of the pollution levels of cities to the whole country, provides a conservative estimate, because cities usually record highest contamination, many people live there and suffer from pollution and, furthermore, most industries are located in or close to urban areas that contribute but can also reduce emissions. Pollution index was therefore considered a suitable indicator to assess safe and healthy living conditions of local communities.

Data collection and attribution

The data refer to the pollution index gathered from Numbeo (ibid.). The survey data are based on visitors’ perceptions not older than 3 years (from the publication date). The indices basically range between 0 and 100 and are calculated by scoring and weighting the survey entries and data from renowned institutions.

Values are provided for 109 countries. The other countries remained without value.

Risk assessment: Risk of high pollution levels

The risk levels are equal intervals of 20 index points with indices below 20 considered as very low risk, and indices over 80 meaning very high risk of pollution. This coincides with the evaluation scale of the survey results (see Numbeo.com 2025).

Indicator value y, index	Risk level
0 < y < 20	very low risk
20 ≤ y < 40	low risk
40 ≤ y < 60	medium risk
60 ≤ y < 80	high risk
y > 80	very high risk
-	no data

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 305-1

3.4 Stakeholder Value Chain actors

According to Di Xu et al. (2020), value chain actors correspond to "those who are involved in the sale or production of products, or in the operation of the system, except for the consumers." This group plays a pivotal role in shaping the social performance of a product through their practices related to corruption, fair competition, and social responsibility. Indicators such as enterprise involvement in bribery, public sector corruption, anti-competitive behaviour, and ethical practices along the supply chain help assess the integrity and sustainability of business operations. Addressing these dimensions ensures that S-LCAs promote transparency, accountability, and responsible conduct throughout the value chain.

Subcategory	Indicator
Fair Competition	Presence of anti-competitive behaviour or violation of anti-trust and monopoly legislation
Corruption	Public Sector Corruption
	Active involvement of enterprises in corruption and bribery
Promoting Social Responsibility	Social responsibility along the supply chain

3.4.1 Subcategory Fair competition

Sustainable conditions along the life cycle of a product also concern, of course, suppliers, competitors and other value chain actors.

It is important to keep competition on the market fair and transparent in order to allow supply and

demand to regulate freely, to maintain prices moderate, to facilitate innovative product and service developments and keep quality and choice of goods and services high. At the end, this favours local economies, suppliers and customers.

Any form of collusion or anti-trust between market actors hinders fair competition and is, therefore, in most countries considered a crime. Hence, local and multinational companies and organizations must behave and act in a way that allows fair competition. In order to control and ensure this, appropriate policies and laws should exist in every country.

Overall,

> *"this subcategory assesses if the organization's competitive activities are conducted in a fair way and in compliance with legislations preventing anti-competitive behaviour, anti-trust, or monopoly practices."* (UNEP 2021, p. 86)

For this purpose, the following indicator is selected: *"Presence of anti-competitive behaviour or violation of anti-trust and monopoly legislation".*

3.4.1.1 Presence of anti-competitive behaviour or violation of anti-trust and monopoly legislation

This indicator refers to any kind of anti-competitive behaviour. This includes all forms of collusion, abuse of monopoly or other market positions, and other unfair business practices. The most common forms of collusion or antitrust violations are:

- price fixing, i.e. an "agreement among competitors to raise, fix, or otherwise maintain the price at which their goods or services are sold" (U.S. Department of Justice 2015),
- bid rigging, i.e. market actors manipulate a public bid by submitting false bids or ones not complying with the conditions, or suppressing competitor´s bids (ibid.), or
- market division or allocation schemes, i.e. "agreements in which competitors divide markets among themselves. In such schemes, competing firms allocate specific customers or types of customers, products, or territories among themselves." (ibid.)

Other unfair business practices are, e.g. creating market or output restrictions or anti-competitive mergers.

The indicator measures the risk of anti-competitive business practices and violation of anti-trust legislation in different industry sectors.

Data collection and attribution

Basis for this indicator are the enforcement cases recorded by the U.S. Federal Trade Commission (FTC 2023) for U.S. firms. Among others, the commission "monitor[s] business practices, review[s] potential mergers, and challenge[s] them when appropriate to ensure that the market works according to consumer preferences, not illegal practices." (ibid.). All cases and proceedings are listed and publicly available. They are basically sorted by the "mission" of FTC, i.e. competition or consumer protection, and the competition topic, i.e. merger or nonmerger (price fixing, bid rigging, market allocation etc.).

To measure the indicator, all competition-related cases for the USA (i.e. all merger and nonmerger topics) between January 2000 and February 2015 were selected. They were sorted by industry classification and counted per industry sector. These absolute numbers were normalised by dividing them by the number of employees in the respective industries (data taken from USDOL 2015) and multiplied by 10,000.

It is assumed that occurrence and frequency of anti-competitive behaviour and unfair business practices are similar for the same industry sectors worldwide. Therefore, data from the U.S. is extrapolated to all countries by mapping the original industry sectors from the FTC to the country-specific sectors in PSILCA. The normalised values, i.e. number of enforcement cases per 10,000 employees, were then assigned to the matching sectors in every country. Sectors without a matching sector from the raw data remained without a value and risk assessment.

Risk assessment: Risk of anti-competitive behaviour or unfair business practices in the sector

The higher the number of cases per 10,000 employees the higher the risk of unfair business practices in the sector. The risk assessment is roughly oriented at the mean of the normalised values.

Indicator value y, number per 10,000 employees	Risk level
0	no risk
0 < y < 0.05	very low risk
0.05 ≤ y < 0.1	low risk
0.1 ≤ y < 0.2	medium risk
0.2 ≤ y < 0.4	high risk
0.4 ≤ y	very high risk
-	no data

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 205-3

3.4.2 Subcategory Corruption

In general, corruption is "the abuse of entrusted power for private gain" (Transparency International 2015). Three main types of corruption can be distinguished "depending on the amounts of money lost and the sector where it occurs" (ibid.).

"Grand corruption consists of acts committed at a high level of government that distort policies or the central functioning of the state, enabling leaders to benefit at the expense of the public good.

Petty corruption refers to everyday abuse of entrusted power by low- and mid-level public officials in their interactions with ordinary citizens, who often are trying to access basic goods or services in places like hospitals, schools, police departments and other agencies.

Political corruption is a manipulation of policies, institutions and rules of procedure in the allocation of resources and financing by political decision makers, who abuse their position to sustain their power, status and wealth."(ibid.)

It becomes clear that corruption normally refers to public institutions or governments and can affect daily life. This is also highlighted by Transparency International (2015):

"Corruption translates into human suffering, with poor families being extorted for bribes to see doctors or to get access to clean drinking water. It leads to failure in the delivery of basic services like education

or healthcare. It derails the building of essential infrastructure, as corrupt leaders skim funds."

Therefore, it could also be attributed to the stakeholder Society. However, at this point the subcategory shall rather assess whether an organization or industry sector is engaged in corruption, e.g. by taking advantage from public institutions, by fraud or bribery affecting supply chain actors, or by clientelism and nepotism within the company.

To this aim, the overall state of corruption in a country is assessed by the indicator "Public sector corruption". The indicator "Active involvement of enterprises in corruption and bribery" evaluates to what degree an organization has been engaged in corruptive behaviour, or whether it has implemented appropriate measures to prevent corruption.

3.4.2.1 Public sector corruption

Public sector corruption, i.e. corruption as defined above, is measured by the Corruption Perceptions Index (Transparency International 2022):

"A country [sic!] or territory's score indicates the perceived level of public sector corruption on a scale of 0-100, where 0 means that a country is perceived as highly corrupt and 100 means it is perceived as very clean." (ibid.)

The index is based on expert opinions.

Since *"the poor and most vulnerable are [corruption´s] primary victims"* (Transparency International 2015) it is important that governments take anti-corruption actions and combat this behaviour.

Data collection and attribution

The index is created by Transparency International (2015). Scores for different countries and territories are provided in a ranking list that makes it possible to easily compare the degree of corruption between different countries. The values used were obtained from the 2022 index, which covered 180 countries that were categorized into regional groups and corresponded to 171 PSILCA countries. The remaining countries were mapped based on akin countries or given regional averages. The value given to the Former USSR was averaged from the data for the 15 USSR countries.

Risk assessment: Risk of corruption in the country

The risk assessment is based on the distribution of the scores and on the evaluation given by Transparency International (2022): *"While no country has a perfect score, two-thirds of countries score below 50, indicating a serious corruption problem."* The following risk scale is applied:

Indicator value y, index score	Risk level
100 ≥ y ≥ 85	very low risk
85 ≥ y ≥ 75	low risk
75 ≥ y ≥ 65	medium risk
65 ≥ y ≥ 55	high risk
55 ≥ y	very high risk
-	no data

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 205-3

3.4.2.2 Active involvement of enterprises in corruption and bribery

Corruption does not only affect daily life of mainly most vulnerable people, it also hinders economic growth and therefore human development.

"Corruption also undermines growth and development. On the one hand, businesses forego innovation and competitiveness for bribery. On the other hand, individuals within governments divert funds for their own personal use that should be used to promote the well-being of people." (OECD 2014, p. 3)

Hence, OECD considers corruption and bribery a serious problem that must be criminalised and combated (see ibid.). To this end, this indicator shall assess the degree of an active involvement of companies in corruption and bribery along their supply chains.

Data collection and attribution

Corruption is a very "complex and convert crime" (OECD 2014, p. 3) difficult to detect and fight. To tackle the problem, OECD adopted the Convention on Combating Bribery of Foreign Public Officials in International Business Transactions (OECD 2011), short the OECD Anti-Bribery Convention, in 1999. To measure and document transnational corruption, a Foreign Bribery Report was first published in 2014 (OECD 2014). Due to the scarce amount of data available for the time being, this indicator refers to foreign bribery. The OECD Anti-Bribery Convention, Art. 1, defines foreign bribery as:

"to offer, promise or give any undue pecuniary or other advantage, whether directly or through intermediaries, to a foreign public official, for that official or for a third party, in order that the official act (sic!) or refrain (sic!) from acting in relation to the performance of official duties, in order to obtain or retain business or other improper advantage in the conduct of international business". (OECD 2011, p. 7)

In the report, different analyses and statistics are presented for 427 foreign bribery enforcement actions concluded between 15 February 1999 and 1 June 2014. To measure this indicator, statistics about the spread of foreign bribery cases across industry sectors were taken as reference (see Figure 12).

Percentages refer to the share of all foreign bribery cases reported in the survey period (see above) attributable to specific activity sectors. It becomes clear that almost two thirds of all cases occurred in only four industry sectors.

Since the OECD Anti-Bribery Convention was adopted by 41 countries (all OECD member states as well as Argentina, Brazil, Bulgaria, Colombia, Latvia, Russia, and South Africa) (see OECD 2011), data were assumed for all these countries. Hence, percentage values were assigned to their according Eora sectors (see method described in chapter 2.4.2).

A mean value (7.14%) was calculated and assigned to the remaining sectors of the signatories because it is probable that companies of other sectors are also involved in bribery without being revealed so far.

This value corresponds to medium risk of involvement in foreign bribery (see next section).

The other countries in PSILCA and their respective sectors (7038 in total) remain without data.

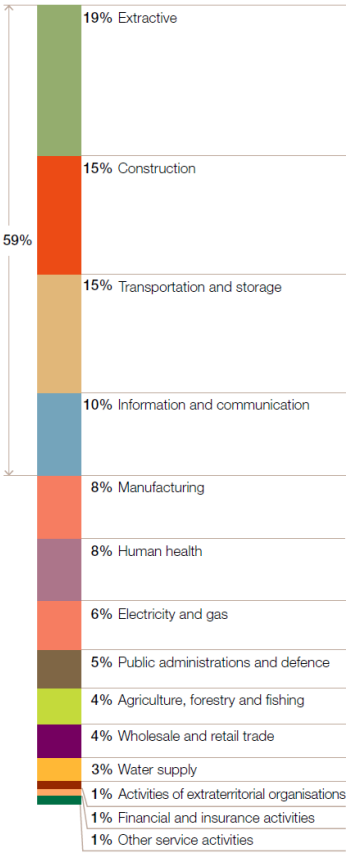


Figure 17: Foreign bribery cases according to their occurrence in activity sectors (OECD 2014, p. 22)

Risk assessment: Risk of involvement in foreign bribery

The risk scale is oriented towards the maximum percentage of bribery cases detected in one sector. All risk levels are distributed within this range.

Indicator value y, %	Risk level
0 < y ≤ 3	very low risk
4< y ≤ 7	low risk
8 < y ≤ 11	medium risk
12 < y ≤ 15	high risk
15 < y	very high risk
-	no data

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 205-3

3.4.3 Subcategory Promoting social responsibility

Social responsibility is understood as a company´s obligation to perform in a way that considers the interests and needs of all its stakeholders, i.e. employees, customers, communities, society etc. Main areas in question are human rights, labour, environment and anti-corruption.

By integrating social responsibility into own business processes and relations, and promoting it along supply chains, an organization can create real social value. The actions implemented by a company to ensure social responsibility can differ widely from one organization to another and are thus difficult to structure and quantify. Thus, for the purpose of PSILCA, this subcategory should rather be measured by memberships in initiatives and foundations with a related focus, and the existence and number of codes of conducts and contractual agreements with suppliers concerning social responsibility (see UNEP 2021, p. 89).

3.4.3.1 Social responsibility along the supply chain

The indicator examines, to what extent social responsibility is taken seriously and assured by companies within specific sectors. The approach follows the idea mentioned above to recur to initiatives and agreements with a focus on social sustainability. The UN Global Compact Initiative (2017) is considered to be an adequate association. It supports and binds participating companies to align their strategies with the initiative´s Ten Principles referring to human rights, labour, environment, and anti-corruption. Seven of these principles directly address workers, local communities or value chain actors, hence, the initiative has a strong social focus.

Data collection and attribution

UN Global Compact provides a list of participants classified by sector and country. For the assessment, all entries (companies and non-businesses) within a country and sector were counted and mapped to the Eora sectors. Therefore, country-specific-sectors that are not covered by any entry – a number of 3315 – are assessed by "very high risk".

Risk assessment: Risk of unsustainable business practices

The risk scale follows the exponential distribution of the values.

Indicator value y, number of companies	Risk level
110 ≤ y	very low risk
70 ≤ y < 100	low risk
5 ≤ y < 70	medium risk
1 ≤ y < 5	high risk
y < 1	very high risk
-	no data

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 416-2

3.5 Stakeholder: Children

The stakeholder group "Children" is essential for evaluating the long-term social sustainability of a system, as children represent both the most vulnerable population and the foundation of future generations. This stakeholder includes subcategories such as child welfare, education, and health and safety, reflecting the fundamental rights and needs of children. Indicators like child marriage rates, female genital mutilation prevalence, mean years of schooling, and under-five mortality rates provide insight into the systemic risks and protections affecting children's well-being. By assessing these indicators, S-LCAs can identify harmful practices and areas where intervention is necessary to uphold children's rights. Protecting children within supply chains and production systems is critical for fostering equitable and humane development. Their inclusion in S-LCA ensures that social responsibility extends to those who are least able to advocate for themselves.

Subcategory	Indicator
Children Welfare	Children marriage, female
	Children marriage, male
	Female genital mutilation 0-14
Education	Mean years of schooling, total
	Mean years of schooling, female
	Mean years of schooling, male
Health and Safety	Under-five mortality rate

3.5.1 Subcategory: Children Welfare

3.5.1.1 Child marriage, female

Child marriage refers to formal marriages or informal unions involving girls under the age of 15. It is recognized as a violation of human rights that can severely compromise a girl's development, education, health, and economic prospects (UNICEF, 2025).

Marrying at a young age increases risks of early pregnancy, school dropout, domestic violence, and lifelong poverty, and it perpetuates gender inequality across generations.

Data collection and attribution

Data for this indicator are sourced from UNICEF's global databases, based primarily on household surveys such as the Multiple Indicator Cluster Surveys (MICS) and Demographic and Health Surveys (DHS) (UNICEF, 2019).

The indicator measures the percentage of women aged 20–24 who were married or in a union before their 15th birthday. Data are collected at the national level and expressed as a percentage. Where no national data are available, a "no data" value was assigned.

Risk Assessment: Risk of Early Marriage Among Females

The risk assessment is based on the percentage of women married before the age of 15, following the scale below:

Indicator value y (% of women)	Risk Level
0	No risk
0 < y < 0.4	Very low risk
0.4 ≤ y ≤ 2	Low risk
2 < y ≤ 5	Medium risk
5 < y ≤ 8	High risk
y > 8	Very high risk
-	No data

3.5.1.2 Child marriage, male

Child marriage among males refers to formal marriages or informal unions involving boys under the age of 18. While the consequences differ from those experienced by girls, child marriage remains a violation of boys' rights, cutting short their childhood and exposing them to early adult responsibilities such as parenthood and economic provision (UNICEF, 2025).

Early marriage can limit boys' educational attainment, restrict career development, and perpetuate cycles of poverty and reduced opportunity. Although less prevalent than among females, the practice of child marriage among boys is a significant concern requiring further research and policy action.

Data collection and attribution

Data for this indicator are sourced from UNICEF's global child marriage datasets, based on nationally representative household surveys including MICS and DHS (UNICEF, 2025).

The indicator measures the percentage of men aged 20–24 who were married or in a union before their 18th birthday. Due to limitations in available data and reporting consistency, estimates for boys are less comprehensive than for girls.

National-level data are used where available. In cases where data are not available, countries were assigned a "no data" value.

Risk Assessment: Risk of Early Marriage Among Males

The risk assessment is based on the percentage of men married before the age of 18, following the scale below:

Indicator value y, (% of men)	Risk Level
0	No risk
0 < y < 1.2	Very low risk
1.2 ≤ y ≤ 2.1	Low risk
2.1 < y ≤ 3.5	Medium risk
3.5 < y ≤ 5.6	High risk
y > 5.6	Very high risk
-	No data

SDG	SPD (PCR)	GRI
 	Not Applicable	/

3.5.1.3 Female Genital Mutilation (aged 0 – 14)

Female genital mutilation (FGM) refers to all procedures involving partial or total removal of the external female genitalia or other injury to the female genital organs for non-medical reasons. When performed on girls under the age of 15, FGM is a grave violation of children's rights and exposes girls to severe health risks, trauma, and lifelong harm (UNICEF, n.d.).

The prevalence of FGM among girls aged 0–14 years serves as a critical indicator of child protection challenges and progress in eliminating harmful traditional practices.

Data collection and attribution

Data for this indicator are sourced from UNICEF's global databases on child protection, based on nationally representative household surveys, including the Multiple Indicator Cluster Surveys (MICS) and Demographic and Health Surveys (DHS) (UNICEF, n.d.).

The indicator measures the percentage of girls aged 0–14 years who have undergone any form of FGM. National-level data are used directly for risk assessment. Countries without available data were assigned a "no data" value.

Risk Assessment: Risk of FGM Impacting Child Welfare

The risk assessment is based on the national prevalence of FGM among girls aged 0–14 years, following the scale below:

Indicator value y (% of girls aged 0–14)	Risk Level
$y < 1$	Very low risk
$1 \leq y < 9$	Low risk
$9 \leq y < 14$	Medium risk
$14 \leq y < 36$	High risk
$y \geq 36$	Very high risk
-	No data

SDG	SPD (PCR)	GRI
 	Not Applicable	/

3.5.2 Subcategory Education

3.5.2.1 Mean years of schooling, female

This indicator reflects the average number of completed years of formal education among the female population aged 25 and older. It follows the same definition and methodological approach as the total indicator (1.1.1.2), which measures educational attainment using standardized years of completed formal schooling across all levels (primary to tertiary), based on data from the United Nations Development Programme (UNDP) and the UNESCO Institute for Statistics (UIS).

Data collection and attribution

Data are sourced from national censuses and household surveys and compiled by the UNDP following the ISCED classification system as described under indicator 1.1.1.2. For PSILCA, country-level values were linked to the EORA name and sector structure. In cases of missing or outdated data, regional or modelled estimates were used in alignment with comparable countries.

Risk assessment: Risk of insufficient educational attainment among women

The same logic used for the total population is applied here. Lower average years of schooling among women indicate higher risks of gender inequality, limited access to quality employment, and reduced participation in social and economic life. The following thresholds are used to classify risk:

Indicator value y, mean years of schooling (population 25+), female	Risk level
$y \leq 6.76$	very high risk
$6.76 < y \leq 8.73$	high risk
$8.73 < y \leq 10.59$	medium risk
$10.59 < y \leq 12.40$	low risk
$y > 12.40$	very low risk

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.5.2.2 Mean years of schooling, male

This indicator measures the average number of completed years of formal education among the male population aged 25 and older. It is based on the same definition and methodology as the total indicator (1.1.1.2), which uses standardized durations of completed primary, secondary, and tertiary education to assess educational attainment, following data from the United Nations Development Programme (UNDP) and the UNESCO Institute for Statistics (UIS).

Data collection and attribution

The data are sourced from national censuses and household surveys, compiled by the UNDP, and converted using the ISCED classification as described under the total indicator. In PSILCA, values were assigned at the country level and aligned with the EORA name and sector structure. Regional or modelled estimates were used where direct national data were unavailable.

Risk assessment: Risk of insufficient educational attainment among men

Lower average years of schooling among men may signal structural weaknesses in human capital and access to education, with implications for workforce skill levels and economic participation. The risk scale is based on the distribution of mean years of schooling in the male population and is structured as follows:

Indicator value y, mean years of schooling (population 25+), male	Risk level
$y \leq 6.76$	very high risk
$6.76 < y \leq 8.73$	high risk
$8.73 < y \leq 10.59$	medium risk
$10.59 < y \leq 12.40$	low risk
$y > 12.40$	very low risk

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.5.2.3 Mean years of schooling, total

This indicator reflects the average number of completed years of formal education among the total population aged 25 and older, regardless of gender, based on data from the United Nations Development Programme (UNDP) and the UNESCO Institute for Statistics (UIS). It provides a measure of overall educational attainment and human capital development within a country.

The indicator considers all levels of formal education completed—from primary to tertiary—and converts them into standardized years of schooling. It reflects only completed education levels and does not account for years spent in incomplete programs.

Data collection and attribution

Data are compiled by the UNDP based on educational attainment statistics sourced from national censuses and household surveys. The UIS provides the methodology for converting completed education levels into years of schooling using the ISCED classification system. For PSILCA, values are assigned at the country level and linked to the EORA names and sector structure. Where recent or complete data are unavailable, regional estimates or modelled values are used based on the latest Human Development Report datasets.

Risk assessment: Risk of Risk of insufficient educational attainment

The risk scale for this indicator is based on the global distribution of mean years of schooling. Low values reflect a higher share of the population with insufficient or low levels of education and are therefore

associated with elevated social and economic risks. The following thresholds are used:

Indicator value y, mean years of schooling (population 25+), total	Risk level
y ≤ 6.76	very high risk
6.76 < y ≤ 8.73	high risk
8.73 < y ≤ 10.59	medium risk
10.59 < y ≤ 12.40	low risk
y > 12.40	very low risk

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.5.3 Subcategory Health and Safety

3.5.3.1 Under five mortality rate

The under-five mortality rate measures the probability of a child dying before reaching the age of five, per 1,000 live births. It is a critical indicator of child health and well-being, reflecting the quality of healthcare systems, access to essential services, and broader social determinants of health (UNICEF, 2023d).
High under-five mortality rates signal deficiencies in nutrition, maternal care, immunization, and the availability of safe water and sanitation. Reducing child mortality is a core goal of sustainable development and human rights efforts globally.

Data collection and attribution

Data for this indicator are sourced from UNICEF's global databases on child survival, which compile estimates from national vital registration systems, household surveys (such as MICS and DHS), and statistical modelling techniques. The indicator expresses the number of deaths of children under five per 1,000 live births.

National-level data are used directly for risk assessment. Countries without available data are assigned a "no data" value.

Risk Assessment: Risk to Children's Health and Safety Based on Under-Five Mortality

The risk assessment is based on the national under-five mortality rate, following the scale below:

Indicator value y (deaths per 1,000 live births)	Risk Level
y < 4.64	Very low risk
4.64 ≤ y < 10.94	Low risk
10.94 ≤ y < 20.03	Medium risk
20.03 ≤ y < 41.34	High risk

y ≥ 41.34	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	/

3.6 Stakeholder: Consumer

The stakeholder group "Consumers" plays a vital role in assessing how products and services impact end users in terms of safety, accessibility, and ethical considerations. This group reflects the rights, well-being, and informed decision-making of those who purchase or use the outputs of a system. The related indicators examine aspects such as the availability of product information, consumer protection measures, and risks related to product use. Including consumers in S-LCA ensures that systems are not only efficient and profitable but also socially responsible and accountable to the people they ultimately serve. This perspective helps drive improvements in corporate behaviour, product design, and communication, enhancing trust and sustainability across markets.

Subcategory	Indicator
Consumer Protection	Online consumer protection legislation
	Data protection and privacy

3.6.1 Subcategory Consumer Protection

3.6.1.1 Online consumer protection legislation

Online consumer protection legislation indicates whether a country has enacted specific legal frameworks to safeguard the rights of consumers in digital marketplaces. Such legislation typically addresses issues like data privacy, dispute resolution, contract fairness, and protection against fraudulent practices (United Nations Conference on Trade and Development [UNCTAD], n.d.). The presence of online consumer protection laws reflects a country's commitment to ensuring safe and fair digital transactions, fostering trust in e-commerce, and enabling consumers to exercise their rights effectively. In contrast, the absence of such legislation leaves consumers exposed to potential exploitation, fraud, and inadequate recourse mechanisms.

Data collection and attribution

Data for this indicator are sourced from the United Nations Conference on Trade and Development (UNCTAD) *Global Online Consumer Protection Database*. Countries are categorized as either having legislation in place (coded as 1) or lacking legislation (coded as 2). Countries without available data are assigned a "no data" value.

Risk Assessment: Risk of Inadequate Consumer Protection in Digital Markets

The risk assessment is based on the legal status of online consumer protection, following the scale below:

Indicator value y (code)	Risk Level
Legislation present (1)	Very low risk
No legislation present (2)	Very high risk
-	No data

SDG	SPD (PCR)	GRI
	Not Applicable	GRI 418-1

3.6.1.2 Data protection and privacy

Data protection and privacy legislation indicates whether a country has legal frameworks in place to safeguard individuals' personal data, ensure transparency in data handling, and provide recourse in cases of misuse or breaches. Such legislation is essential for consumer protection in digital markets, as it defines the responsibilities of businesses and the rights of individuals regarding data collection, processing, and sharing (United Nations Conference on Trade and Development [UNCTAD], n.d.). The presence of robust data protection laws is critical for fostering consumer trust, preventing data misuse, and upholding the right to privacy in an increasingly digitalized economy.

Data collection and attribution

Data for this indicator are sourced from the United Nations Conference on Trade and Development (UNCTAD) *Data Protection and Privacy Legislation Worldwide* database. Countries are categorized as either having data protection legislation (coded as 1) or lacking such legislation (coded as 2). Countries without available data are assigned a “no data” value.

Risk Assessment: Risk of Inadequate Consumer Protection in Data Privacy

The risk assessment is based on the legal status of data protection and privacy legislation, following the scale below:

Indicator value y (code)	Risk Level
Legislation present (1)	Very low risk
No legislation present (2)	Very high risk
-	No data

SDG	SPD (PCR)	GRI

	Not Applicable	GRI 418-1

4 PSILCA in openLCA

4.1 General comments on PSILCA in openLCA

The PSILCA database is available first in the free and open source LCA software openLCA (www.openlca.org), a high-performance and feature-rich LCA software.

In the database, sectors (industries and/ or commodities) per country are modelled as processes based on the Eora Input-Output database. Eora provides data on money flows between country-specific sectors. Each country-specific sector (CSS) generates output (i.e. a product), evaluated in USD, and receives materials and products from other sectors, also in USD. In PSILCA, the sectors are scaled so that each sector produces an output of exactly 1 USD that is used to calculate the product system (see Figure 19).

Without cut-off, a PSILCA system which follows all the links from one selected CSS to other sectors gets really large, with roughly 15,000 sectors and millions of connections, and sectors with more than 1,000 other sectors delivering products to the sector (Figure 18).

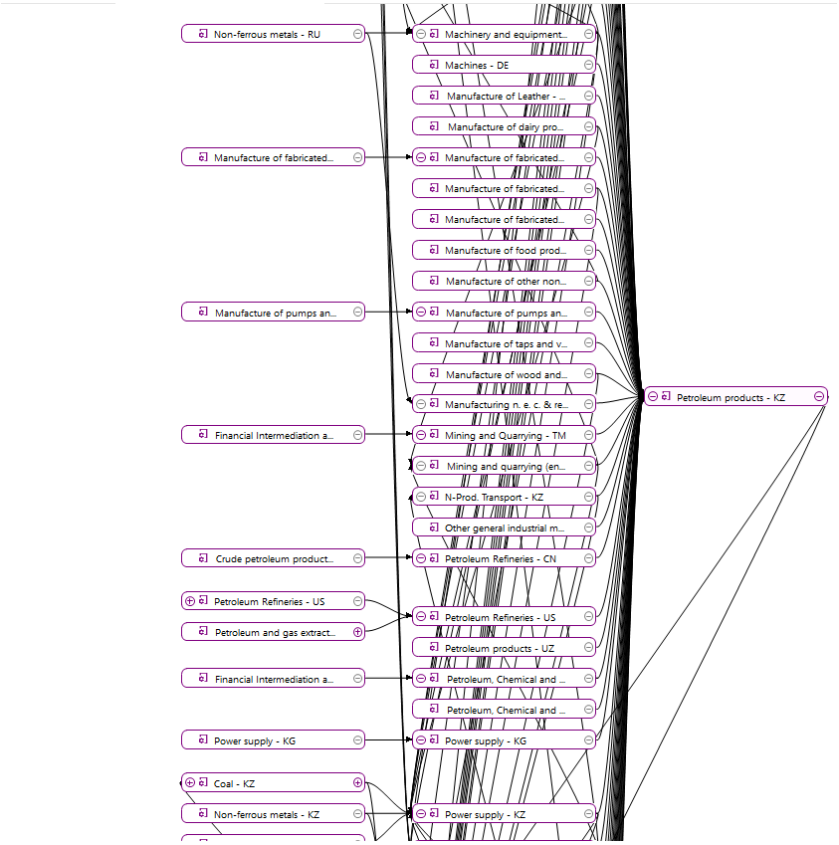


Figure 18: Model graph (part) of a product system in openLCA for the sector "Basic construction" in Germany in PSILCA, with 3 tiers of sector inputs (for some selected sectors visible)

For each process, the risk-assessed indicators are represented as elementary flows, "characterised" with the activity variable. For the time being, all indicators use worker hours as activity variable. As described in chapter 2.7 the amount of worker hours is calculated in relation to 1 USD output for each process and has, therefore, the same amount for every risk assessed indicator within a process (see Figure 19).



Figure 19: Inputs and outputs of the process "Hotels and Restaurants – IT" in openLCA

Indicator information in openLCA is provided in two levels, for each indicator separately, and for each process exchange. General indicator information is provided individually for each indicator, independently of processes (see Figure 20). This information includes the risk assessment procedure ("evaluation scheme") and the activity variable used for the indicator.

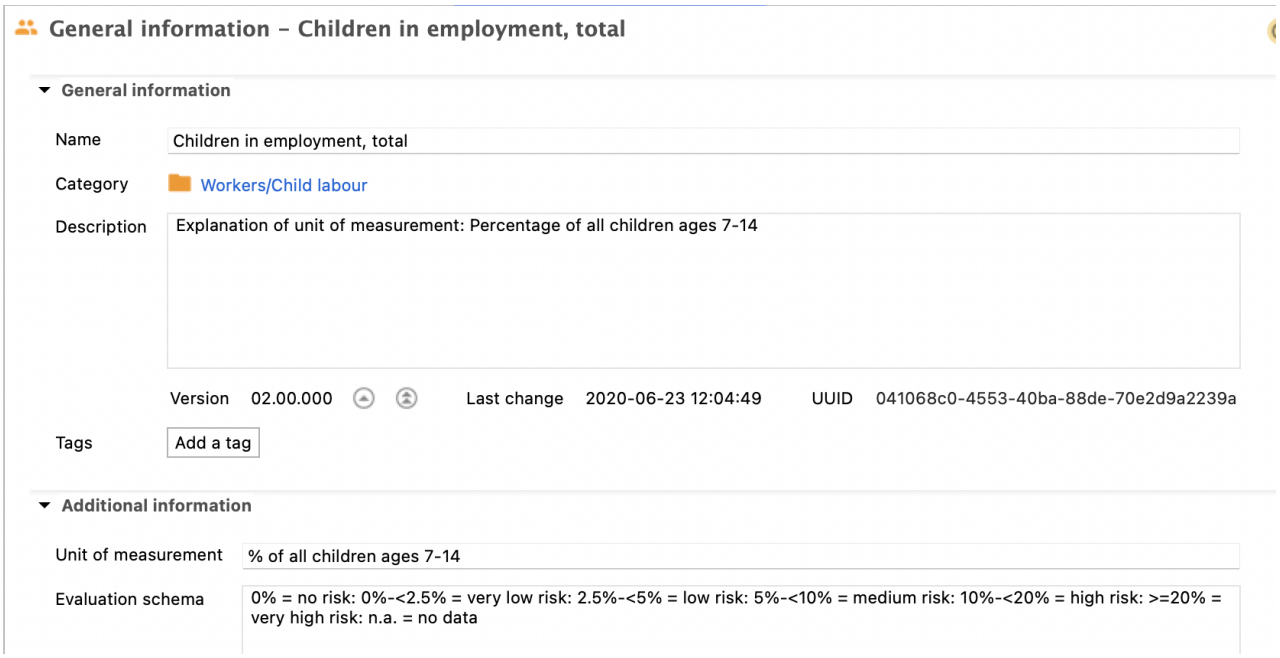


Figure 20: Social indicator information in the PSILCA database as provided in openLCA

Then, indicator results are provided for each process, in a level of detail depending on the PSILCA database type (Starter, Professional or Developer) – for the Developer database, data quality, unassessed indicator values, indicator risk levels and sources are provided (see Figure 21).

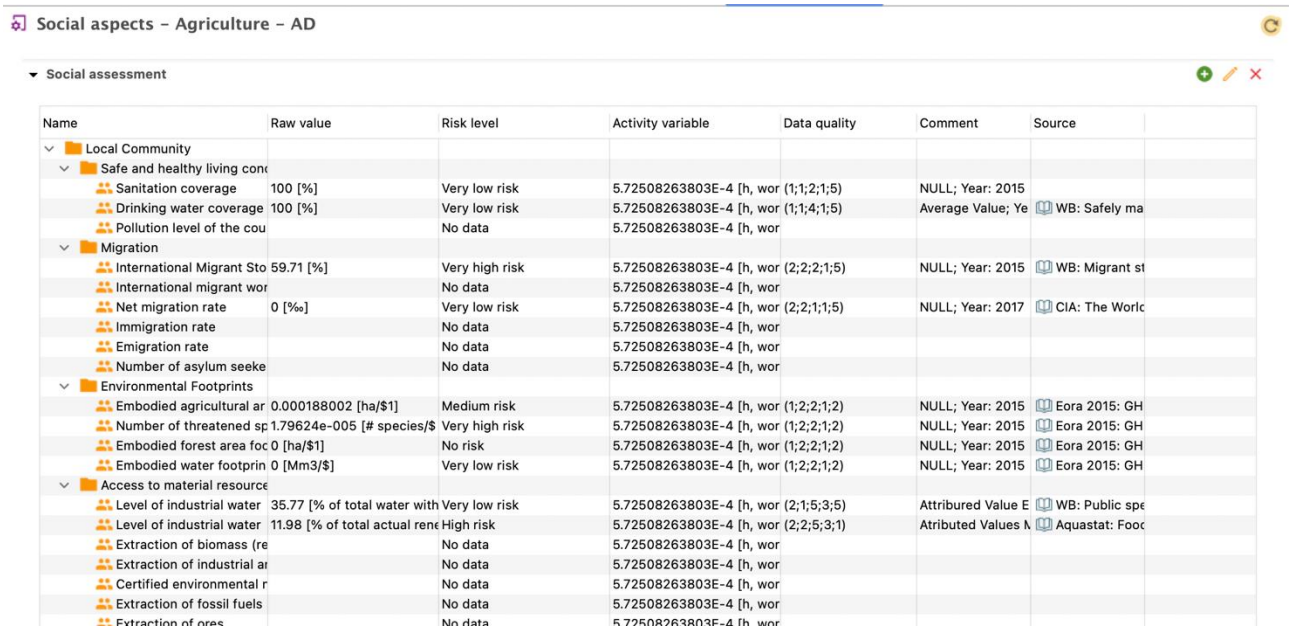


Figure 21: Social aspects in the PSILCA database (Developer) as provided in openLCA for each process (i.e. sector) separately

In the developer database, information on data quality can also be modified by the user, for each indicator and process. The pedigree data quality matrix is shown; colours emphasize the assessment, from green for a score of 1, to red for a score of 5 (see Figure 22).

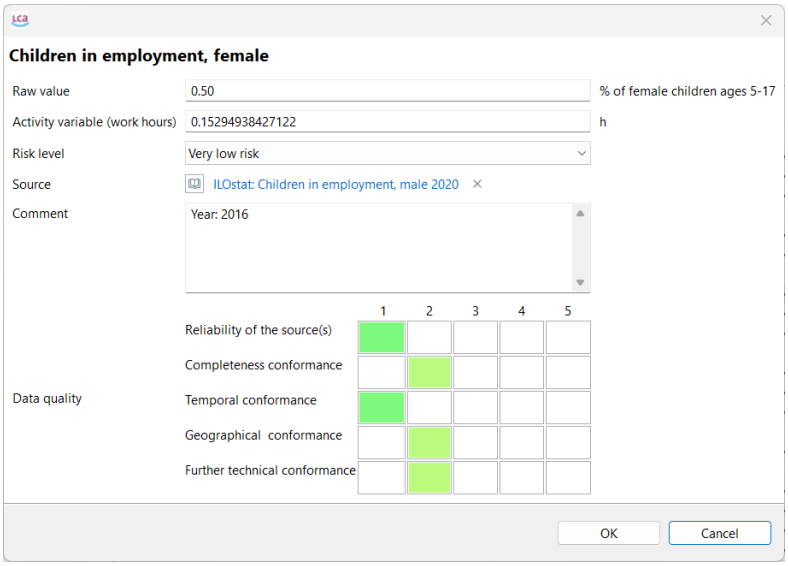


Figure 22: Data quality pedigree matrix in the PSILCA database as provided in openLCA for each process (i.e. sector) and indicator separately

The direct calculation approach (see section 2.7.2) is provided for the professional and developer version.

4.2 Quick guide on using PSILCA in openLCA

openLCA is an LCA software and the implementation of PSILCA in openLCA reflects this, with CSS modelled as processes, typically product flows on the input and elementary flows (here the social effects) on the output side. However, in order to use PSILCA properly in openLCA it is, of course, very useful to know the basics of the software. This text has not the intention to fully explain openLCA; more information about how to use openLCA, including e.g. video tutorials and manuals, are available under http://www.openlca.org/learnmore (GreenDelta GmbH, 2020).

4.2.1 Memory and time for the creation and calculation of a product system

The current PSILCA version provided in February 2023 is based on an Eora database where a cut-off of 1E-5 (*Starter* type), 1E-7 (*Professional* type) or no cut-off for the *Developer* type has been applied. This means that in the *Starter* and *Professional* types all flows with a contribution below 1E-5/ 1E-7 USD to the final product have been deleted from the database. Nevertheless, data volume is quite big. In order to perform calculations, it is recommended to use a PC with rather high amount of RAM[6] and a modern processor. openLCA can be downloaded for free under https://www.openlca.org/download-form/ (GreenDelta GmbH 2020a).

Some plausibility checks were carried out with a PSILCA version, cut-off 1E-6, in order to show the reduction of required time and memory for calculations. It shows that creating and calculating product systems without an additional cut-off criterion requires considerable time (47 min) and working memory (up to 30 GB). Consequently, full calculations are only possible on very powerful computers. In order to use less memory, it is advised to enter a cut-off criterion to create a product system.

Figure 23 and Figure 24 (on the next page) show the memory and time required for the creation and calculation of product systems of "Basic construction" in Germany entering different cut-offs. These calculations were done on a very powerful computer with a 64-bit operating system, 96 GB random access memory (RAM) and two Intel(R) Xeon(R) CPU X5690 processors with 12 cores and 3.46 GHz respectively. By applying a cut-off of 1E-11, the necessary working memory for openLCA reduces from 30 GB to 17 GB and the overall calculation time from 47 min to only 16 min. By using a cut-off of 1E-7, memory has already reduced to 3.5 GB and the system was calculated in less than three minutes etc. However, with the recent availability of libraries, the time and space required have been reduced to mere seconds and a few megabytes, respectively (see chapter 5).

[6] ... and allocate the RAM to openLCA under preferences in openLCA.

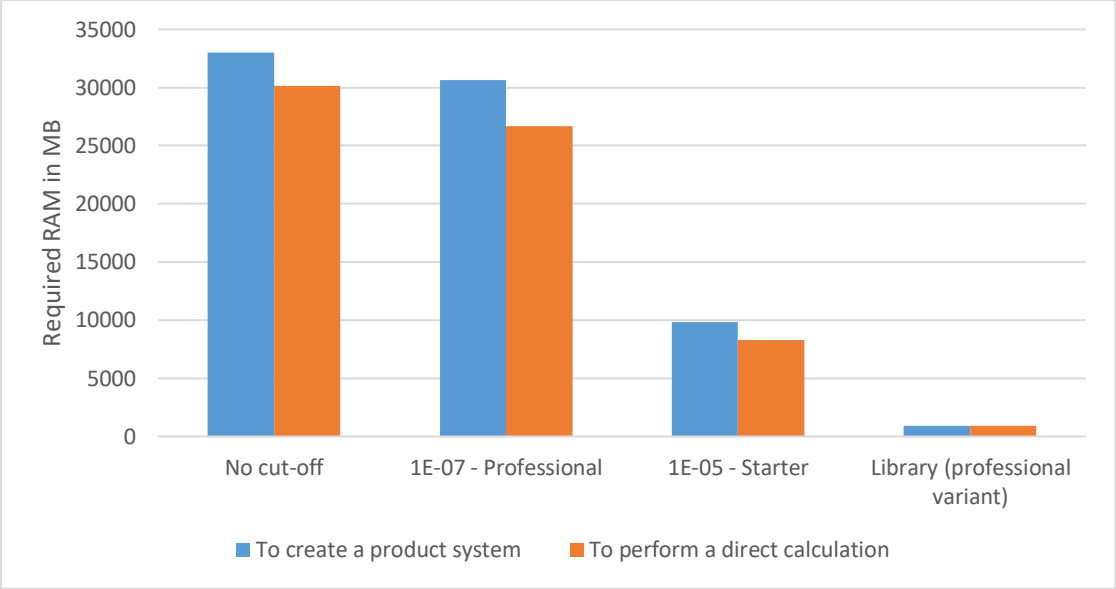


Figure 23: Required RAM for the creation of the product system "Agriculture" in Afghanistan with all PSILCA variant and library versions

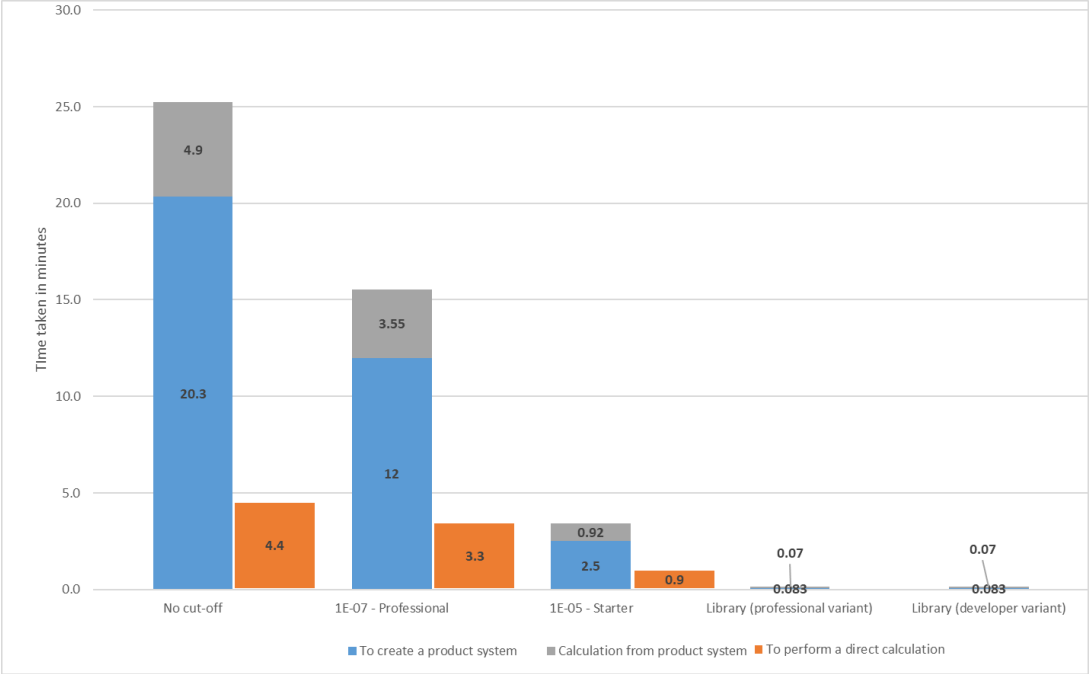


Figure 24: Duration of the creation of the product system "Agriculture" in Afghanistan with all PSILCA variant and library versions

Therefore, after installing openLCA, it is recommended to increase the maximum memory usage of openLCA, considering the RAM of the computer. For PCs with 32 GB memory the maximum memory usage of openLCA should be around 27 GB. For computers with smaller RAM sizes the maximum memory usage of openLCA has to be lower; it can never be higher than the RAM available as hardware (and some parts of the RAM are always required for the operation system etc.). You can experiment with the maximum allocated memory. If your computer is not able to provide sufficient memory, openLCA will not start.

To increase the maximum memory usage go to *File* *Settings* *Configuration* and then specify the *maximum memory usage* (see Figure 25).

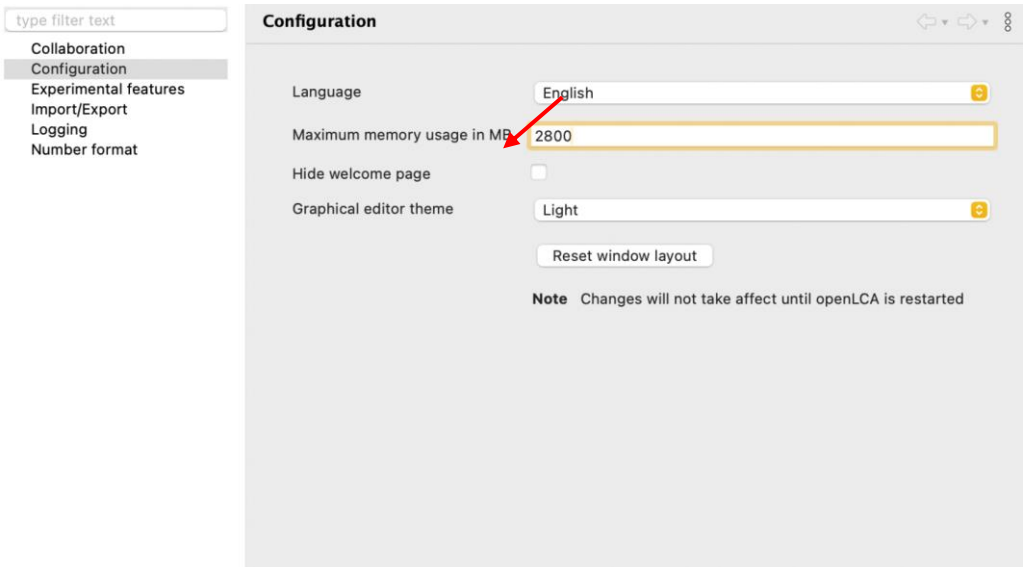


Figure 25: Increase of maximum memory usage in openLCA

4.2.2 How to use PSILCA in openLCA?

Importing PSILCA

PSILCA is provided as a zolca-file. After downloading and saving the file, the database can be imported into openLCA. Just right-click on the white area on the left side and select *From file*. A new window pops up where you select the folder where you downloaded the zolca file of your database. Then open it (see Figure 26).

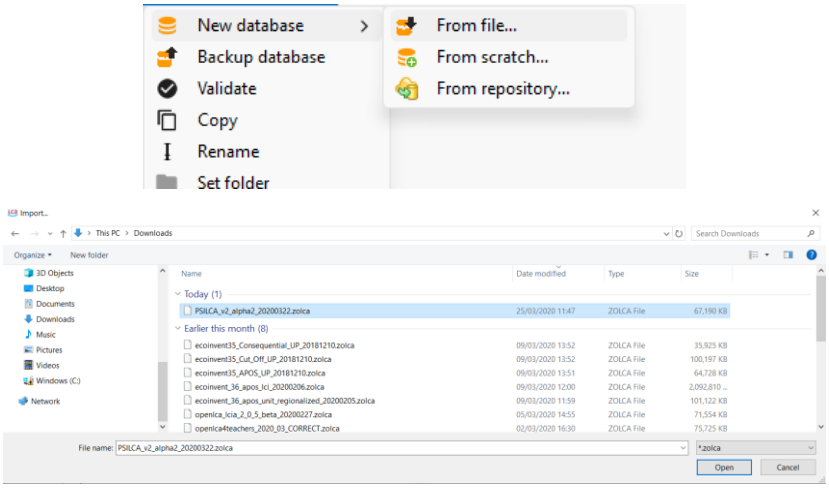


Figure 26: Restore PSILCA in openLCA

The database will be imported into the software. Due to its size, this can take a few minutes.

Opening the database, flows and processes

The database can be opened by double-clicking on it or right-clicking and selecting *Open database*.

To open a category (i.e. Processes, Flows, Products systems etc.) navigate through the navigation tree on the left side of the openLCA application by clicking on the small triangles. Flows have the icons with a large, brown “F”, and processes the icons with a large, violet “P”. They are opened by double-clicking on them (see Figure 27).

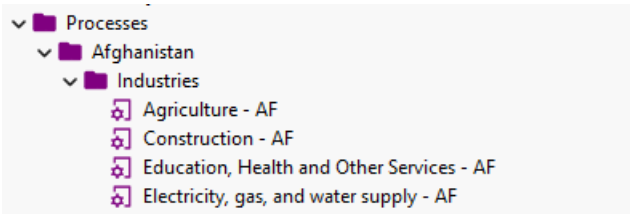


Figure 27: Part of navigation tree of PSILCA in openLCA

The flow or process will be opened in the editor window on the right side. For detailed information about the category switch through the different tabs on the bottom (see Figure 28).

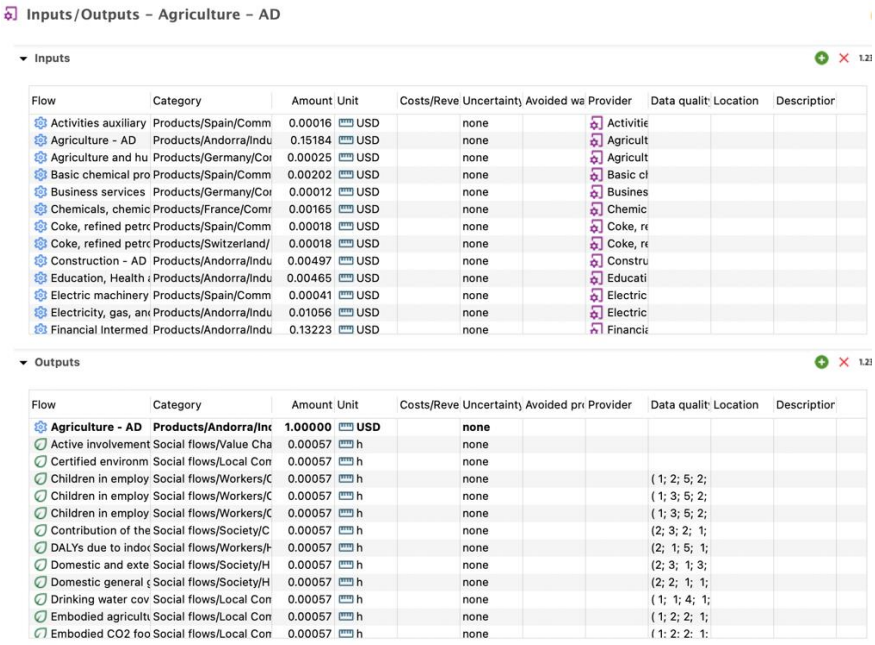


Figure 28: View of inputs and outputs of a process with its tabs

Creating a product system

To create a product system select *Create product system in* the *General information* tab of the respective process (see Figure 29).

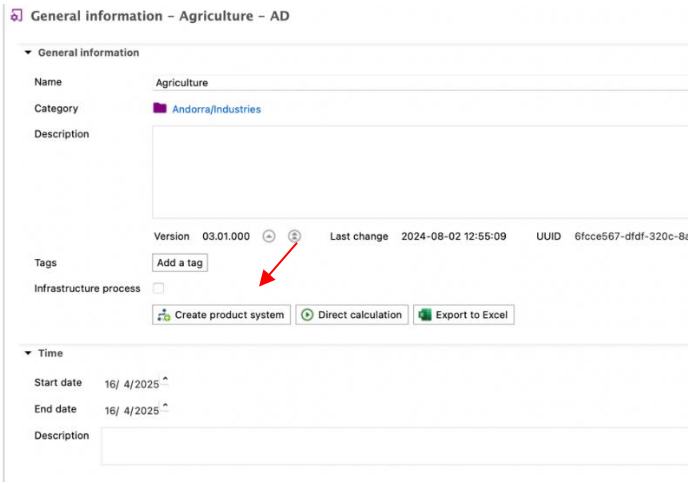


Figure 29: Creation of a product system

Note: Remember that the calculation of a product system without a cut-off can take a lot of time (or not

be possible on PCs with small memories) due to the huge amount of data. Therefore, it is highly recommended to enter a cut-off criterion (e.g. 1E-5) to reduce the memory usage of openLCA and avoid problems. This can be done in the window that opens after selecting *Create product system.* Enable *Cut-off* and insert the desired cut-off in the respective field (see Figure 30).

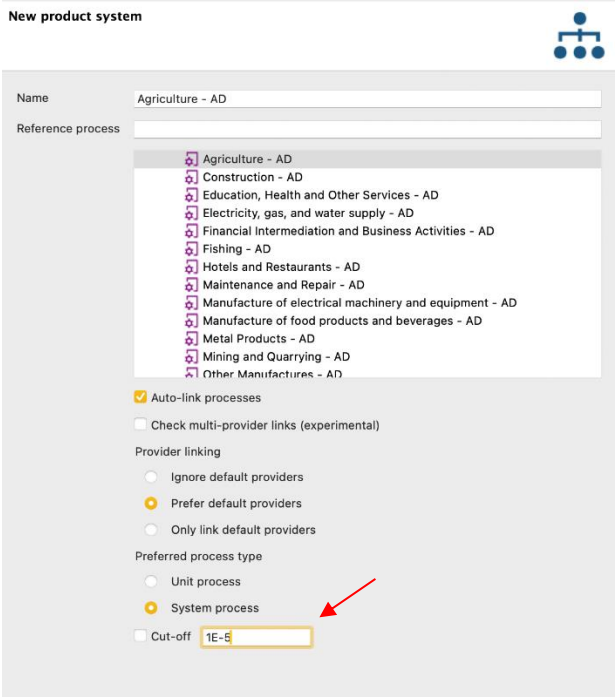


Figure 30: Inserting a cut-off criterion

Click *finish* to create the product system.

Alternatively, users can perform a direct calculation of a process without creating a product system. In many cases, a product system is not required; it is only needed when parameters, alternative connection options, or similar configurations are involved. If product systems are used, they should be built with appropriate libraries (see section 5). As seen in the screenshot below, users click on 'direct calculation' and then a pop-up window appreas where they can simply click on run calculation and then a pop-up window with the calculation set up will appear (explained in the next section).

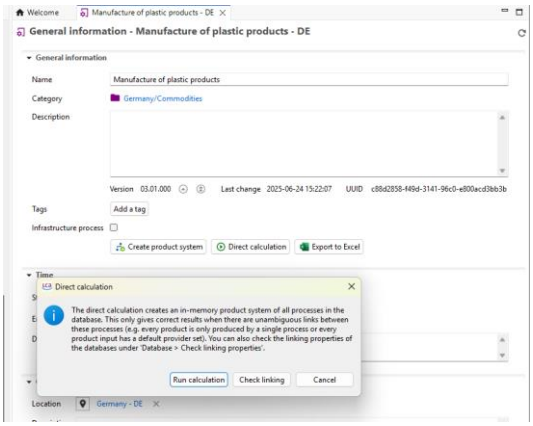


Figure 31 Direct calculation of a process in PSILCA

(Technical details: Low RAM combined with building product systems using excessively small cutoffs can cause this issue. The system creation crashes and leaves large amounts of data in the database transaction log. When reopening the database, recovery of these logs fails, resulting in a connection timeout. openLCA then assumes it cannot connect. Currently, the only solution is to manually delete the transaction log files in the database folder.)

Calculating results

After creating the product system, results (e.g. social impacts) can be calculated for it (either quick or analysis results). To do so, click on *Calculate,* select an impact assessment method (the "Social Impacts Weighting Method" is the default method) and the calculation type in the window "Calculation properties" opening up, and finish the calculation (see Figure 32).

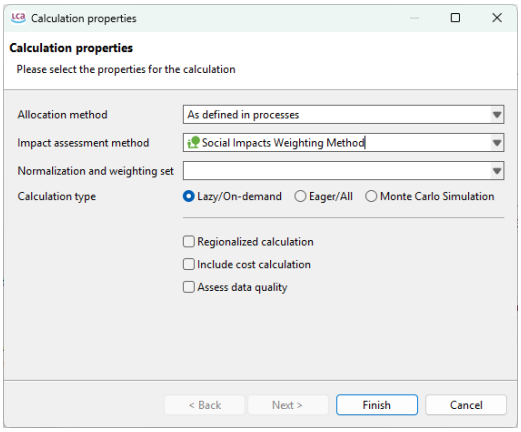


Figure 32: Calculation of results for a product system in openLCA

Analysing results of a product system

The calculation results (quick and analysis results) provide different charts and tables showing the inventory results, life cycle impact assessment results, process and flow contributions to impact categories and information about locations.

The following figures show some examples of result presentation for the process "Basic construction" in Germany (as screenshots from openLCA):

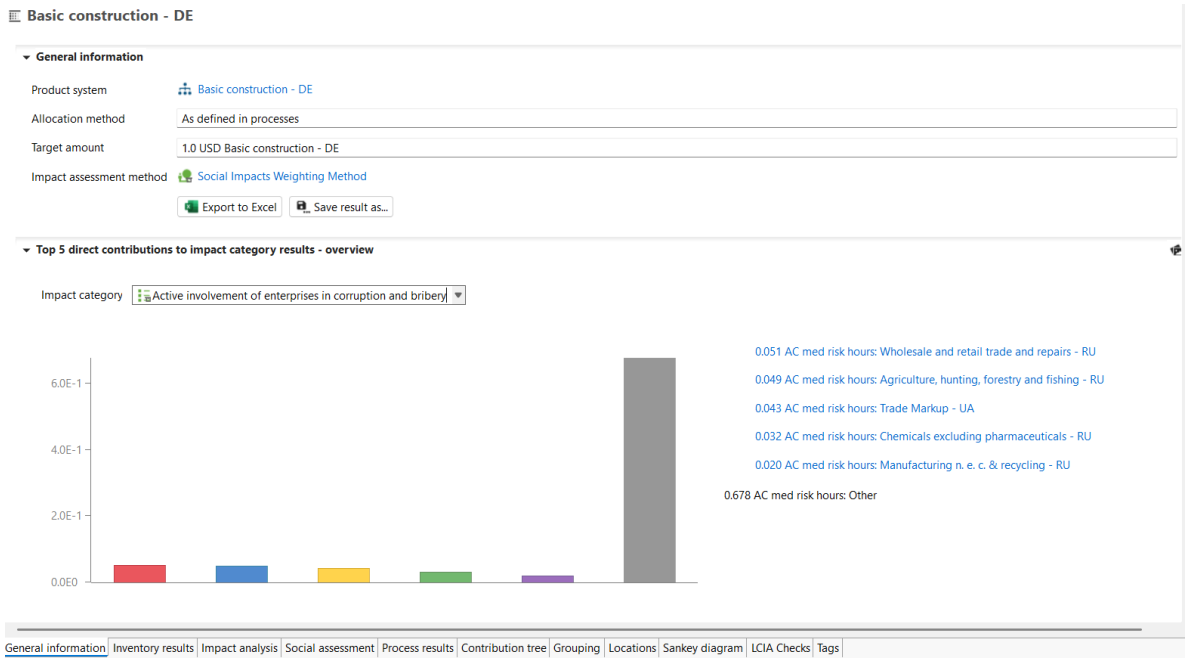


Figure 33: General information and selected flow and impact contributions

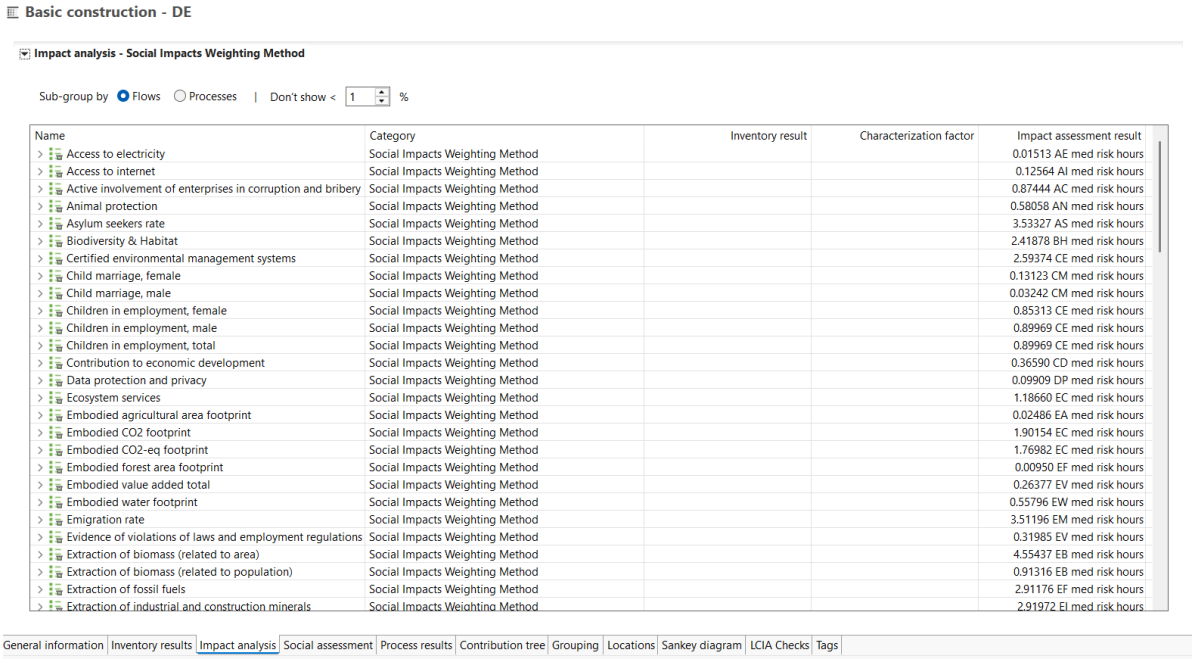


Figure 34: Impact analysis result

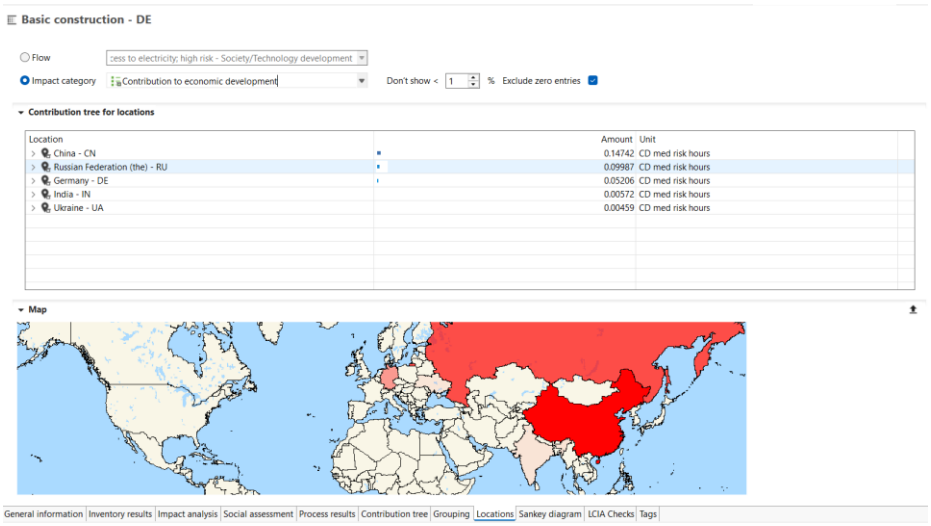


Figure 35: Geographical hot spots, expenditure on education

By clicking on *Export to Excel* (in the *General information* tab) results can also be converted into an excel file and saved independently from openLCA (see Figure 36).

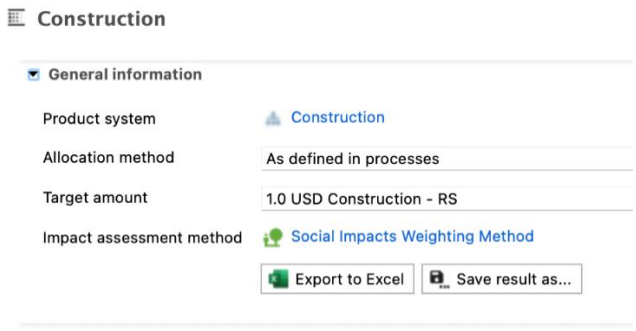


Figure 36: Export of results to an excel file

This calculation works with a cut-off, and also without a cut-off. As explained above, the calculation without a cut-off requires a powerful computer, depending on the database. As an example, for calculating basic construction, Germany, setting up the product system takes 53 minutes and requires 101.685 GB RAM, performing the calculation afterwards takes additional 18.5 minutes and altogether 118.640 GB RAM[7].

Alternative to product system creation, the direct network calculation feature

openLCA in version 1.10 and higher allows a network calculation without making a product system first, via the Direct calculation button in the General information tab of each process, see Figure 37.

[7] Computer: Threadripper 3970X, 256 GB RAM

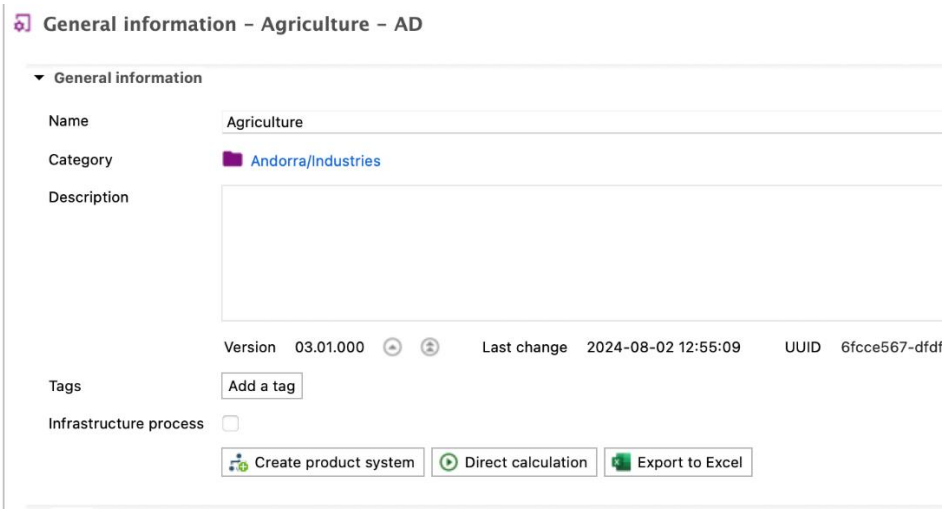


Figure 37: Direct calculation feature

This saves time and memory for densely populated databases with many connections, typically I/O databases, and makes e.g. the PSILCA developer database fully calculable also on an average computer.

For example, for the "Basic Construction" DE process, where the life cycle calculation took more than one hour in the normal mode (see above), the direct calculation on the same computer took less than 4 minutes, requiring < 16 GB of RAM, for the same system, i.e. the complete developer database without any cut-offs.

Note that this works only if the database contains unambiguous, simple links, which can be checked before using this feature. More information is available in the openLCA user manual (GreenDelta GmbH 2020b) or at the following link https://www.openlca.org/fast-network-calculation-in-openlca-1-10-2-what-is-it-and-what-is-it-good-for/.

4.3 Variation of results due to different cut-off criteria

As demonstrated above (see chapter 4.2.1) the use of cut-off criteria reduces the maximum memory usage of openLCA and the calculation time. Unfortunately, of course, this also leads to a loss of detail in the results[8].

Figure 38 shows the general effects on the system using different cut-offs for the product systems "Manufacture of textiles" and "Basic construction" in Germany. It becomes clear that the effects are not equally high for the two systems. The product systems with a cut-off of 1E-11 both contain (almost) all processes, but the one for "Basic construction" with 1E-9 has already reduced by roughly 2,400 processes while the system of "Manufacture of textiles" still contains 14,322 5 processes. For the system of "Basic construction" with 1E-7 the number of connected processes has reduced significantly while the one of "Manufacture of textiles" still counts almost 11,000 (see Figure 38).

[8] This chapter is taken from the previous database version. Since the structure of the database remains the same, with identical number of processes (country / sector combinations), also the conclusions drawn are valid for the version 3 of the database.

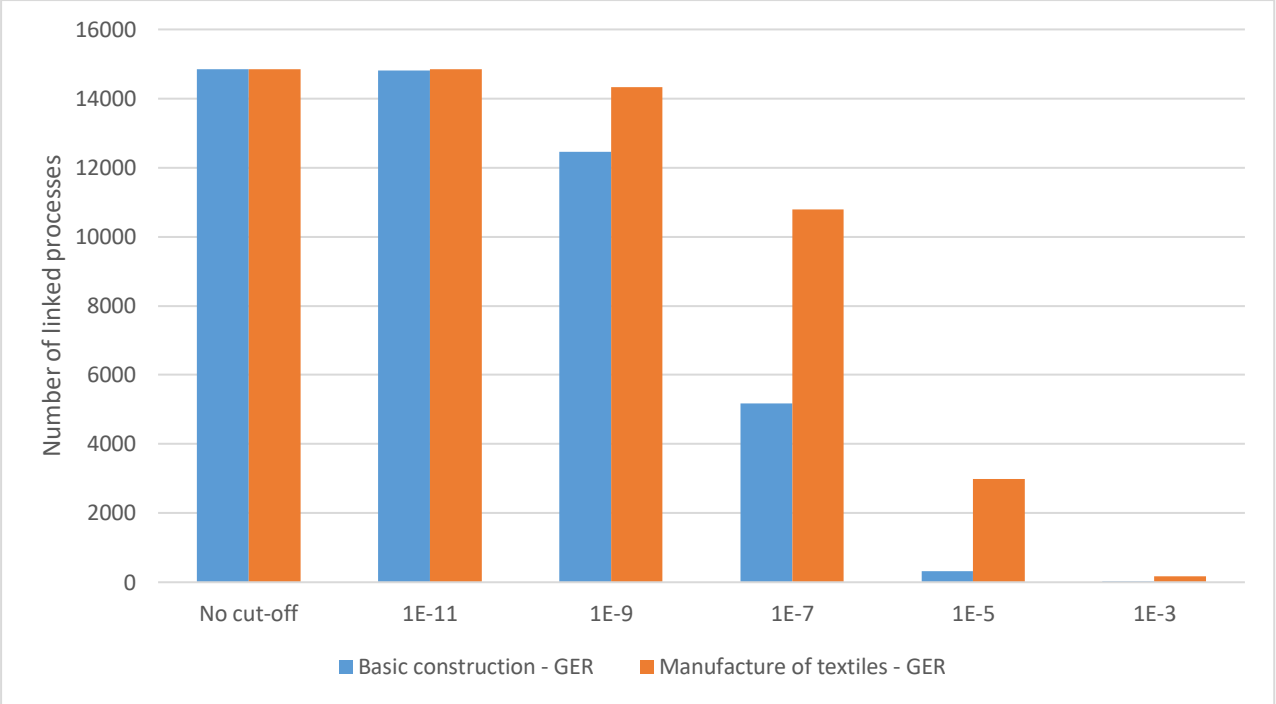


Figure 38: Number of processes depending on different cut-off criteria, for two product systems

Of course, with the reduction of the number of processes considered, also the number of process links is reduced a lot, from almost 40 million in the versions without cut-off to 177 and 38 with a cut-off of 1E-03 for the two product systems respectively (see Figure 39).

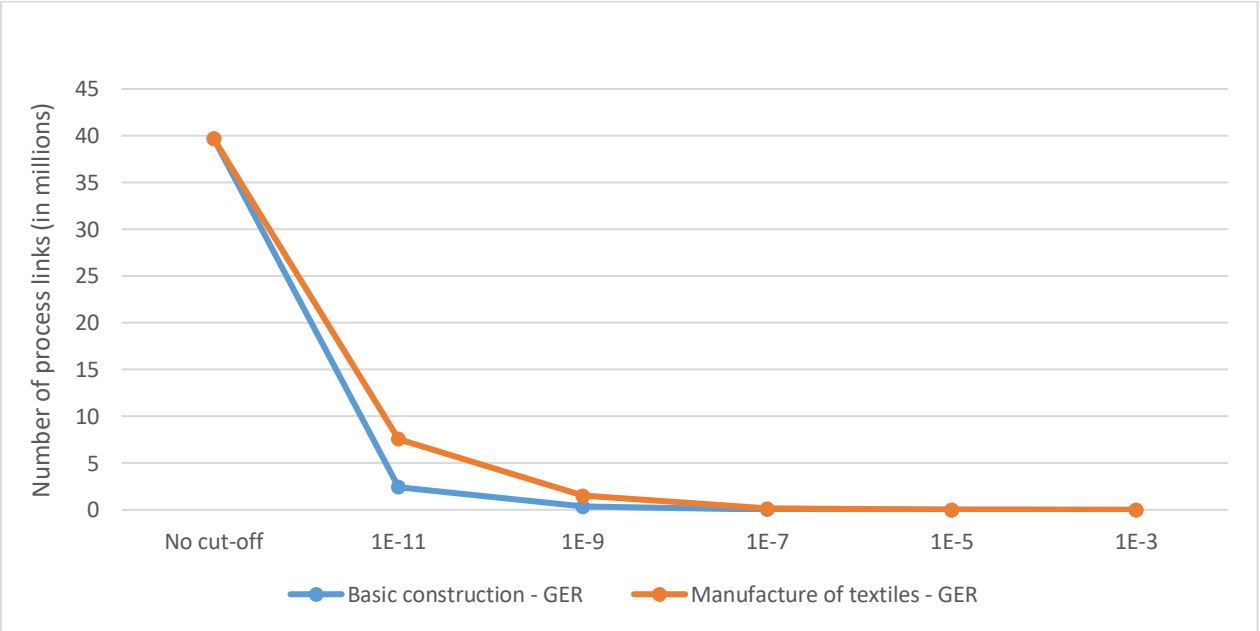


Figure 39: Number of process links depending on different cut-off criteria, for two product systems

This short analysis shows that the effects on the system can vary greatly between different product systems. However, the strong reduction of the number of processes especially with cut-offs of 1E-7 and below already indicates that it is not recommendable to apply very high cut-offs.

In the following, some analysis results are presented for the product system “Manufacture of textiles” in Germany calculated with different cut-offs.

Figure 40 illustrates the overall impact of child labour in the "Manufacture of textiles" sector in Germany. Like the reduction in the number of processes, the amount of medium-risk child labour hours begins to decrease more noticeably with a cut-off threshold of 1E-7 (Professional Variant). However, it still accounts for more than 90% of the total impact without any cut-off applied. A significant reduction in the overall impact is observed only at a cut-off of 1E-5, where it represents roughly half of the impact compared to the system without a cut-off. However, as seen, the library results depict the same value to its corresponding zolca database (1E-7).

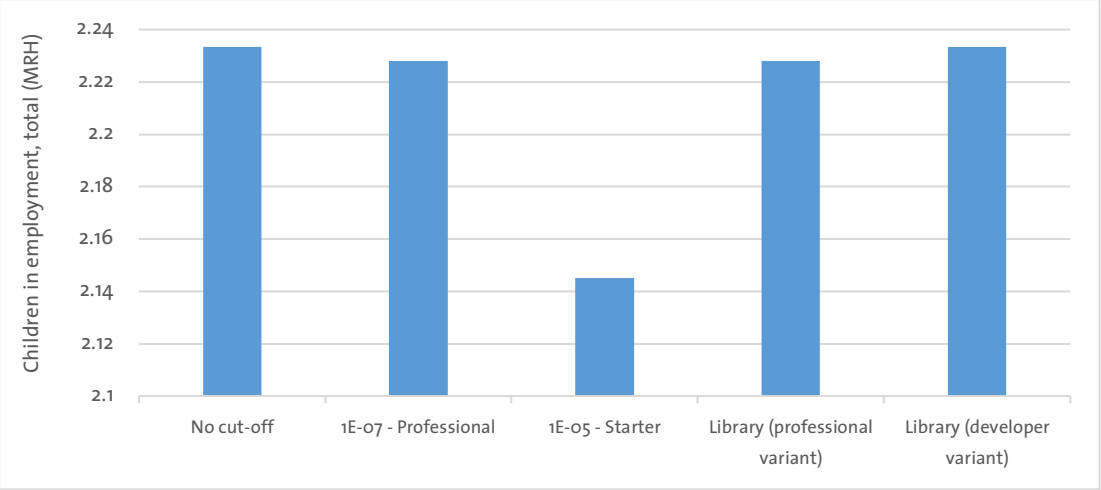


Figure 40: Overall impact of child labour for "Manufacture of textiles" in Germany

In the following figures, the highest impact contributions for child labour of "Manufacture of textiles" in Germany are illustrated disaggregated by processes and locations. Only results for the systems without a cut-off, with a cut-off of 1E-7 and 1E-5 are shown because results for 1E-11 and 1E-9 do not vary much from the ones without a cut-off.

Figure 41 shows that the shares of the most contributing processes to child labour – "Wholesale & retail trade and repairs (Russia)" and "Textile, textile products, leather and footwear (Russia)" – become smaller with a growing cut-off because less important processes from the upstream chain are cut off.

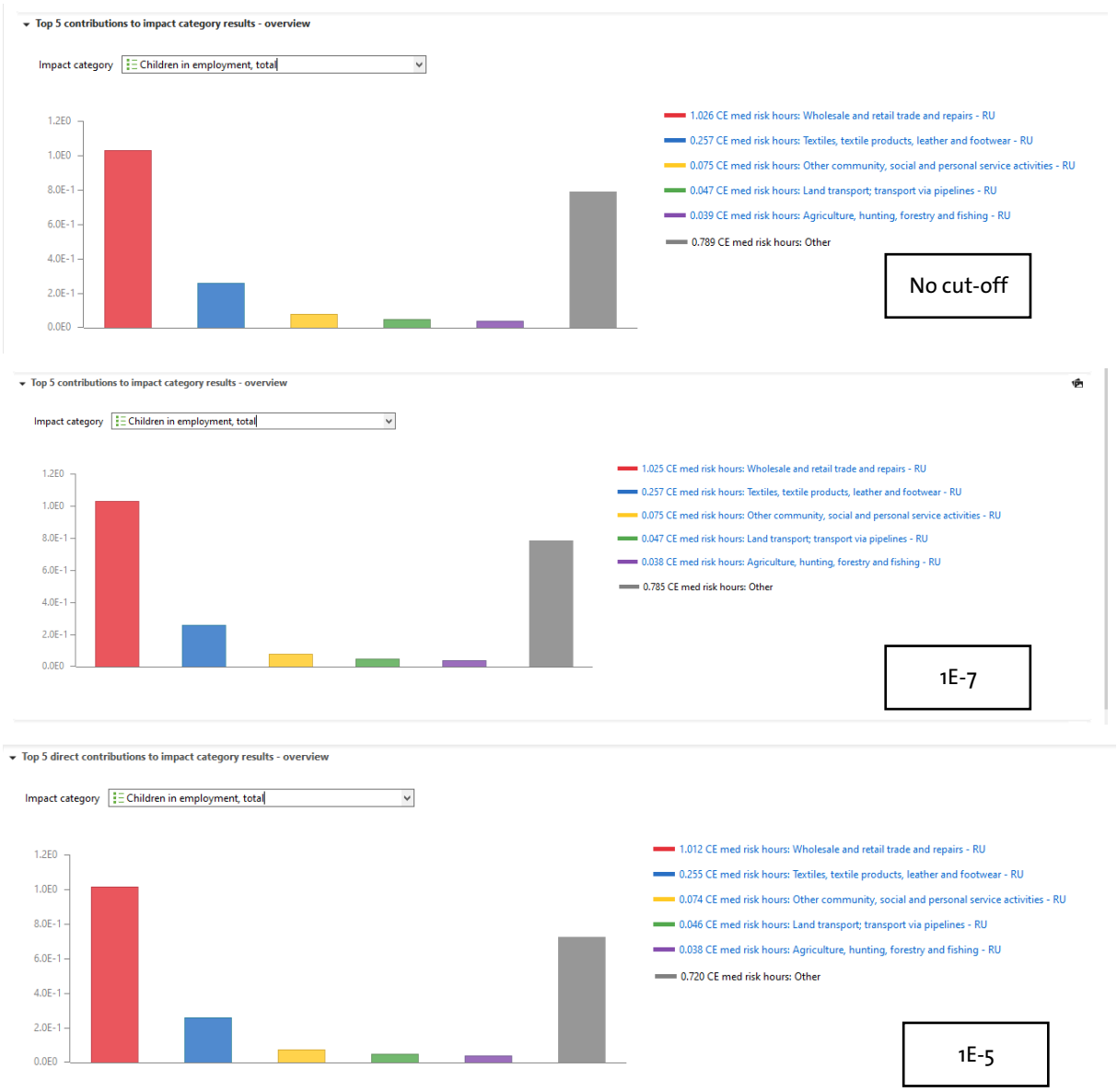
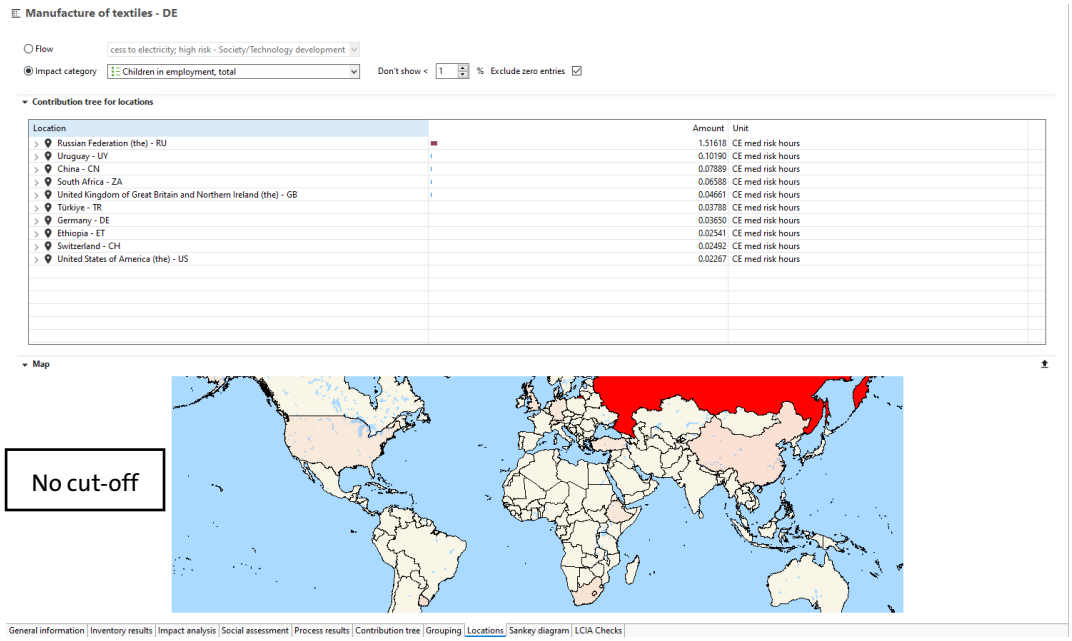
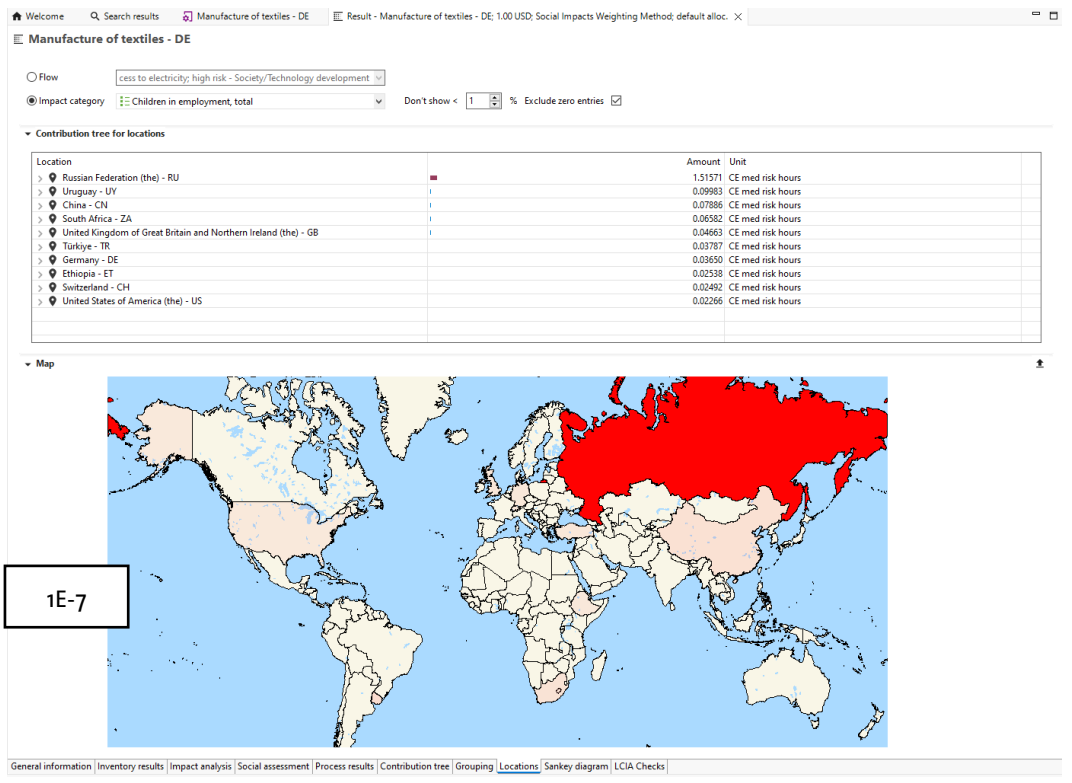


Figure 41: Bar chart of highest contributions to child labour for product systems of "Manufacture of textiles" in Germany without a cut-off (above), with a cut-off of 1E-7 (middle) and 1E-5 (below)

The maps in Figure 42 illustrate that with increasing cut-off criteria less countries seem to contribute to child labour at all while others gain more importance (e.g. Turkey). Of course, this is due to the fact that processes from some countries are cut off the product system and, hence, do not contribute anymore (or much less) to the final result (e.g. Argentina).



No cut-off



1E-7

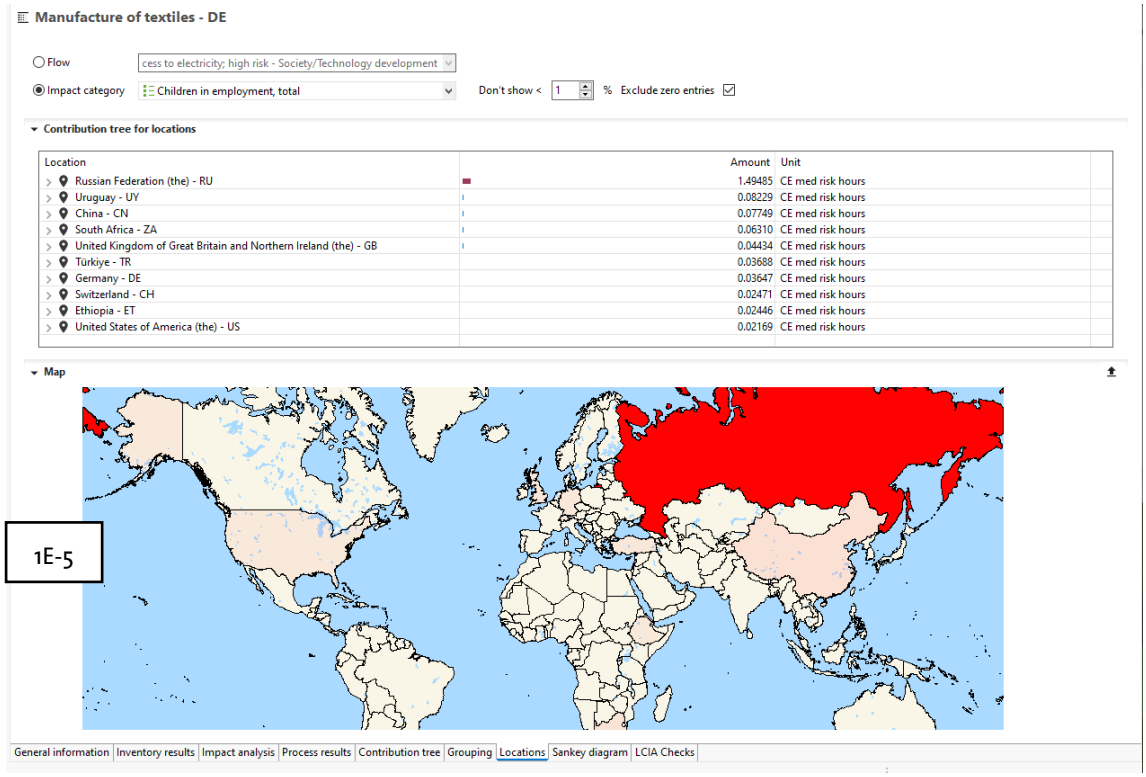


Figure 42: Most contributing locations (countries) to child labour for product systems of "Manufacture of textiles" in Germany without a cut-off (above), with a cut-off of 1E-7 (middle) and 1E-5 (below)

Out of these findings, an interim conclusion can already be drawn. For the examined product systems, all the analyses indicate that results only start to change significantly from a cut-off of 1E-7. The comparison of general results shows that – including the cut-off of 1E-5 – the four most contributing processes remain the same (see Figure 41).

Of course, the level of detail (e.g. the total amount of medium risk hours of an impact or the exact contribution of locations to an impact category) becomes more imprecise with increasing cut-offs. Additionally, since cut-off criteria refer to the monetary contribution to the final product (or sector) there is a growing risk of "cutting off" social hotspots (e.g. processes with high or very high risks of an impact) when applying higher cut-offs.

Consequently, in order to receive most detailed and exact results cut-off criteria should be as small as possible. Nonetheless, calculations with cut-offs until around 1E-7 or even 1E-5 still deliver reliable results for comparing most relevant impacts and detecting social hotspots (processes as well as countries).

5 Libraries of PSILCA

Libraries are tools that enable faster impact calculations and consistent use of processes, flows, impact categories, etc., across databases. The improved calculation speed is made possible by precalculated matrices.

PSILCA v4.0 is now available in library format, making it lighter to download and import, and significantly faster to use for calculations. Even in the developer version, it produces results that are identical to those of the standard (non-library) zolca version.

Libraries can also be downloaded from Nexus, where they are provided in ZIP format. To use a library in openLCA, first create an empty database (right click → from scratch) as shown below:

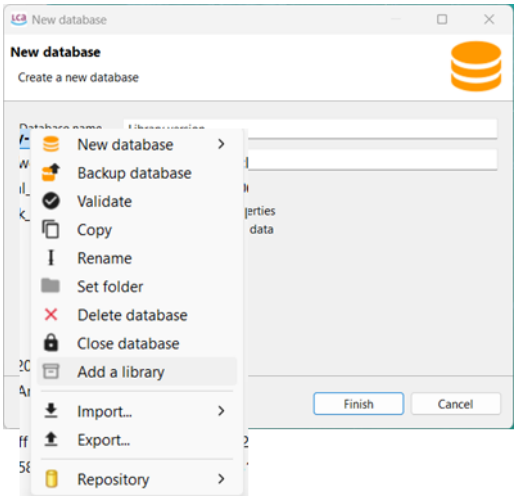


Figure 43: create an empty database on openLCA

Then, right-click on the active empty database and select "Add library." A pop-up window shall appear and then users can import the zip file.

Library-based processes appear in *italic grey font* and are marked with a gear icon, indicating they are sourced from a library. However, it's important to note that when using a library, no changes can be made to the background database, this includes modifications to input/output values, activity variables, risk levels, etc.

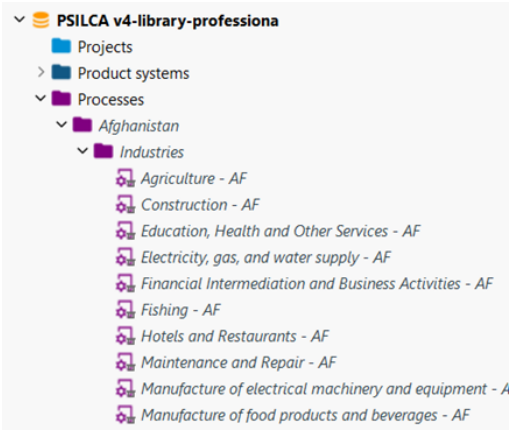


Figure 44: PSILCA Professional variant library version

To learn more about the technical details of libraries, please refer to: https://greendelta.github.io/openLCA2-manual/libraries/file_system.html

6 Updating risk levels

Updating risk levels for a given indicator was already possible in previous versions using a Jython script, which was publicly available in the PSILCA v3.1.1 manual. This script has now been added directly to the databases in both the Professional and Developer variants. It can be found under the 'scripts' folder, as shown in the screenshot below.

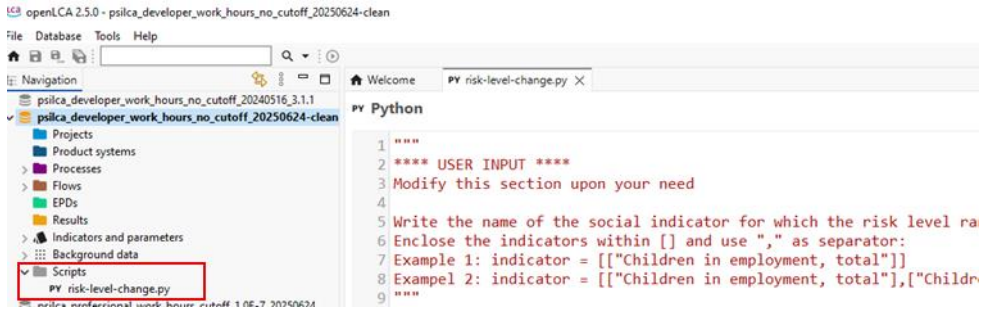


Figure 45: Script to change risk levels

As explained within the script, users only need to edit **two sections**:

1. The location where they wish to store the **change log file**.

```
Define the path of the change log file (a list of the changes done in the Evaluation Schemes and Social Aspects will be recorded)

Note: if the log file is open, the code won't run
"""

# Path to the change log
change_log = 'C:/Users/username/Desktop/log_psilca_indicators.csv'
```

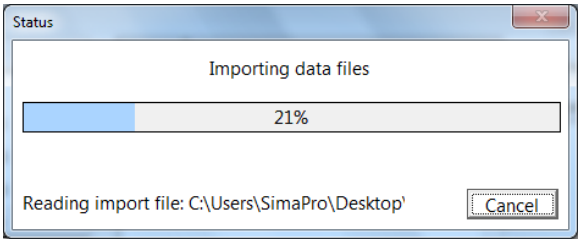
2. The definition of the **new evaluation scheme** for the indicator they intend to modify.

```
Risk levels are fixed in openLCA. Levels available:
HIGH_OPPORTUNITY, MEDIUM_OPPORTUNITY, LOW_OPPORTUNITY, NO_RISK, VERY_LOW_RISK, LOW_RISK, MEDIUM_RISK, HIGH_RISK, VERY_HIGH_RISK, NO_DATA, N
"""

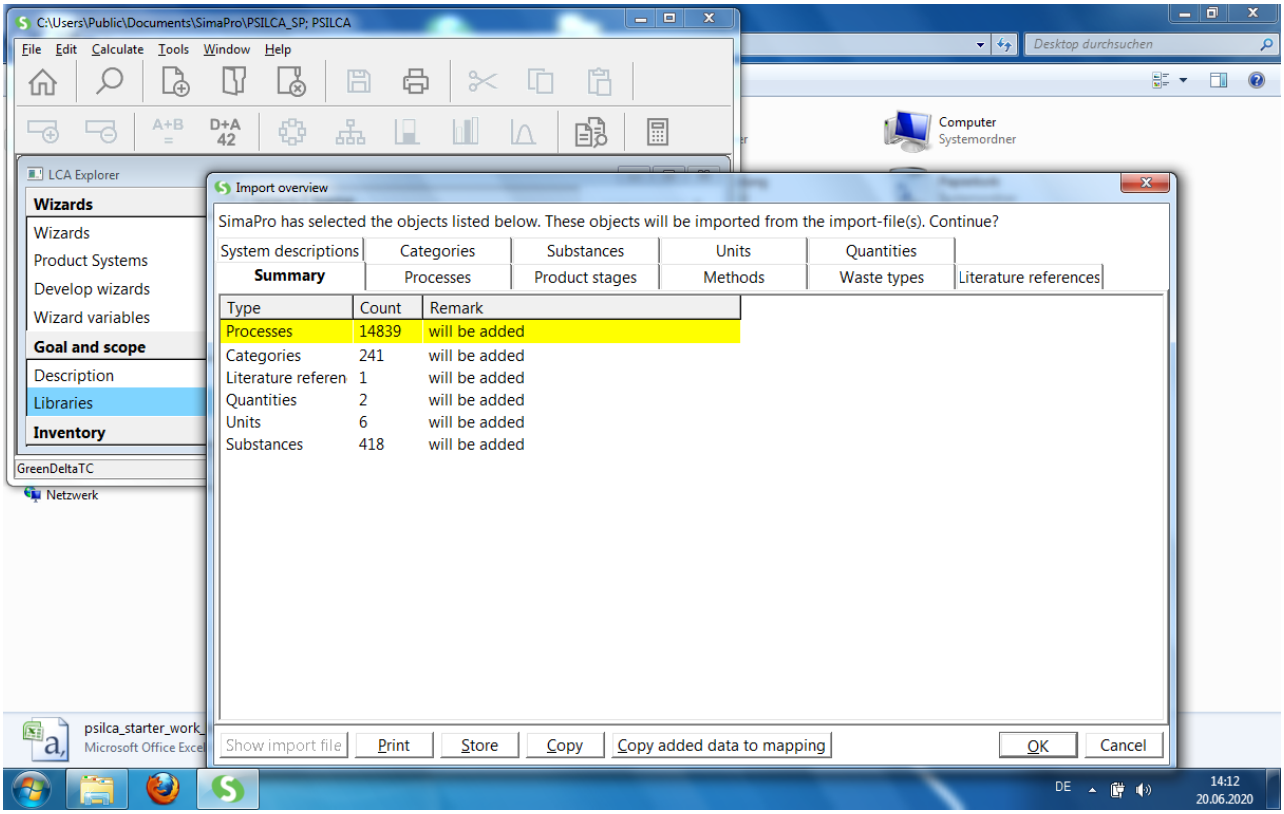
evaluation_scheme = [
    ["NO_DATA", "EV", "n.a."],  # No data available
    ["NO_RISK", "EV", "0.00"],  # No risk: y = 0.00
    ["VERY_LOW_RISK", "R3", "0", "0.63"],  # Very low risk: 0 < y < 0.63
    ["LOW_RISK", "R1", "0.63", "1.23"],  # Low risk: 0.63 <= y < 1.23
    ["MEDIUM_RISK", "R1", "1.23", "2.18"],  # Medium risk: 1.23 <= y < 2.18
    ["HIGH_RISK", "R4", "2.18", "3.16"],  # High risk: 2.18 <= y <= 3.16
    ["VERY_HIGH_RISK", "N3", "3.16"]  # Very high risk: y > 3.16
]
```

7 PSILCA in SimaPro

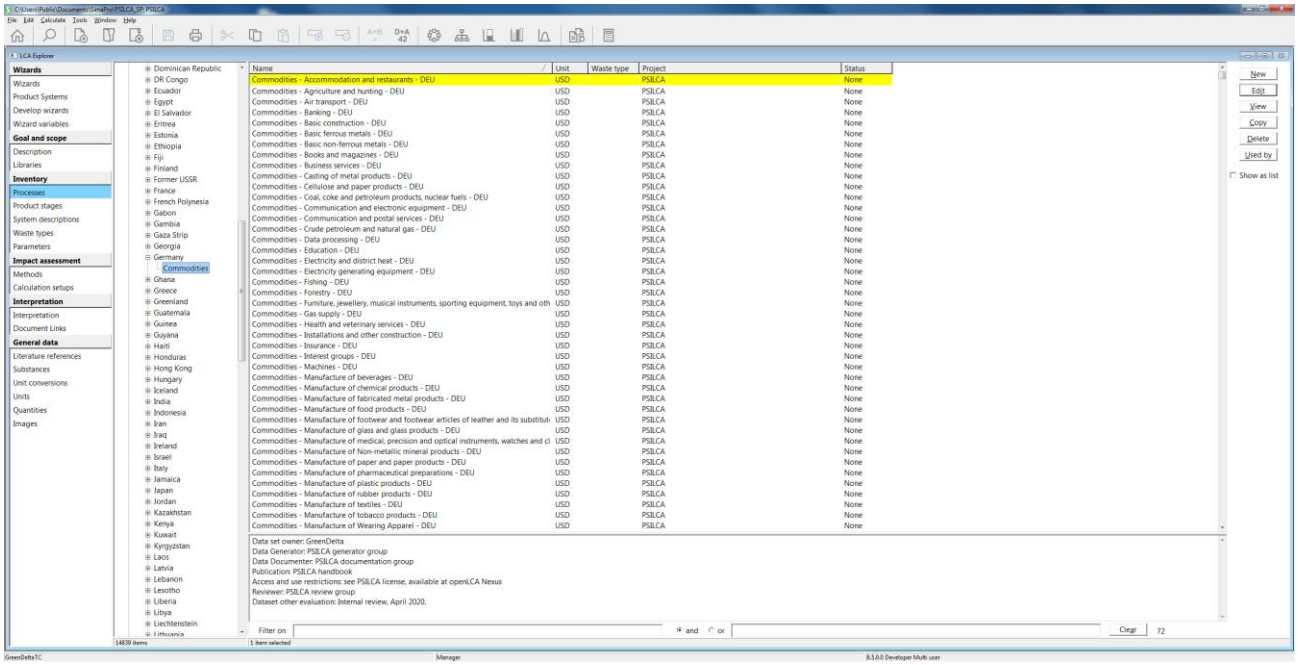
PSILCA is also available for the SimaPro LCA software, as a SimaPro csv file. In order to use it, simply import the csv, which can take a while, into a new database in SimaPro.



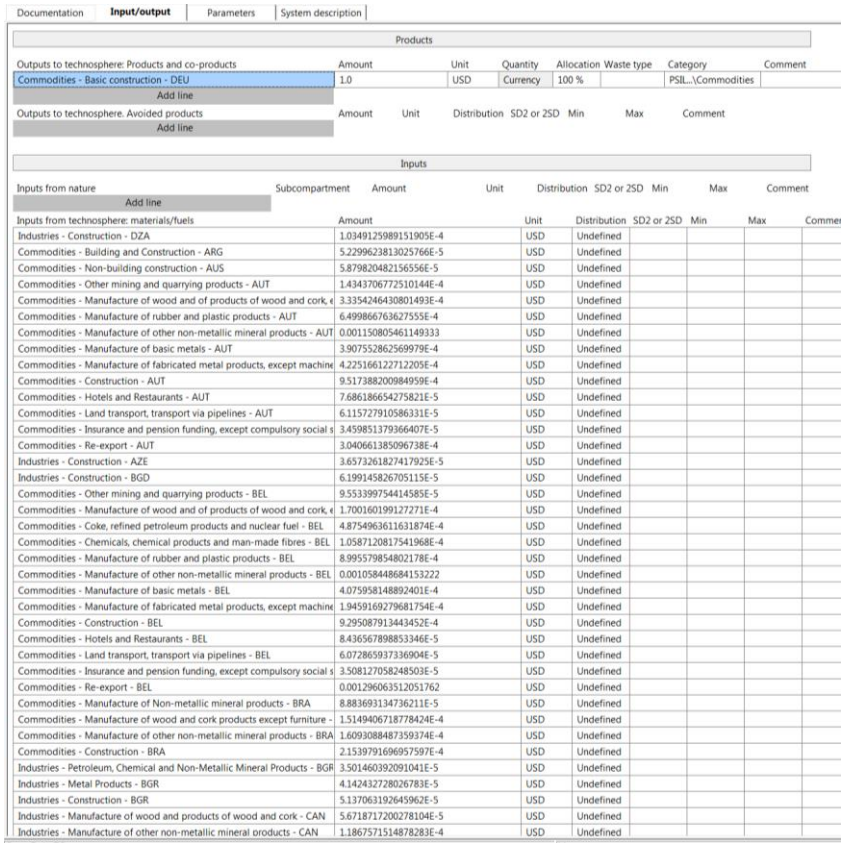
Since SimaPro does not allow the modification of the calculation algorithm, and is not compatible with the product system concept, only the "usual", worker hour databases are available for the software.



The database contains the same country-specific sectors as the openLCA databases.



The processes are more truncated, though; in the distributed version, all product flows < 3 x 10e-5 were deleted, since otherwise, SimaPro is not able to calculate them due to memory restrictions (Figure 47).



Documentation | **Input/output** | Parameters | System description

Products

Outputs to technosphere: Products and co-products	Amount	Unit	Quantity	Allocation	Waste type	Category	Comment
Commodities - Basic construction - DEU	1.0	USD	Currency	100 %		PSIL...\Commodities	

Add line

Outputs to technosphere: Avoided products	Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment

Add line

Inputs

Inputs from nature	Subcompartment	Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment

Add line

Inputs from technosphere: materials/fuels	Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comme
Industries - Construction - DZA	1.03491259891519O5E-4	USD	Undefined				
Commodities - Building and Construction - ARG	5.22996238130257666-5	USD	Undefined				
Commodities - Non-building construction - AUS	5.87982048215655E-5	USD	Undefined				
Commodities - Other mining and quarrying products - AUT	1.43437067725101446-4	USD	Undefined				
Commodities - Manufacture of wood and of products of wood and cork, (	3.33542464308014936-4	USD	Undefined				
Commodities - Manufacture of rubber and plastic products - AUT	6.49986676362755E-4	USD	Undefined				
Commodities - Manufacture of other non-metallic mineral products - AUT	0.00115080546114933 3	USD	Undefined				
Commodities - Manufacture of basic metals - AUT	3.90755286256997E-4	USD	Undefined				
Commodities - Manufacture of fabricated metal products, except machine	4.22516612271220 5E-4	USD	Undefined				
Commodities - Construction - AUT	9.51738820098495 9E-4	USD	Undefined				
Commodities - Hotels and Restaurants - AUT	7.68618665427582 1E-5	USD	Undefined				
Commodities - Land transport, transport via pipelines - AUT	6.11572791058633 1E-5	USD	Undefined				
Commodities - Insurance and pension funding, except compulsory social s	3.45985137936640 7E-5	USD	Undefined				
Commodities - Re-export - AUT	3.04066138509673 8E-4	USD	Undefined				
Industries - Construction - AZE	3.65732618274179 25E-5	USD	Undefined				
Industries - Construction - BGD	6.19914582670511 5E-5	USD	Undefined				
Commodities - Other mining and quarrying products - BEL	9.55339975441458 5E-5	USD	Undefined				
Commodities - Manufacture of wood and of products of wood and cork, (	1.70016019912727 1E-4	USD	Undefined				
Commodities - Coke, refined petroleum products and nuclear fuel - BEL	4.87549636116318 74E-4	USD	Undefined				
Commodities - Chemicals, chemical products and man-made fibres - BEL	1.05871208175419 68E-4	USD	Undefined				
Commodities - Manufacture of rubber and plastic products - BEL	8.99557985480217 8E-4	USD	Undefined				
Commodities - Manufacture of other non-metallic mineral products - BEL	0.00105844868415 3222	USD	Undefined				
Commodities - Manufacture of basic metals - BEL	4.07595814889240 1E-4	USD	Undefined				
Commodities - Manufacture of fabricated metal products, except machine	1.94591692796817 54E-4	USD	Undefined				
Commodities - Construction - BEL	9.29508791344345 2E-4	USD	Undefined				
Commodities - Hotels and Restaurants - BEL	8.43656789885334 6E-5	USD	Undefined				
Commodities - Land transport, transport via pipelines - BEL	6.07286593733690 4E-5	USD	Undefined				
Commodities - Insurance and pension funding, except compulsory social s	3.50812705824850 3E-5	USD	Undefined				
Commodities - Re-export - BEL	0.00129606351205 1762	USD	Undefined				
Commodities - Manufacture of Non-metallic mineral products - BRA	8.88369313473621 1E-5	USD	Undefined				
Commodities - Manufacture of wood and cork products except furniture -	1.51494067187784 24E-4	USD	Undefined				
Commodities - Manufacture of other non-metallic mineral products - BRA	1.60930884873593 74E-4	USD	Undefined				
Commodities - Construction - BRA	2.15397916969575 97E-4	USD	Undefined				
Industries - Petroleum, Chemical and Non-Metallic Mineral Products - BGR	3.50146039209104 1E-5	USD	Undefined				
Industries - Metal Products - BGR	4.14243272802678 3E-5	USD	Undefined				
Industries - Construction - BGR	5.13706319264596 2E-5	USD	Undefined				
Industries - Manufacture of wood and products of wood and cork - CAN	5.67187172002781 04E-5	USD	Undefined				
Industries - Manufacture of other non-metallic mineral products - CAN	1.18675715148782 83E-4	USD	Undefined				

Figure 46 Process Basic Construction, DE, in SimaPro (excerpt)

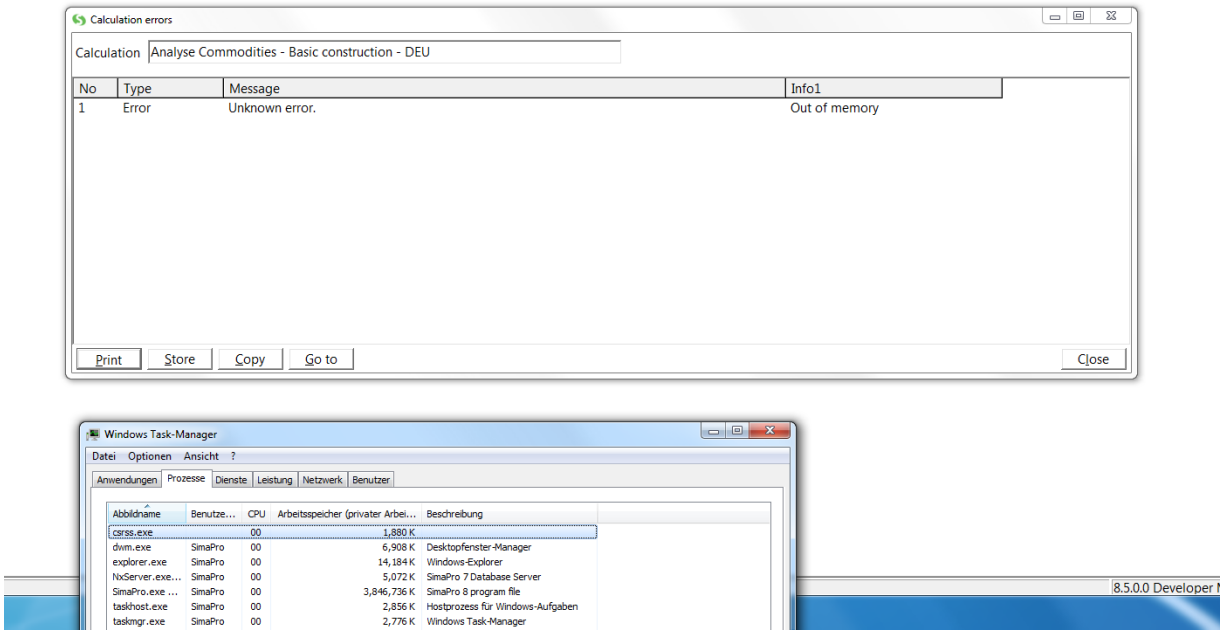


Figure 47: Calculating the PSILCA starter database in SimaPro, 8.5.5 Developer version, with a cut-off of 1e-5 (i.e. the PSILCA Starter setting)

With the distributed version, the calculation works (Figure 48) evidently, values are somewhat lower than with the openLCA versions of the database since more data was truncated. Table 7 and Figure 49 show a comparison of results for the process basic construction, Germany, for the openLCA PSILCA v4 developer, professional and starter version and for the SimaPro version as well.

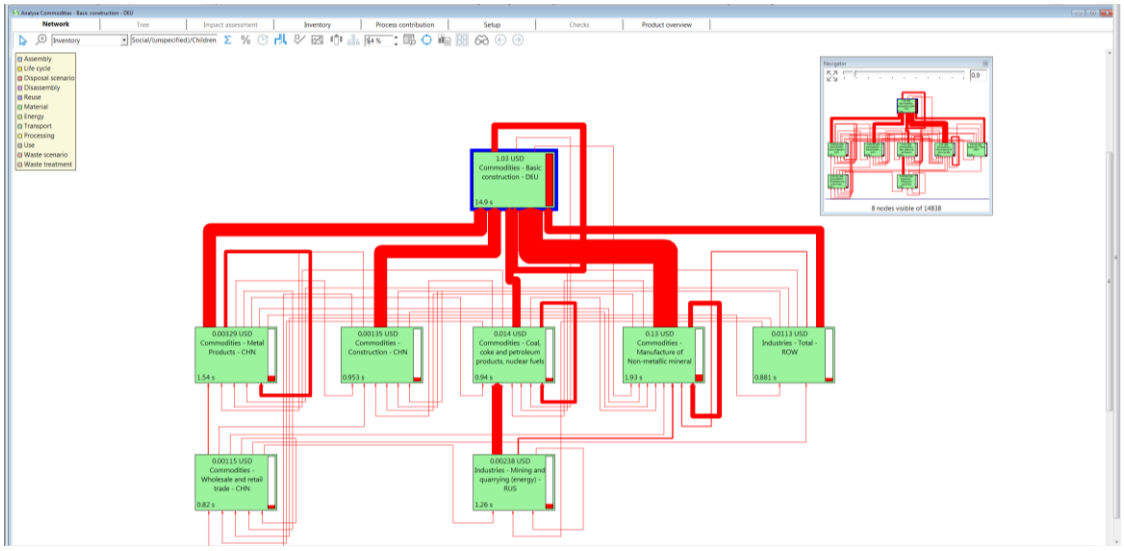


Figure 48: Network result view for the SimaPro version, process basic construction, Germany, female child work

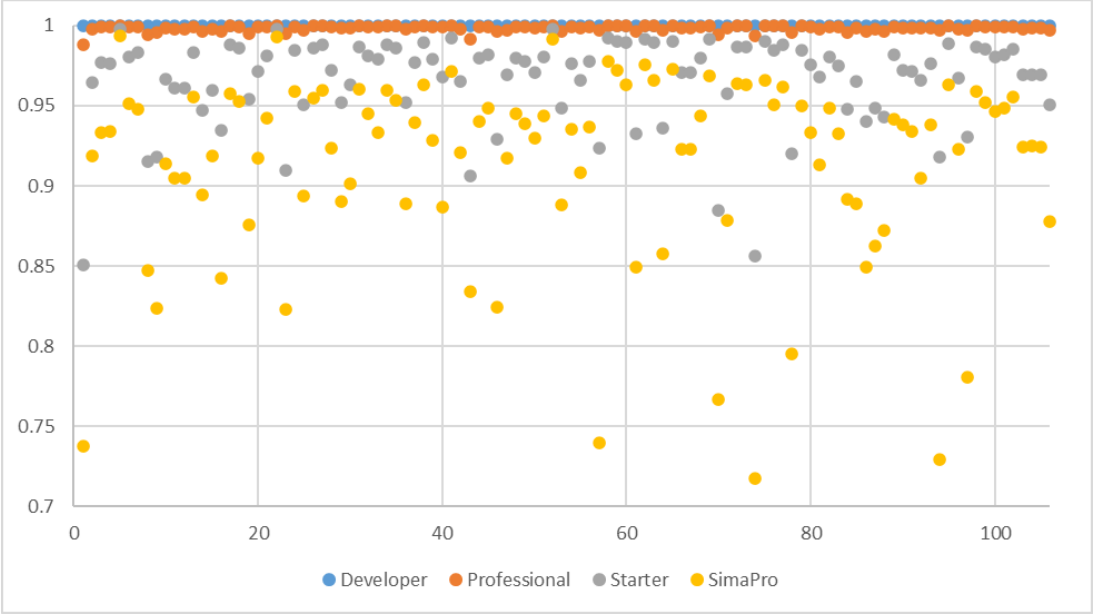


Figure 49: Comparison of PSILCA results for different database versions, Developer, professional, starter, and SimaPro, for the network calculation result for basic construction, Germany; developer result = 1

Table 7: Comparison of PSILCA results for different database versions, Developer, professional, starter, and SimaPro, for the network calculation result for basic construction, Germany (excerpt)

Name	Developer	Professional	Starter	SimaPro
Access to electricity	1	0.987999	0.850929	0.737498
Access to internet	1	0.997995	0.964464	0.918906
Active involvement of enterprises in corruption and bribery	1	0.999237	0.976805	0.933566
Animal protection	1	0.999137	0.976032	0.934062
Asylum seekers rate	1	0.999967	0.997933	0.993798

Name	Developer	Professional	Starter	SimaPro
Biodiversity & Habitat	1	0.999057	0.980428	0.95143
Certified environmental management systems	1	0.99954	0.983021	0.947725
Child marriage, female	1	0.994384	0.915152	0.847174
Child marriage, male	1	0.99554	0.918367	0.823352
Children in employment, female	1	0.998432	0.966731	0.913761
Children in employment, male	1	0.997736	0.960772	0.904901
Children in employment, total	1	0.997736	0.960772	0.904901
Contribution to economic development	1	0.999425	0.983001	0.955184
Data protection and privacy	1	0.996399	0.947224	0.894085
Ecosystem services	1	0.997861	0.959785	0.918714
Embodied agricultural area footprint	1	0.996604	0.934655	0.842206
Embodied CO2 footprint	1	0.9997	0.988104	0.957715
Embodied CO2-eq footprint	1	0.999554	0.986227	0.952473
Embodied forest area footprint	1	0.995367	0.954279	0.875394
Embodied value added total	1	0.998946	0.971642	0.916995
Embodied water footprint	1	0.999376	0.981287	0.941985
Emigration rate	1	0.999942	0.997846	0.992836
Evidence of violations of laws and employment regulations	1	0.995297	0.90976	0.822824
Extraction of biomass (related to area)	1	0.999526	0.984759	0.959188
Extraction of biomass (related to population)	1	0.997413	0.950648	0.893702
Extraction of fossil fuels	1	0.999664	0.986375	0.955027
Extraction of industrial and construction minerals	1	0.999772	0.987825	0.959956
Extraction of ores	1	0.999203	0.972277	0.923769
Female genital mutilation 0-14	1	0.998467	0.952115	0.890531
Female genital mutilation 15-49	1	0.998209	0.963028	0.901182
Female with account at a financial institution	1	0.999675	0.986882	0.960375
Food insecurity	1	0.999298	0.981117	0.945126
Freedom of association and collective bargaining	1	0.999444	0.97933	0.933056

Name	Developer	Professional	Starter	SimaPro
Freedom of the press	1	0.999728	0.988204	0.959703
Frequency of forced labour	1	0.999614	0.98635	0.953557
Gender inequalities	1	0.99785	0.951867	0.888952
Gender wage gap	1	0.999194	0.976726	0.939881
Global freedom scores	1	0.999753	0.989337	0.96284
Global Peace Index	1	0.999377	0.979386	0.928344
Global Terrorism Index	1	0.998987	0.967891	0.886942
Goods produced by forced labour	1	0.99987	0.992461	0.971799
Health expenditure, domestic general government	1	0.998119	0.965507	0.921044
Health expenditure, external resources	1	0.991654	0.906451	0.833716
Health expenditure, out-of-pocket	1	0.999395	0.979755	0.940148
Health expenditure, total	1	0.999487	0.981964	0.948391
Homicides	1	0.996247	0.929246	0.824013
Household air pollution attributable DALYs, female	1	0.997498	0.969367	0.917349
Household air pollution attributable DALYs, male	1	0.998949	0.97981	0.945396
Illiteracy rate, female	1	0.999191	0.977456	0.938626
Illiteracy rate, male	1	0.998515	0.971015	0.929656
Illiteracy rate, total	1	0.999271	0.980282	0.943707
Immigration rate	1	0.999942	0.997543	0.991832
Indigenous People Rights Protection Index	1	0.996795	0.948506	0.887926
Informal employment, female	1	0.999104	0.976555	0.935094
Informal employment, male	1	0.998539	0.96574	0.908257
Informal employment, total	1	0.999131	0.977423	0.93681
Internally displaced people	1	0.997052	0.923528	0.739433
International Migrant Stock	1	0.999779	0.992531	0.977565
International migrant workers in the sector	1	0.999636	0.990447	0.972152
Internet freedom scores	1	0.999749	0.989376	0.963032
Labour productivity	1	0.996769	0.932762	0.849313
Level of industrial water use (related to	1	0.999832	0.991382	0.975797

Name	Developer	Professional	Starter	SimaPro
renewable water resources)				
Level of industrial water use (related to total withdrawal)	1	0.999774	0.989864	0.96601
Life expectancy at birth	1	0.997407	0.935943	0.857899
Living wage, per month	1	0.9997	0.990081	0.972831
Mean years of schooling, female	1	0.998269	0.970827	0.922784
Mean years of schooling, male	1	0.998269	0.970826	0.922784
Mean years of schooling, total	1	0.999124	0.979839	0.944015
Men in the sectoral labour force	1	0.999783	0.991694	0.969004
Minimum wage, per month	1	0.994049	0.884621	0.766634
Net migration rate	1	0.998679	0.957761	0.878668
number of strikes	1	0.999626	0.987083	0.963746
Number of threatened species	1	0.999605	0.987011	0.963139
Online Consumer Protection Legislation	1	0.993925	0.856	0.717146
Paid maternity leave	1	0.999752	0.990055	0.965614
Political stability and absence of violence	1	0.999595	0.984562	0.950854
Pollution level of the country	1	0.999724	0.988068	0.961911
Population below national poverty line	1	0.995983	0.919953	0.795004
Presence of anti-competitive behaviour or violation of anti-trust and monopoly legislation	1	0.999582	0.984721	0.949805
Presence of indigenous population	1	0.999106	0.975812	0.9331
Presence of sufficient safety measures	1	0.998161	0.967758	0.913434
Public expenditure on education	1	0.999389	0.980692	0.948441
Public sector corruption	1	0.99889	0.975085	0.93244
R&D expenditures	1	0.995883	0.947689	0.891776
Rate of fatal accidents at workplace	1	0.998772	0.965084	0.888922
Rate of non-fatal accidents at workplace	1	0.996752	0.940131	0.849357
Rate of researchers	1	0.997564	0.948398	0.862295
Safe access to Drinking water coverage	1	0.99656	0.942971	0.8725
Sanitation coverage	1	0.999493	0.981948	0.941422
Sector average wage, per month	1	0.998556	0.972197	0.938106
Social Protection Expenditures	1	0.998521	0.971173	0.933821

Name	Developer	Professional	Starter	SimaPro
Social responsibility along the supply chain	1	0.998299	0.965692	0.90493
State of democracy	1	0.998818	0.976485	0.938165
Trade union density	1	0.996838	0.918192	0.729334
Trafficking in persons	1	0.999724	0.989143	0.963087
Under-five mortality rate	1	0.998054	0.967382	0.923179
Unemployment rate in the country	1	0.997002	0.930448	0.780678
Violations of mandatory health and safety standards	1	0.999762	0.986585	0.958638
Waste management	1	0.999524	0.985677	0.952349
Weekly hours of work per employee female	1	0.999172	0.980231	0.946314
Weekly hours of work per employee male	1	0.999365	0.981923	0.948504
Women in the sectoral labour force	1	0.999471	0.985655	0.955791
Youth illiteracy rate, female	1	0.998165	0.969418	0.92402
Youth illiteracy rate, male	1	0.998242	0.969617	0.924884
Youth illiteracy rate, total	1	0.998257	0.969684	0.924372
Youth unemployment	1	0.997235	0.950778	0.878069

8 PSILCA Variants

Three variants of the PSILCA database are available: Starter, Professional, and Developer. All three are compatible with openLCA, while the Starter version is also available for SimaPro (see Chapter 7). Each variant includes the same set of indicators, countries, and sectors. However, only the Professional and Developer versions offer the option to calculate social impacts using both worker hours (as the activity variable) and raw values. The overview of common database features for all variants are summarized in Table 8 and differences in the structure of the three PSILCA versions are summarized in Table 9.

Table 8: PSILCA - structure

Database features	PSILCA (all variants)
Underlying input/ output database	Eora 2015
Number of countries	190
Total number of processes	14,839

Entities	Industries and Commodities
Economic data from	2015
Country-specific sectors dependent on data availability and country-specific economy	Yes
Number of social indicators in current version	106
Number of social themes/ subcategories	33
Number of Stakeholders	6
Activity variable	Worker hours

When reporting social information, it is important to note that raw values (i.e., the original social data collected by GreenDelta to assess each indicator) are disclosed only in the Professional and Developer versions of PSILCA. Data quality information is available exclusively in the Developer version. Additionally, the cut-off criteria applied vary depending on the specific PSILCA variant. The main differences regarding transparency and the reporting of social information are summarized in Table 9.

Table 9 PSILCA variants – Differences in data availability across database variants

	PSILCA Starter	PSILCA Professional	PSILCA Developer
Indicator risk level (per process)	✓	✓	✓
Source reference per dataset	✓	✓	✓
Time reference per dataset	✓	✓	✓
Indicator raw value (per process)	-	✓	✓
Data quality information (per process)	-	-	✓
Possibility to change risk levels (individually per process)	✓	✓	✓
Possibility to change risk levels (globally, i.e. evaluation scheme)	-	✓	✓
Documentation available	✓	✓	✓
Cut-off	1E-5	1E-7	none

For a better overview of the differences, Figure 50, Figure 51 and Figure 52 report social aspects disclosed for the

'agriculture' sector in Afghanistan in PSILCA Starter, Professional and Developer respectively.

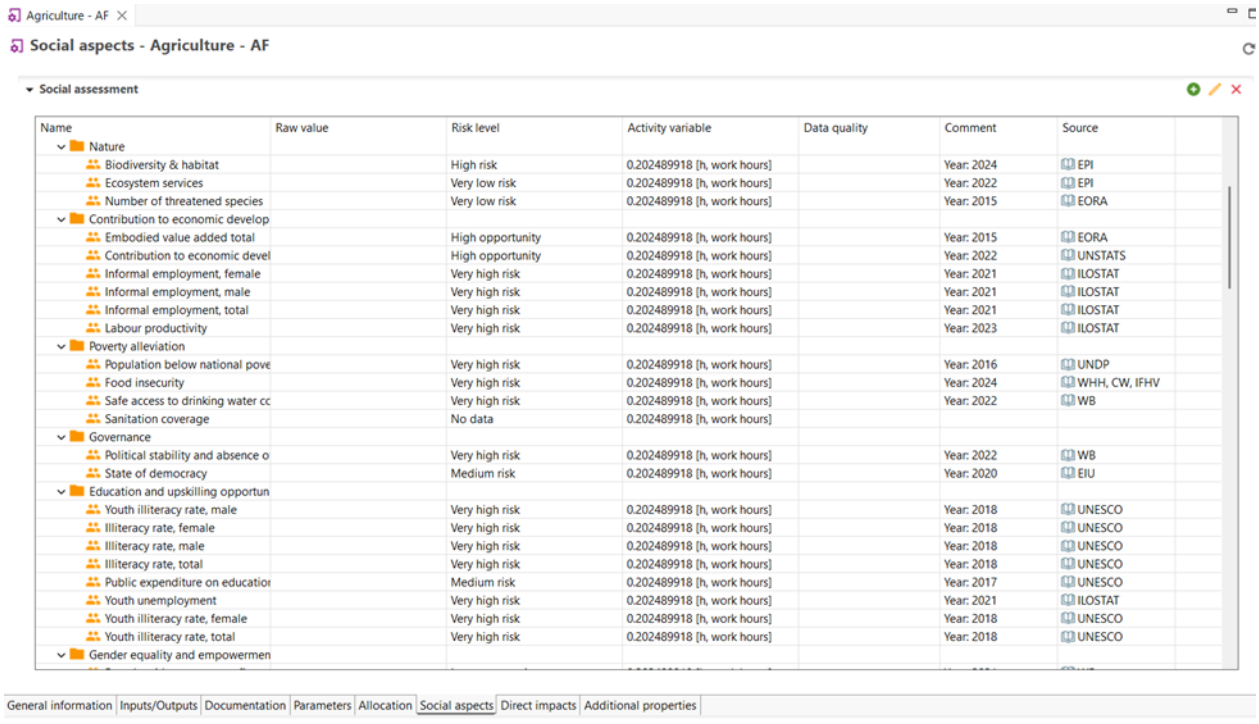


Figure 50: Social aspects for Agriculture in Afghanistan – PSILCA Starter

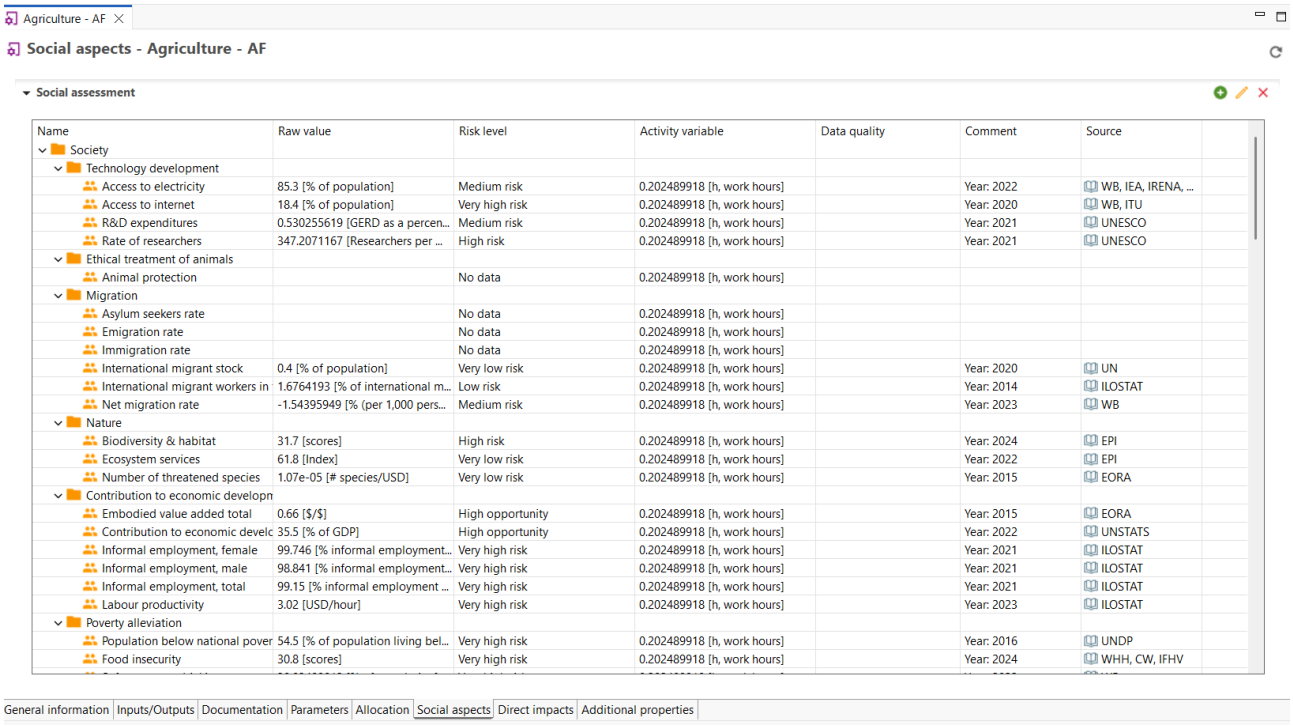
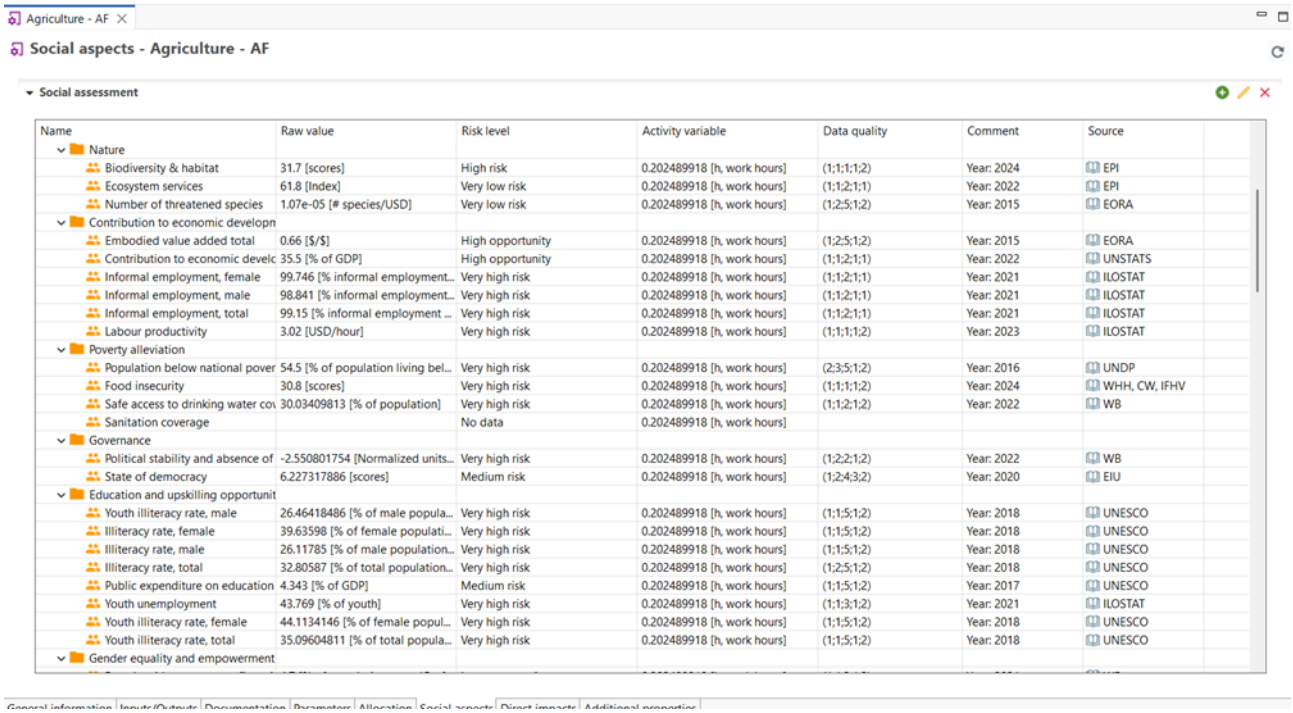


Figure 51: Social aspects for Agriculture in Afghanistan – PSILCA Professional



Name	Raw value	Risk level	Activity variable	Data quality	Comment	Source
Nature						
Biodiversity & habitat	31.7 [scores]	High risk	0.202489918 [h, work hours]	(1;1;1;1;2)	Year: 2024	EPI
Ecosystem services	61.8 [Index]	Very low risk	0.202489918 [h, work hours]	(1;1;2;1;1)	Year: 2022	EPI
Number of threatened species	1.07e-05 [# species/USD]	Very low risk	0.202489918 [h, work hours]	(1;2;5;1;2)	Year: 2015	EORA
Contribution to economic developn						
Embodied value added total	0.66 [$/$]	High opportunity	0.202489918 [h, work hours]	(1;2;5;1;2)	Year: 2015	EORA
Contribution to economic develc	35.5 [% of GDP]	High opportunity	0.202489918 [h, work hours]	(1;1;2;1;1)	Year: 2022	UNSTATS
Informal employment, female	99.746 [% informal employment...	Very high risk	0.202489918 [h, work hours]	(1;1;2;1;1)	Year: 2021	ILOSTAT
Informal employment, male	98.841 [% informal employment...	Very high risk	0.202489918 [h, work hours]	(1;1;2;1;1)	Year: 2021	ILOSTAT
Informal employment, total	99.15 [% informal employment ...	Very high risk	0.202489918 [h, work hours]	(1;1;2;1;1)	Year: 2021	ILOSTAT
Labour productivity	3.02 [USD/hour]	Very high risk	0.202489918 [h, work hours]	(1;1;1;1;2)	Year: 2023	ILOSTAT
Poverty alleviation						
Population below national pover	54.5 [% of population living bel...	Very high risk	0.202489918 [h, work hours]	(2;3;5;1;2)	Year: 2016	UNDP
Food insecurity	30.8 [scores]	Very high risk	0.202489918 [h, work hours]	(1;1;1;1;2)	Year: 2024	WHH, CW, IFHV
Safe access to drinking water co	30.03409813 [% of population]	Very high risk	0.202489918 [h, work hours]	(1;1;2;1;2)	Year: 2022	WB
Sanitation coverage		No data	0.202489918 [h, work hours]			
Governance						
Political stability and absence of	-2.550801754 [Normalized units...	Very high risk	0.202489918 [h, work hours]	(1;2;2;1;2)	Year: 2022	WB
State of democracy	6.227317886 [scores]	Medium risk	0.202489918 [h, work hours]	(1;2;4;3;2)	Year: 2020	EIU
Education and upskilling opportunit						
Youth illiteracy rate, male	26.46418486 [% of male popula...	Very high risk	0.202489918 [h, work hours]	(1;1;5;1;2)	Year: 2018	UNESCO
Illiteracy rate, female	39.63598 [% of female populati...	Very high risk	0.202489918 [h, work hours]	(1;1;5;1;2)	Year: 2018	UNESCO
Illiteracy rate, male	26.11785 [% of male population...	Very high risk	0.202489918 [h, work hours]	(1;1;5;1;2)	Year: 2018	UNESCO
Illiteracy rate, total	32.80587 [% of total population...	Very high risk	0.202489918 [h, work hours]	(1;2;5;1;2)	Year: 2018	UNESCO
Public expenditure on education	4.343 [% of GDP]	Medium risk	0.202489918 [h, work hours]	(1;1;5;1;2)	Year: 2017	UNESCO
Youth unemployment	43.769 [% of youth]	Very high risk	0.202489918 [h, work hours]	(1;1;3;1;2)	Year: 2021	ILOSTAT
Youth illiteracy rate, female	44.1134146 [% of female popul...	Very high risk	0.202489918 [h, work hours]	(1;1;5;1;2)	Year: 2018	UNESCO
Youth illiteracy rate, total	35.09604811 [% of total popula...	Very high risk	0.202489918 [h, work hours]	(1;1;5;1;2)	Year: 2018	UNESCO
Gender equality and empowerment						

Figure 52: Social aspects for Agriculture in Afghanistan – PSILCA Developer

9 Contact

Feedback about the practical use, bugs, implementation in openLCA etc. is very welcome. There is also the possibility to contribute data on specific indicators, countries or sectors.

If you have any comments or questions, please contact us:

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References

Agius, R. (2010): What is Occupational Health?, in Health, Environment & Work, http://www.agius.com/hew/resource/ohsilo.htm, last access: January 2023

Amsterdam Institute for Advanced Labour Studies (AIAS) (2013): ICTWSS: Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (version 4, April 2013), http://www.uva-aias.net/en/ictwss/, last access: January 2023

Blumenfeld, S. (2012): What is functional illiteracy? in The New American, That Freedom shall not perish, http://www.thenewamerican.com/reviews/opinion/item/13860-what-is-functional-illiteracy, last access: January 2023

Block, S., Emerson, J. W., Esty, D. C., de Sherbinin, A., Wendling, Z. A., et al. (2024). *2024 Environmental Performance Index*. New Haven, CT: Yale Center for Environmental Law & Policy. Retrieved from https://epi.yale.edu/measure/2024/WMG

Central Intelligence Agency. (2017). *Labourforce* [Data set]. In *The World Factbook*. Retrieved May 21, 2025, from https://www.cia.gov/the-world-factbook/field/labor-force cia.gov

Central Intelligence Agency (CIA) (2017): The World Factbook. Net Migration Rate, https://www.cia.gov/the-world-factbook/field/net-migration-rate/country-comparison , last access: January 2023

Centre for Research on the Epidemiology of disasters (CRED) (2015): EM-DAT. The International Disaster Database, advanced search, http://www.emdat.be/database, last access: January 2023

Ciroth, A., & De Bellis, A. (2020). *A direct quantification of indicators in social LCA – beyond worker hours* [Video]. SLCA2020. https://youtu.be/ChdeMfRsr8M

Ciroth, A., Franze, J. (2011): LCA of an Ecolabeled Notebook – Consideration of Social and Environmental Impacts Along the Entire Life Cycle. Berlin, 2011

Ciroth, A., Franze, J., Fontes, J., Ramirez, A., Haaster, B. van (2013): Social Guidance Document, background document on the social life cycle assessment of technologies. Report prepared within the EC 7th framework project Prosuite. Available on https://www.greendelta.com/wp-content/uploads/2020/06/social-assessment-prosuite_task_3_4_2013.pdf

Climate Service Center, Hamburger Bildungsserver and Deutscher Bildungsserver (2015): Wiki Klimawandel: Wasserresourcen und Klimawandel, http://wiki.bildungsserver.de/klimawandel/index.php/Wasserressourcen_und_Klimawandel , last access: January 2023

Di Xu, Weichen Li, Lichun Dong (2020): Chapter 11 - A composite life cycle sustainability index for sustainability prioritization of industrial systems, Life Cycle Sustainability Assessment for Decision-Making pages 225-252, https://doi.org/10.1016/B978-0-12-818355-7.00011-7

EHSToday (2015): http://ehstoday.com/safety/2015-osha-violations, last access: January 2023

Eora (2019): http://worldmrio.com/, last access: 27/12/2022

ER (2019) Exchange rates; https://www.exchange-rates.org/ last access: January 2023

European Communities. (2008). *NACE Rev. 2: Statistical classification of economic activities in the European Community* (Catalogue No. KS-RA-07-015-EN-N; ISSN 1977-0375; ISBN 978-92-79-04741-1). Office for Official Publications of the European Communities. https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-

RA-07-015-EN.PDF

Eurostat. (2008). *Statistical classification of economic activities in the European Community*. Retrieved December 27, 2022, from https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF

Federal Trade Commission (FTC) (2023): Enforcement – Cases and Proceedings, https://www.ftc.gov/enforcement/cases-proceedings, last access: January 2023

Food and Agriculture Organization of the United Nations (FAO) (2017): AQUASTAT, http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en, last access: January 2023

Food and Agriculture Organization. (2024). *Industrial water withdrawal* [Data set]. AQUASTAT. Retrieved May 21, 2025, from https://data.apps.fao.org/aquastat/?lang=en

Freedom House. (2024). *Freedom on the Net: Research Methodology*. Retrieved April 26, 2025, from https://freedomhouse.org/reports/freedom-net/freedom-net-research-methodology

Gallup (2016): New Report Shows Modern Slavery Exists Worldwide, http://news.gallup.com/opinion/gallup/192101/new-report-shows-modern-slavery-exists-worldwide.aspx, last access: January 2023

Global Hunger Index (GHI). (n.d.). *Methodology*. Retrieved April 26, 2025, from https://www.globalhungerindex.org/methodology.html

GeoDZ.com (2015): Das Lexikon der Erde: Naturkatastrophe, http://www.geodz.com/deu/d/Naturkatastrophe, last access: January 2023

Goedkoop, M.J.; de Beer, I.M; Harmens, R.; Peter Saling; Dave Morris; Alexandra Florea; Anne Laure Hettinger; Diana Indrane; Diana Visser; Ana Morao; Elizabeth Musoke-Flores; Carmen Alvarado; Ipshita Rawat; Urs Schenker; Megann Head; Massimo Collotta; Thomas Andro; Jean-François Viot; Alain Whatelet; Product Social Impact Assessment Handbook - 2020, Amersfoort, November 1st, 2020.

GreenDelta GmbH (2020a): openLCA, https://www.openlca.org/download-form/ last access: December 2022

GreenDelta GmbH (2020b): openLCA 1.10 User Manual, https://www.openlca.org/wp-content/uploads/2020/02/openLCA_1.10_User-Manual.pdf, last access: March 2020

H2020 Orienting. (2023). *H2020 Orienting*. Retrieved December 27, 2022, from https://orienting.eu/

Hayter, S., Fashoyin, T., Kochan, T. (2011): Collective bargaining for the 21st Century https://journals.sagepub.com/doi/10.1177/0022185610397144 , last access: January 2023

Institute for Economics & Peace. Global Peace Index 2018: Measuring Peace in a Complex World, (2018); http://visionofhumanity.org/reports last access: January 2023

Institute for Economics and Peace (IEP). (2024). *Global Peace Index*. Retrieved April 26, 2025, from https://www.visionofhumanity.org/maps/#/

Institute for Economics and Peace (IEP). (2024). *Global Terrorism Index*. Retrieved April 26, 2025, from https://www.visionofhumanity.org/maps/global-terrorism-index/#/

International Council on Mining & Metals (ICMM) (2016): Role of mining in national economies. Mining contribution index. Third edition, supplement, online available at https://www.icmm.com/en-gb/research/social-performance/2016/role-of-mining-in-national-economies , last access: January 2023

Internal Displacement Monitoring Centre (IDMC). (n.d.). *Global Internal Displacement Database: Methodology*. Retrieved April 26, 2025, from https://www.internal-displacement.org/database/methodology/

International Labour Organisation (ILO) (1919): C001 – Hours of Work (Industry) Convention, 1919 (No. 1). Convention Limiting the Hours of Work in Industrial Undertakings to Eight in the Day and Forty-eight in the Week (Entry into force: 13 Jun 1921), http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C001, last access January 2023

International Labour Organisation (ILO) (1935): C047 – Forty-Hour Week Convention, 1935 (No. 47). Convention concerning the Reduction of Hours of Work to Forty a Week (Entry into force: 23 Jun 1957), http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C047, last access January 2023

International Labour Organisation (ILO) (1952): C102 – Social Security (Minimum Standards) Convention, 1952 (No. 102). Convention concerning Minimum Standards of Social Security (Entry into force: 27 Apr 1955), http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_INSTRUMENT_ID:312247, last access January 2023

International Labour Organisation (ILO) (1981): C155 – Occupational Safety and Health Convention, 1981 (No. 155). Convention concerning Occupational Safety and Health and the Working Environment (Entry into force: 11 Aug 1983), http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C155, last access: January 2023

International Labour Organisation (ILO) (1989): Ratifications of C169 – Indigenous and Tribal Peoples Convention, 1989 (No. 169), http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11300:0::NO::P11300_INSTRUMENT_ID:312314, last access: January 2023

International Labour Organisation (ILO) (1998): 1998 Declaration on Fundamental Principles and Rights at Work, http://www.ilo.org/dyn/normlex/en/f?p=1000:62:3671622959025514::NO:62:P62_LIST_ENTRIE_ID:2453911:NO , last access: January 2023

International Labour Organisation (ILO) (2012): ILO Global Estimate of Forced Labour 2012: Results and methodology, http://www.ilo.org/washington/areas/elimination-of-forced-labor/WCMS_182004/lang--en/index.htm, last access January 2023

International Labour Organisation (ILO) (2015a): Classification, Country groupings, https://ilostat.ilo.org/resources/concepts-and-definitions/classification-country-groupings/, last access: January 2023

International Labour Organisation (ILO) (2015b): Questions and answers on forced labour, http://www.ilo.org/global/about-the-ilo/newsroom/comment-analysis/WCMS_181922/lang--en/index.htm, last access: January 2023

International Labour Organisation (ILO) (2015c): Key Indicators of the Labour Market https://www.ilo.org/global/statistics-and-databases/research-and-databases/kilm/lang--en/index.htm , last access: January 2023

International Labour Organisation (ILO) (2016): International Labour Standards on Freedom of association, http://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/freedom-of-association/lang--en/index.htm, last access: January 2023

International Labour Organisation (ILO) (2019): ILOSTAT database of labour statistics 2019, https://ilostat.ilo.org/data//, last access: January 2023

International Labour Organization. (2023). *Child labour statistics [ILOSTAT database].*

https://ILOSTAT.ilo.org/topics/child-labour/

International Labour Organization. (2023). *Labour force participation rate by sex and economic activity (%)* [ILOSTAT database]. https://ILOSTAT.ilo.org/

International Labour Organisation (ILO) (2023a): Statistics on labour costs 2022, https://ilostat.ilo.org/topics/labour-costs/# , last access January 2023

International Labour Organization (ILO 2023b): Statistics on employment https://ilostat.ilo.org/topics/employment/ , last access: January 2023

International Labour Organization (ILO 2023c): Statistics on safety and health at work https://ilostat.ilo.org/topics/safety-and-health-at-work/ , last access: January 2023

International Labour Organization (ILO 2023d): Statistics on wages https://ilostat.ilo.org/topics/wages/ last access: January 2023

International Labour Organization (ILO 2023e): Statistics on working time, https://ilostat.ilo.org/topics/working-time/ , last access: January 2023

International Labour Organization (ILO 2023f): Statistics on unemployment and labour underutilization https://ilostat.ilo.org/topics/unemployment-and-labour-underutilization , last access: January 2023

International Labour Organization (ILO). (2023f). *Labour productivity*. Retrieved April 26, 2025, from https://ilostat.ilo.org/topics/labour-productivity/

International Labour Organization (ILO 2023g): Statistics on migrant workers https://ilostat.ilo.org/topics/labour-migration/ last access: January 2023

International Labour Organization (ILO 2023h): Statistics on child labour https://ilostat.ilo.org/topics/child-labour/ last access: January 2023

International Labour Organization (ILO). (2023i). Strikes and lockouts (ILOSTAT database). ILOSTAT. https://ilostat.ilo.org/

International Labour Organization (ILO). (2023j). International migrant workers by sex and economic sector (ILOSTAT database). ILOSTAT. https://ilostat.ilo.org/

International Labour Organization (ILO). (2024). Fatal occupational injuries per 100,000 workers by sex and migrant status [Data set]. ILOSTAT. Retrieved May 21, 2025, from https://ilostat.ilo.org/topics/safety-and-health-at-work/

International Labour Organization (ILO). (2024). Non-fatal occupational injuries per 100,000 workers by sex and migrant status [Data set]. ILOSTAT. Retrieved May 21, 2025, from https://ilostat.ilo.org/topics/safety-and-health-at-work/

International Labour Organization (ILO). (2024x). *Unemployment and labour underutilization*. Retrieved April 26, 2025, from https://ilostat.ilo.org/topics/unemployment-and-labour-underutilization/#

International Labour Organization (ILO). (2025). *Gender income gap, ratio of women's to men's labour income*. https://ILOSTAT.ilo.org/

International Labour Organization (ILO). (2023n) *World Social Protection Database*. Retrieved April 26, 2025, from https://www.social-protection.org/gimi/WSPDB.action?id=55

International Labour Organization. (2023*o*). *Informality*. ILOSTAT. Retrieved June 13, 2025, from https://ilostat.ilo.org/topics/informality/

International Labour Organization. (2023p). *Resolution concerning statistics on the informal economy* (21st International Conference of Labour Statisticians, October 11–20, 2023). Geneva: International Labour Organization. Retrieved June 17, 2025, from https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40dgreports/%40stat/documents/normativeinstrument/wcms_901516.pdf

International Labour Organization. (n.d.). *Definition and purpose of minimum wage*. Retrieved April 26, 2025, from https://www.ilo.org/resource/11-definition-and-purpose#1

International Labour Organization (ILO). (n.d.). *About SDG indicator 8.8.2*. Retrieved April 26, 2025, from https://ilostat.ilo.org/methods/concepts-and-definitions/description-sustainable-development-labour-market-indicators/about-sdg-indicator-8-8-2/

International Monetary Fund (IMF 2023): Main aggregates and fiscal balances, % GDP, https://data.imf.org/?sk=c4f7655e-bd37-4683-8685-b7aa1818a832&sId=1437421172270 , last access January 2023

International Standardization Organization (ISO) (2017): ISO 14001 – data per country and sector –2017; Industrial sectors per countries – data for 2017, https://isotc.iso.org/livelink/livelink?func=ll&objId=18808772&objAction=browse&viewType=1 , last access: January 2023

International Telecommunication Union (ITU). (n.d.). *Measuring digital development: Facts and figures*. Retrieved April 26, 2025, from https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

Investopedia (2015): Full employment (Text and video), http://www.investopedia.com/terms/f/fullemployment.asp, last access: January 2023

Lenzen, M., Kanemoto, K., Moran, D., and Geschke, A. (2012): Mapping the structure of the world economy, Environmental Science & Technology 46(15) pp. 8374-8381. DOI: 10.1021/es300171x

Lenzen, M., Moran, D., Kanemoto, K., Geschke, A. (2013): Building Eora: A Global Multi-regional Input-Output Database at High Country and Sector Resolution, Economic Systems Research, 25:1, 20-49, DOI:10.1080/09535314.2013.769938

MaterialsFlows.net, The Material Flow Analysis Portal (2015): http://www.materialflows.net/home/, last access: January 2023

National Statistics, Republic of China (Taiwan). (2023, February). Retrieved March 18, 2023, from https://eng.stat.gov.tw/

Najcevska, Mirjana (2010): Structural Discrimination – Definitions, Approaches and Trends (Summary), in United Nations Human Rights Office of the High Commissioner (OHCHR)

Norris, G.A. (2006): Social impacts in product life cycles – Towards life cycle attribute assessment. International Journal of Life Cycle Assessment 11 (1): 97 - 104

Numbeo.com (2015): Numbeo. "Cost of living", http://www.numbeo.com/cost-of-living/, last access: January 2023

Numbeo.com (2017): Numbeo. "Pollution index for country 2017 https://www.numbeo.com/pollution/rankings_by_country.jsp?title=2017 , last access: January 2023

Numbeo.com (2019): Numbeo. "Pollution index for country 2019 https://www.numbeo.com/pollution/rankings_by_country.jsp?title=2019, last access: July 2019

Oanda (2017): Oanda Currency Converter, http://www.oanda.com/currency/converter/, last access: August 2019

OECD. (2022). Biodiversity: Red List Index (indicator). Retrieved March 18, 2023, from https://stats.oecd.org/Index.aspx?DataSetCode=WILD_LIFE.

Office of the United Nations High Commissioner for Human Rights (OHCHR) (2015): Special Rapporteur on the rights of indigenous peoples. Country reports, http://www.ohchr.org/EN/Issues/IPeoples/SRIndigenousPeoples/Pages/CountryReports.aspx, last access: January 2023

openLCA (2020): http://www.openlca.org/, last access: January 2023

OpenLCA. (2025.). *Social LCA case study (model + documentation) of a hooded sweatshirt*. Retrieved from https://nexus.openlca.org/casestudy/Social%20case%20studies

Organisation for Economic Co-operation and Development (OECD) (2011): Convention on Combating Bribery of Foreign Public Officials in International Business Transactions. And Related Documents, online available at: http://www.oecd.org/corruption/oecdantibriberyconvention.htm , last access: January 2023

Organisation for Economic Co-operation and Development (OECD) (2014): OECD Foreign Bribery Report: An Analysis of the Crime of Bribery of Foreign Public Officials, OECD Publishing, online available at: http://dx.doi.org/10.1787/9789264226616-en, last access: January 2023

Organisation for Economic Co-operation and Development (OECD) (2015): Gender wage gap (indicator). doi: 10.1787/7cee77aa-en , last access: January 2023

Organisation for Economic Co-operation and Development (OECD). (2015). *The ABC of gender equality in education: Aptitude, behaviour, confidence*. OECD Publishing. https://doi.org/10.1787/9789264229945-en

Organisation for Economic Co-operation and Development (OECD) (2017): International Migration Database: http://www.oecd.org/corruption/oecdantibriberyconvention.htm , last access: January 2023

Organisation for Economic Co-operation and Development (OECD). (2022). *Emigration rates by educational attainment and sex (indicator)*. OECD Data. https://data.oecd.org/migration/emigration-rates.htm

Organisation for Economic Co-operation and Development (OECD). (2022). Asylum seekers rate (indicator). OECD Data. https://data.oecd.org/migration/asylum-seekers.htm

ProSuite (2013): ProSuite (Prospective Sustainability Assessment of Technologies), EU 7th FP Project, 2009-2013, Deliverables D 4.1 Literature Review on Social Indicators and Integrated Model of Indicator Selection; D 4.2 Preliminary Selection of Social Indicators; D 4.3 Final Selection of Social Indicators, all available from http://prosuite.org/web/guest/public-deliverables, last access: July 2019

Reporters Without Borders (RSF). (2025). *Methodology used in compiling the World Press Freedom Index 2025*. Retrieved April 26, 2025, from https://rsf.org/en/methodology-used-compiling-world-press-freedom-index-2025?year=2025&data_type=general

Taiwan, Foreign Residents by Nationality (2022). Ministry of Interior. Retrieved February 20, 2023, from https://www.immigration.gov.tw/5475/5478/141478/141380/334204/cp_news

The Indigenous World 2024. Mamo, D. (Ed.). (2024). *The Indigenous World 2024* (38th ed.). International Work Group for Indigenous Affairs. Retrieved from https://iwgia.org/en/resources/publications/5508-the-indigenous-world-2024.html

The UN Refugee Agency (UNHCR) (2018): Global trends Forced Displacement in 2018, https://www.unhcr.org/5d08d7ee7.pdf, last access: January 2023

Transparency International (2015): What is corruption?, http://www.transparency.org/what-is-corruption/, last access: January 2023

Transparency International (2017): Corruption Perceptions Index 2016, https://www.transparency.org/news/feature/corruption_perceptions_index_2016, last access: January 2023

UNEP, 2020. Guidelines for Social Life Cycle Assessment of Products and Organizations 2020. Benoît Norris, C., Traverso, M., Neugebauer, S., Ekener, E., Schaubroeck, T., Russo Garrido, S., Berger, M., Valdivia, S., Lehmann, A., Finkbeiner, M., Arcese, G. (eds.). United Nations Environment Programme (UNEP).

UNEP, 2021. Methodological Sheets for Subcategories in Social Life Cycle Assessment (S-LCA) 2021. Traverso, M., Valdivia, S., Luthin, A., Roche, L., Arcese, G., Neugebauer, S., Petti, L., D'Eusanio, M., Tragnone, B.M., Mankaa, R., Hanafi, J., Benoît Norris, C., Zamagni, A. (eds.). United Nations Environment Programme (UNEP).

UNEP/SETAC Life Cycle Initiative (2009): Guidelines for social life cycle assessment of products, Authors: Andrews, E. S.; Barthel, L.-P.; Beck, T.; Benoit, C.; Ciroth, A.; Cucuzella, C.; Gensch, C.-O.; Hérbert, J.; Lesage, P.; Manhart, A.; Mazeau, P.; Mazijn, B.; Methot, A.-L.; Moberg, A.; Norris, G.; Parent, J.; Prakash, S.; Reveret, J.-P.; Spillemaeckers, S.; Ugaya, C. M. L.; Valdivia, S.; Weidema, B., online available at https://www.unep.org/resources/report/guidelines-social-life-cycle-assessment-products

UNESCO Institute for statistics (UIS 2023a), Government expenditure on education as a percentage of GDP, http://sdg4-data.uis.unesco.org/ , last access: January 2023

UNESCO Institute for statistics (UIS 2023b), Indicator 4.6.2: Youth/adult literacy rate, http://sdg4-data.uis.unesco.org/ , last access: January 2023

UNICEF. (n.d.). *Female genital mutilation*. Retrieved April 26, 2025, from https://data.unicef.org/topic/child-protection/female-genital-mutilation/

UNICEF. (2023d). *Under-five mortality*. Retrieved April 26, 2025, from https://data.unicef.org/topic/child-survival/under-five-mortality/

UNICEF. (2025). *Child marriage*. Retrieved April 26, 2025, from https://data.unicef.org/topic/child-protection/child-marriage/

UNICEF. (2019a) *Indicator Profile: Percentage of women aged 20–24 years who were married or in union before age 15*. Retrieved April 26, 2025, from https://data.unicef.org/indicator-profile/PT_F_20-24_MRD_U15/

UNICEF. (n.d.). *Indicator Profile: Percentage of men aged 20–24 years who were married or in union before age 18*. Retrieved April 26, 2025, from https://data.unicef.org/indicator-profile/PT_M_20-24_MRD_U18/#definitions

United Nations (UN) (1948): The Universal Declaration of Human Rights, online available at http://www.un.org/en/universal-declaration-human-rights/, last access: January 2023

United Nations (UN) (2014): Programme of Action of the International Conference on Population Development. Twentieth Anniversary Edition, online available at: http://www.unfpa.org/publications/international-conference-population-and-development-programme-action , last access: January 2023

United Nations (UN) (2017), https://www.un.org/en/ , last access: January 2023

United Nations Conference on Trade and Development (UNCTAD). (n.d.). *Online consumer protection legislation worldwide*. Retrieved April 26, 2025, from https://unctad.org/page/online-consumer-protection-legislation-worldwide

United Nations Environment Programme. (2021). *Guidelines for social life cycle assessment of products and*

organizations (2nd ed.). United Nations Environment Programme. https://www.lifecycleinitiative.org/

United Nations Department of Economic and Social Affairs (UN-DESA) (2007): Permanent Forum on Indigenous issues: Declaration on the Rights of Indigenous Peoples, https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html last access: January 2023

United Nations Office on Drugs and Crime (UNODC). (2023). *Global Study on Homicide 2023*. Vienna: United Nations. Retrieved April 26, 2025, from https://www.unodc.org/documents/data-and-analysis/gsh/2023/Global_study_on_homicide_2023_web.pdf

United Nations et al. (2009): System of National Accounts 2008, online available at http://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf, last access: October 2019

United Nations Global Compact (2017): The Ten Principles of the UN Global Compact, online available at https://www.unglobalcompact.org/what-is-gc/mission/principles, last access: January 2023

United Nations Statistics Division (UNSTAT) (2017): GDP statistics: Shares of breakdown of GDP/Value Added at current prices in Percent (all countries), https://unstats.un.org/unsd/snaama/dnltransfer.asp?fID=22, last access: January 2023

United Nations Department of Economic and Social Affairs. (2023). *International migrant stock*. UN DESA Population Division. https://www.un.org/development/desa/pd/content/international-migrant-stock

United States Department of Justice (2015): Price Fixing, Bid Rigging, and Market Allocation Schemes: What They Are and What to Look For, http://www.justice.gov/atr/price-fixing-bid-rigging-and-market-allocation-schemes, last access: January 2023

United States Department of Labour(USDOL) (2014a): Occupational Safety and Health Administration, https://www.osha.gov/ , last access: January 2023

United States Department of Labour(USDOL) (2014b): Occupational Safety and Health Administration, Enforcement Data https://enforcedata.dol.gov/views/data_summary.php , last access: January 2023

United States Department of Labour(USDOL) (2017): Occupational Safety and Health Administration, Severe Injury Reports, https://www.osha.gov/severeinjury/index.html , last access: January 2023

United States Department of Labor, Bureau of International LabourAffairs (USDOL) (2019): List of goods produced by child Labouror forced labor; https://www.dol.gov/sites/dolgov/files/ILAB/ListofGoods.pdf , last access : January 2023

United States Department of Labor, Bureau of LabourStatistics (USDOL) (2015): Economic News Release. Table B-1. Employees on nonfarm payrolls by industry sector and selected industry detail, data is regularly updated, http://www.bls.gov/news.release/empsit.t17.htm , last access: January 2023

United States Department of State (2018): Trafficking in Persons Report 2018, https://www.state.gov/reports/2018-trafficking-in-persons-report/#:~:text=The%202018%20Trafficking%20in%20Persons%20Report%20is%20an%20essential%20State,in%20the%20United%20States%20and last access January 2023

UNDP. (2021). Environmental Sustainability. Human Development Reports. Retrieved from https://hdr.undp.org/environmental-sustainability

U.S. Census Bureau. (2022). *North American Industry Classification System*. Retrieved December 27, 2022, from https://www.census.gov/naics/

US Consumer Safety Product Commission (USCSPC) (2019) Violations of a mandatory standards; https://www.cpsc.gov/Recalls/Violations/ last access: January 2023

U.S. Consumer Product Safety Commission (USPSC). (2019). *FY 2019 Agency Financial Report*. U.S. Consumer Product Safety Commission. Retrieved May 21, 2025, from https://www.cpsc.gov/content/FY-2019-Agency-Financial-Report?language=en

U.S. Department of Labor, Occupational Safety and Health Administration. (2014a). OSHA at-a-glance (OSHA 3439 - 2014). Washington, DC: U.S. Department of Labor. Retrieved from https://www.osha.gov/publications/osha3439.pdf

U.S. Department of Labor, Occupational Safety and Health Administration. (2014b). OSHA Enforcement Summary: Fiscal Year 2014. Retrieved from https://www.osha.gov/enforcement/2014-enforcement-summary

U.S. Department of State. (2024). *2024 Trafficking in Persons Report*. Retrieved from https://www.state.gov/reports/2024-trafficking-in-persons-report/

U.S. Department of State. (2024). *2024 Trafficking in Persons Report*. Retrieved from https://www.state.gov/reports/2024-trafficking-in-persons-report/

Visser, J., Data Base on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts, 1960-2014 (ICTWSS) (2015), codebook available at: https://aias.s3-eu-central-1.amazonaws.com/website/uploads/14606382100981CTWSS-codebook-50-2.pdf , last access: January 2023

WageIndicator.org (2019): https://wageindicator.org/ , last access: January 2023

WageIndicator. (n.d.). *Minimum wages database*. Retrieved April 26, 2025, from https://wageindicator.org/

Walk Free Foundation (2016): The Global Slavery Index 2016, online access at: https://www.globalslaveryindex.org/resources/downloads/ , last access: January 2023

Walk Free Foundation (2018): The Global Slavery Index 2018, https://www.globalslaveryindex.org/resources/downloads/ , last access: January 2023

Weidema, B.P., Wesnæs, M.S., 1996. Data quality management for life cycle inventories: an example of using data quality indicators. J. Clean. Prod. 4, 167–174.

WHO/UNICEF Joint Monitoring Programme for Water supply, Sanitation and Hygiene (JMP) (2017): Estimates on the use of water, sanitation and hygiene by country (2000-2015), https://washdata.org/monitoring/sanitation, last access: January 2023

Wiedmann et al. (2013): Wiedmann, T., Schandl, H., Lenzen, M., Moran, D., Suh, S., West, J., Kanemoto, K. (2013): The Material Footprint of Nations, Proc. Nat. Acad. Sci. Online before print. doi: 10.1073/pnas.1220362110

Wikipedia (2015a): List of indigenous peoples, https://en.wikipedia.org/wiki/List_of_indigenous_peoples, last access: January 2023

Wikipedia (2015b): Full employment, https://en.wikipedia.org/wiki/Full_employment, last access: January 2023

World Animal Protection. (n.d.). *World Animal Protection Global Index Methodology*. Retrieved April 26, 2025, from https://api.worldanimalprotection.org/methodology

World Bank (2015) https://www.worldbank.org/en/home last access January 2023

World Bank (2017): World Development Indicators, https://data.worldbank.org/indicator last access January 2023

World Bank (2022a): Current health expenditure (% of GDP),

https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS , last access: December 2022

World Bank (2022b): Domestic general government health expenditure (% of current health expenditure), https://data.worldbank.org/indicator/SH.XPD.GHED.CH.ZS , last access: December 2022

World Bank (2022c): External resources for health (% of current health expenditure); https://data.worldbank.org/indicator/SH.XPD.EHEX.CH.ZS , last access: January 2023

World Bank (2022d): Out-of-pocket expenditure (% of current health expenditure), https://data.worldbank.org/indicator/SH.XPD.OOPC.CH.ZS , last access: December 2022

World Bank (2022e) International migrant stock (% of population), http://databank.worldbank.org/data/reports.aspx?source=2&series=SM.POP.TOTL.ZS&country=#, last access: January 2023

World Bank (2022f): Labourforce, total; https://data.worldbank.org/indicator/SL.TLF.TOTL.IN?view=map, last access: January 2023

World Bank (2022g): Life expectancy at birth, total (years), http://data.worldbank.org/indicator/SP.DYN.LE00.IN, last access: January 2023

World Bank. (2023). *World Development Indicators: Net migration rate*. https://databank.worldbank.org/source/world-development-indicators

World Health Organization (WHO) (2004): Estimated deaths & DALYs attributable to selected environmental risk factors, by WHO Member State

World Health Organization (WHO) (2015): http://www.who.int/en/, last access: January 2023

World Health Organization (WHO) (2017): Safely managed drinking water – thematic report on drinking water 2017, https://www.who.int/publications/i/item/9789241565424 , last access: January 2023

World Bank national accounts data, and OECD National Accounts data files. (2020a). *GDP (current US$) - Cuba*. Retrieved March 18, 2023, from https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=CU

World Bank national accounts data, and OECD National Accounts data files. (2020b). *General Government Final Consumption Expenditure (current US$) - Cuba*. Retrieved March 18, 2023, from https://data.worldbank.org/indicator/NE.CON.GOVT.CD?locations=CU

World Bank. (2021). Percentage of population with access to electricity. Retrieved March 18, 2023, Retrieved from https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS

World Bank. (2021). Individuals using the Internet (% of population) [Data file]. Retrieved March 18, 2023, from https://data.worldbank.org/indicator/IT.NET.USER.ZS?end=2021&start=1960

World Bank. (2022). Corruption. Enterprise Surveys. Retrieved March 18, 2023, from https://www.enterprisesurveys.org/en/data/exploretopics/corruption

World Bank. (2023). GDP composition by sector (% of GDP) – Agriculture, Industry, Services. World Development Indicators. https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS

World Bank. (2023). *Women, Business and the Law 2023: Methodology*. Retrieved April 26, 2025, from https://wbl.worldbank.org/en/methodology

World Bank. (n.d.). *Access to electricity (% of population)*. Retrieved April 26, 2025, from https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS

World Health Organization (WHO). (2024). *Sustainable Development Goal Indicator 3.9.1: Mortality attributed to air pollution*. Geneva: World Health Organization.

World MRIO. (2025.). *Documentation*, from https://worldmrio.com/documentation/

World MRIO. (2025). *EORA*. Retrieved December 27, 2022, from https://worldmrio.com/eora/

World MRIO. (2022). *EORA documentation*. Retrieved December 27, 2022, from https://worldmrio.com/documentation/

Zeit online (2011): 7,5 Millionen Deutsche sind Analphabeten, http://www.zeit.de/gesellschaft/2011-02/bildung-analphabetismus-studie, last access: December 2019