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sustainability consulting + software

Webinar

Introducing PSILCA 1.0 – A comprehensive and transparent database for Social LCA

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Agenda

Agenda

1. Background
2. Approach and structure
3. PSILCA variants
4. PSILCA in SimaPro
5. Application
   - “Policy-type” application
   - Hybrid case: Notebook study
6. Current work
7. Purchase of PSILCA

Background

Background

- Necessity to extend Footprint or Life Cycle Assessment approaches by **social effects**
- Growing public interest to uncover **social hotspots** along entire product life cycles, in order to detect
  - potential social risks
  - positive social impacts hidden in product supply chains

→ Generic information for generic processes needed

Challenges

- Social data is often **qualitative** → hard to access, measure and organize
- Indicators (social measures) are needed to capture social observations, but **no consensus** about "important" social impacts
- also **assessment of data and impacts is subjective** → different approaches, individual evaluation and interpretation

- Product Social Impact Life Cycle Assessment Database

Approach and structure

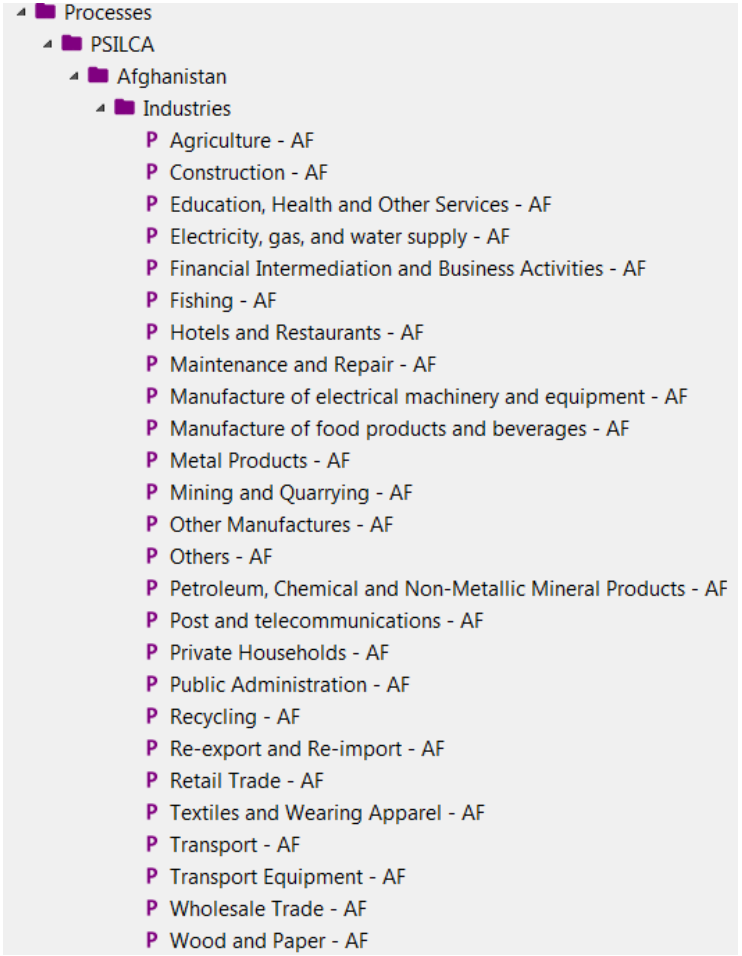
Eora as backbone

Eora MRIO database as backbone (Lenzen et al.):

- 189 individual countries represented by a total of 14,838 sectors (classified by entity: industries and commodities)
- high-resolution heterogeneous classification, or 26-sector harmonized classification
- continuous coverage for the period 1970-2013, PSILCA based on 2012

Structure of processes

26 harmonized sectors (industries) for Afghanistan



1022 detailed sectors (industries and commodities) for UK

PSILCA

Screenshots from openLCA

Social indicators

- Social indicators and its structure mainly inspired by UNEP/SETAC guidance book:

STAKEHOLDER – SUBCATEGORY – INDICATOR – (SUBINDICATOR)

- Currently, there are 54 qualitative and quantitative indicators addressing 17 subcategories (topics) and 4 affected stakeholder groups
- Measured in different units such as single values, percentages or text

Social indicators

Stakeholder	Subcategory	Indicator
WORKERS	Child labour	Children in employment, male
		Children in employment, female
		Children in employment, total
	Forced Labour	Goods produced by forced labour
		Frequency of forced labour
		Trafficking in persons
	Fair Salary	Living wage, per month
		Minimum wage, per month
		Sector average wage, per month
	Working time	Weekly hours of work per employee
	Discrimination	Gender wage gap
	Health and Safety	Rate of non-fatal accidents at workplace
		Rate of fatal accidents at workplace
		DALYs due to indoor and outdoor air and water pollution
		Presence of sufficient safety measures
		Workers affected by natural disasters
	Social benefits, legal issues	Social security expenditures
		Evidence of violations of laws and employment regulations
	Freedom of association and collective bargaining	Trade union density
		Right of Association
		Right of Collective bargaining
		Right to Strike
VALUE CHAIN ACTORS	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 responsibilty	Membership in an initiative that promotes social responsibility along the supply chain

Social indicators

LOCAL COMMUNITY	Access to material resources	Level of industrial water use (related to total withdrawal)
		Level of industrial water use (related to renewable water resources)
		Extraction of fossil fuels
		Extraction of biomass (related to population)
		Extraction of ores
		Extraction of biomass (related to area)
		Extraction of industrial and construction minerals
		Certified environmental management systems
	Respect of indigenous rights	Presence of indigenous population
		Human rights issues faced by indigenous people
	Safe and healthy living conditions	Pollution level of the country
		Drinking water coverage
		Sanitation coverage
	Local employment	Unemployment rate in the country
	Migration	International migrant workers in the sector
		International Migrant Stock
		Net migration rate
SOCIETY	Contribution to economic development	Public expenditure on education
		Illiteracy rate, male
		Youth illiteracy rate, male
		Illiteracy rate, female
		Youth illiteracy rate, female
		Illiteracy rate, total
		Youth illiteracy rate, total
	Health and Safety	Health expenditure out of the total GDP of the country
		Health expenditure, total
		Health expenditure, public
		Health expenditure, out-of-pocket
		Health expenditure, external resources

Social indicators

Indicator structure in openLCA

Screenshot from openLCA

Social indicators

Indicator and its *general information* in openLCA

Screenshot from openLCA

Social indicators

Social aspects in process

Social aspects: Coal mining

Social assessment

Name	Raw value	Risk level	Activity variable	D...	Comment	Source
Workers						
Freedom of association and collective barga						
Right of Association	3.0 [Score]	No risk	0.0146107089789...		Data from: 2011; Last ...	ICTWSS 2013
Trade union density	18.09 [%]	Very high risk	0.0146107089789...		Data from: 2010; Last ...	ILOstat 2014: Trade unions
Right of Collective bargaining	3.0 [Score]	No risk	0.0146107089789...		Data from: 2011; Last ...	ICTWSS 2013
Right to Strike	3.0 [Score]	No risk	0.0146107089789...		Data from: 2011; Last ...	ICTWSS 2013
Health and Safety (Workers)						
DALYs due to indoor and outdoor air and	1.01938778733284 [DALY rate]	Very low risk	0.0146107089789...		Data from: 2004; Last ...	WHO 2009: DALYs
Workers affected by natural disasters	0.21171571550155036 [%]	Very low risk	0.0146107089789...		Data from: 2014; Last ...	EM-DAT 2015: Natural disasters
Rate of non-fatal accidents at workplace		No data	0.0146107089789...			
Rate of fatal accidents at workplace	0.09 [#/yr and 100k empl.]	Very low risk	0.0146107089789...		Data from: 2004; Last ...	ILOstat 2014: Non-fatal acciden...
Presence of sufficient safety measures	2.731127341088218 [# per 100k empl.]	Very low risk	0.0146107089789...		Data from: 2014; Last ...	USDOL 2013: OSHA violations
Discrimination						
Gender wage gap	25.8936897730805 [%]	High risk	0.0146107089789...		Data from 2013	ILOstat 2014
Value Chain Actors						
Corruption						
Active involvement of enterprises in corru	19.0 [%]	Very high risk	0.0146107089789...		Data from: 2014; Last ...	OECD 2014: Bribery
Public sector corruption	74.0 [Score]	Medium risk	0.0146107089789...		Data from: 2012; Last ...	Transparency International 201...
Fair Competition						
Presence of anti-competitive behaviour o	0.4186602870813397 [# per 10k empl.]	Very high risk	0.0146107089789...		Value is extrapolated ...	

General information | Inputs/Outputs | Administrative information | Modeling and validation | Parameters | Allocation | Social aspects

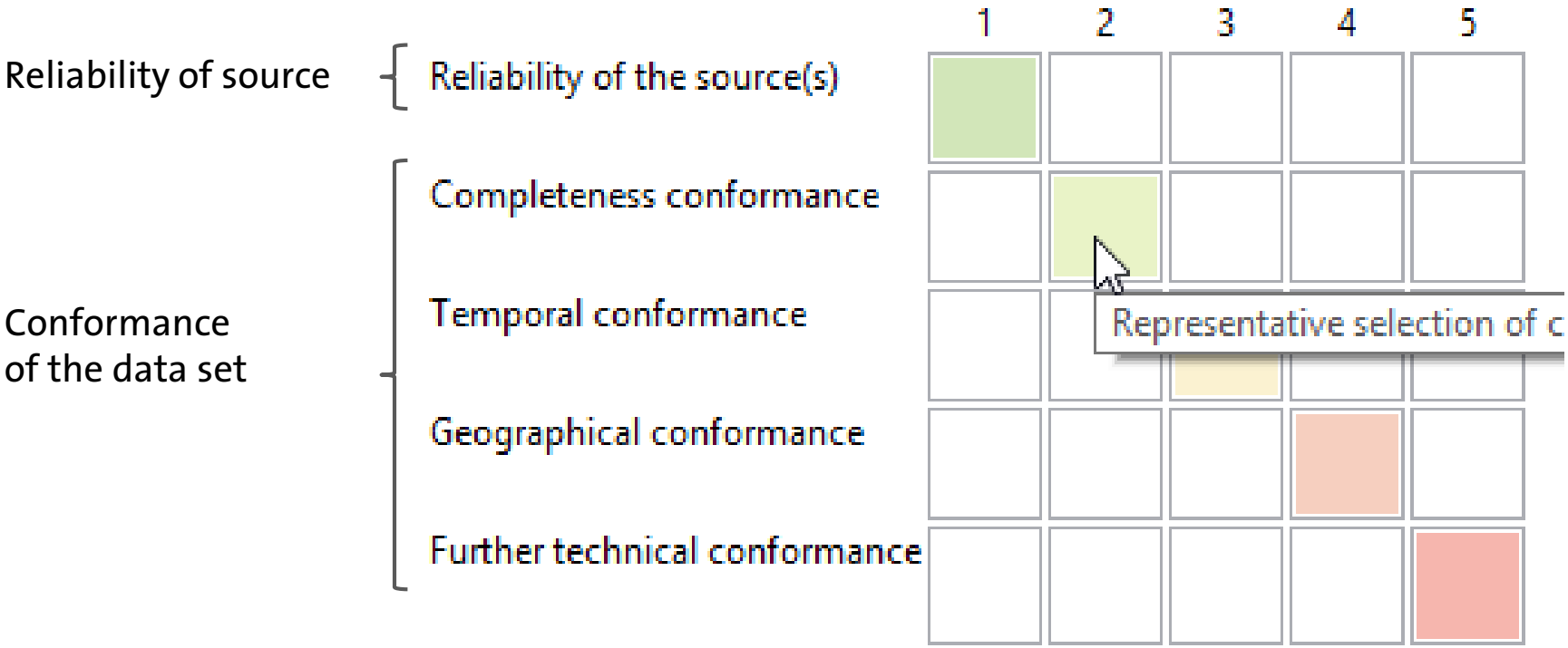
Data sources

Variety of sources are considered for data collection:

- reputable, statistical agencies (World Bank, International Labour Organization, World Health Organization, United Nations...)
- Private or governmental databases (ICTWSS database about trade unions etc. by University of Amsterdam, United States Department of Labor...)
- Various case studies and own investigation
- Big data analyses planned

Data quality

- Data quality assessed by a square, pedigree matrix (based on Weidema and Wesnæs (1996), but adapted to social LCA, Ciroth and Franze 2014)



Screenshot from openLCA

Indicator assessment

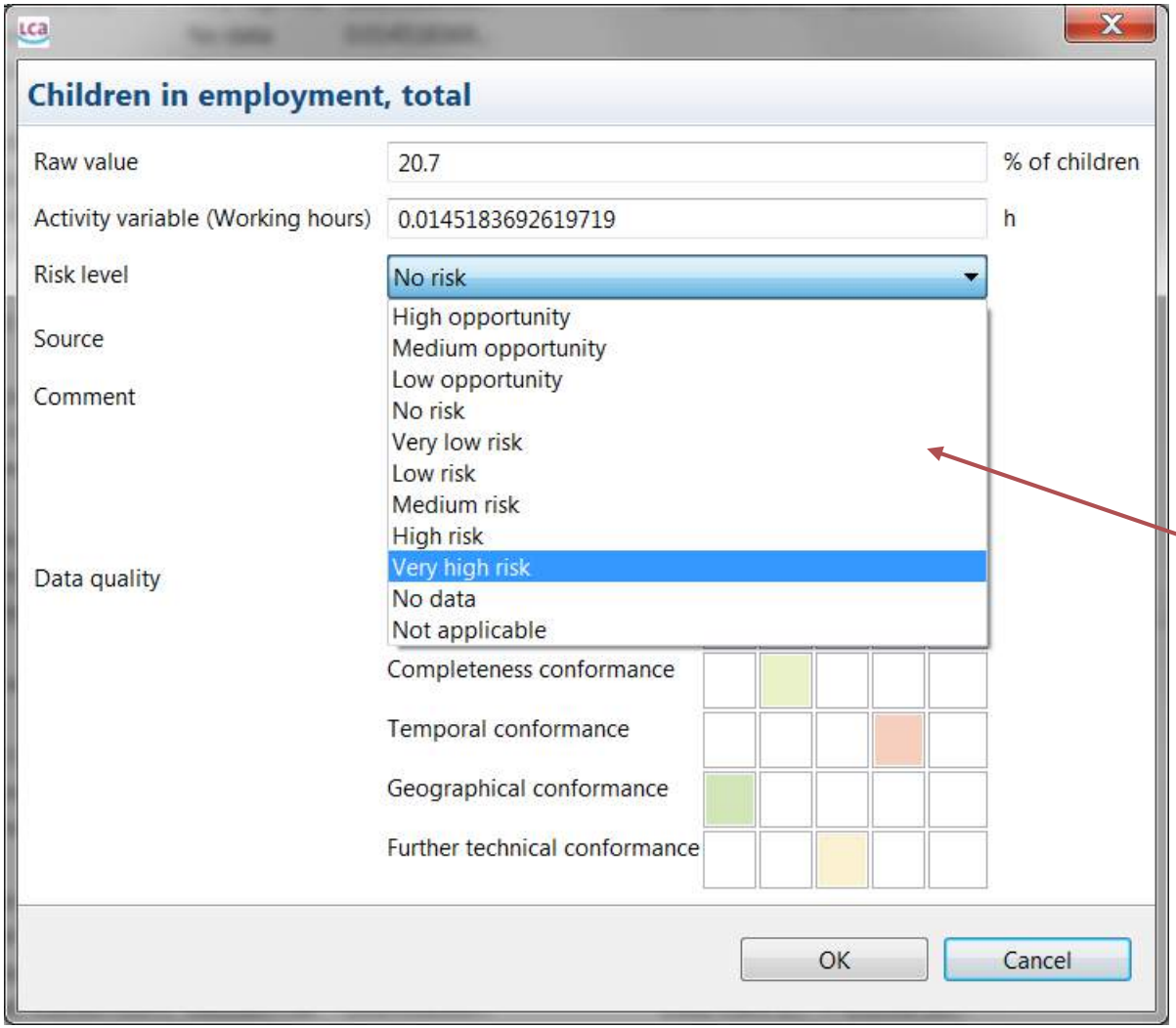
- Assessed by an ordinal risk scale of typically 6 different risk levels:

no risk, very low risk, low risk, medium risk, high risk, very high risk, (no data)

- Evaluation of indicator risk levels is subjective → both the **indicator values and the risk evaluation schemes** are provided
- Risk levels can be modified individually

Modification of risk evaluation

- In each process: change risk levels of indicators



Screenshot from openLCA

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Modification of risk evaluation

- For whole indicator changing overall evaluation scheme (via Python)

Welcome | Python

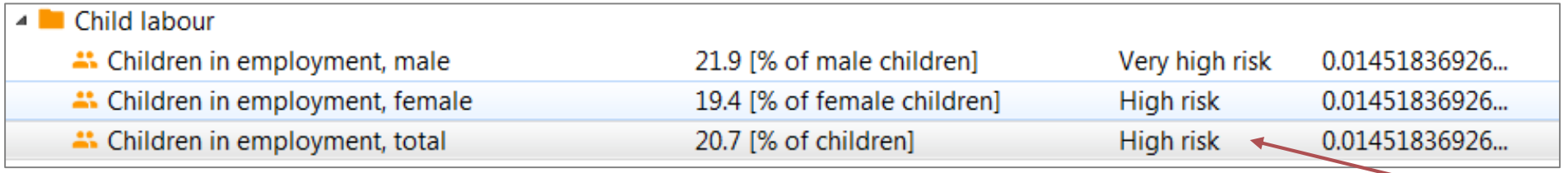
Python

```
# ****USER INPUT****

# Write the name of the social indicator for which the risk level ranges apply. If it is for all, write "ALL"
# Enclose the indicators within [] and use "," as separator:
# Example 1: indicator = [["Children in employment, total"],["Trafficking in persons"]]
# Exampel 2: indicator = [["ALL"]]
indicator = [["Children in employment, total"]]

# Numeric ranges, single numeric values or text variables can be used to define the risk levels.
# Format for defining risk levels using ranges: ["Risk_Level", "VALUE_TYPE1", "Minimum_Value1", "Maximum_Value1", "VALUE_TYPE2", "Minimum_Value2","Maximum_Value2",...]
# Format for defining risk levels using specific text/numeric values: ["Risk_Level","VALUE_TYPE1", "Value1","VALUE_TYPE2","Value2","VALUE_TYPE3","Value3",...]
# These are the codes for each type of value available:
# R1 = Numeric range type 1: minimum value <= Raw amount < maximum value
# R2 = Numeric range type 2: minimum value < Raw amount <= maximum value
# R3 = Numeric range type 3: minimum value < Raw amount < maximum value
# R4 = Numeric range type 4: minimum value <= Raw amount <= maximum value
# EV = Value (either text or number): Raw amount = value
# N1 = Numeric value 1: Raw amount >= value
# N2 = Numeric value 2: Raw amount <= value
# Several ranges, values can be used for defining a risk level e.g. ["NO_DATA","EV","n.a","EV","no data","EV","null"], ["HIGH_RISK","R1","5","10","R2","-10","-5"],...
# If the values refer to float numbers use "." as decimal separator
# Enclose the risk levels and their values within [] and use "," as separator. e.g risk_level = [["NO_DATA","EV","n.a."],["NO_RISK","EV","0"]]
# 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, NOT_APPLICABLE
eval_scheme = [["NO_DATA","EV","n.a."],
               ["NO_RISK","EV","0"],
               ["VERY_LOW_RISK","R3","0","5","R3","-5","0"],
               ["LOW_RISK","R1","5","10","R2","-10","-5"],
               ["MEDIUM_RISK","R1","10","20","R2","-20","-10"],
               ["HIGH_RISK","R1","20","30","R2","-30","-10"],
               ["VERY_HIGH_RISK","N1","30","N2","-30"]]

# Define the path of the change log file (a list of the changes done in the Evaluation Schemes and Social Aspects will be recorded)
change_log = 'C:/Users/Username/Documents/log_psilca_indicators.csv'

```

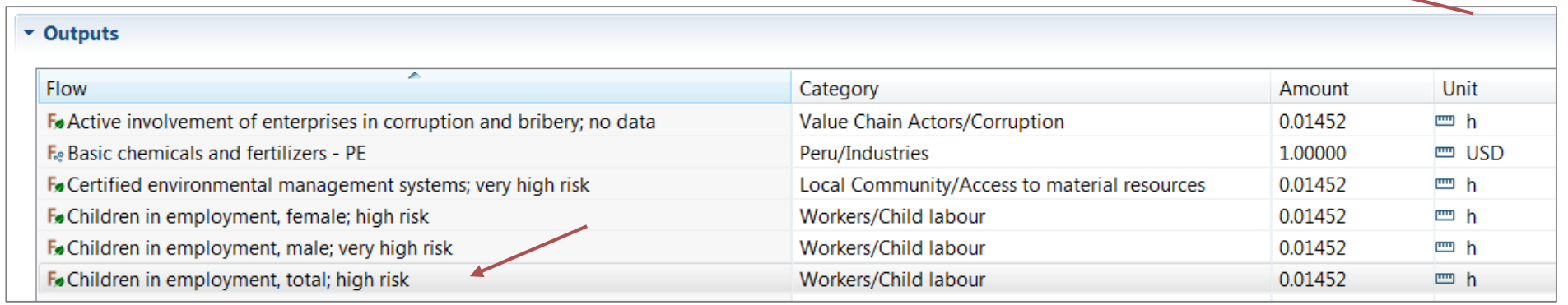
Screenshot from openLCA

Modification of risk evaluation

Changes will be adopted in every process (*social aspects* and output flows) and in the indicator description

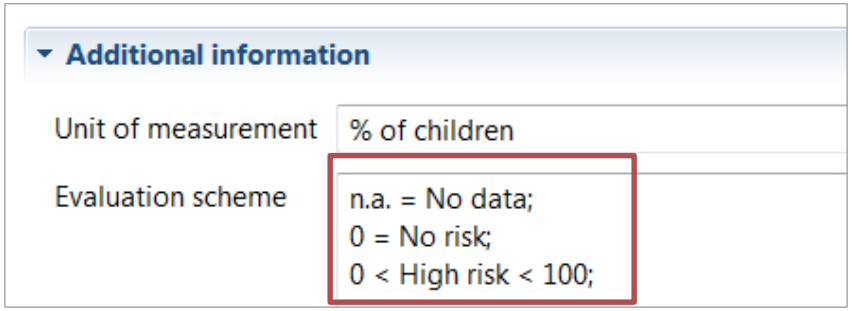


Child labour			
Children in employment, male	21.9 [% of male children]	Very high risk	0.01451836926...
Children in employment, female	19.4 [% of female children]	High risk	0.01451836926...
Children in employment, total	20.7 [% of children]	High risk	0.01451836926...



Outputs

Flow	Category	Amount	Unit
Active involvement of enterprises in corruption and bribery; no data	Value Chain Actors/Corruption	0.01452	h
Basic chemicals and fertilizers - PE	Peru/Industries	1.00000	USD
Certified environmental management systems; very high risk	Local Community/Access to material resources	0.01452	h
Children in employment, female; high risk	Workers/Child labour	0.01452	h
Children in employment, male; very high risk	Workers/Child labour	0.01452	h
Children in employment, total; high risk	Workers/Child labour	0.01452	h



Additional information

Unit of measurement	% of children
Evaluation scheme	n.a. = No data; 0 = No risk; 0 < High risk < 100;

Screenshots from openLCA

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Further documentation

- Sources
- Year of data point
- Comments

Screenshot from openLCA

Activity variable

- So-called “activity variables” (Norris 2006) are necessary to describe the relevance of impacts caused by a process in a life cycle
- Worker hours are applied (initially to all indicators, also those not concerning labor conditions) =
    - h/USD output for each process
- Further activity variables for other stakeholders are currently being assessed

Activity variable

Calculation of Worker hours for a process (related to 1 USD output)

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

With:

$$Unit\ labour\ costs =$$

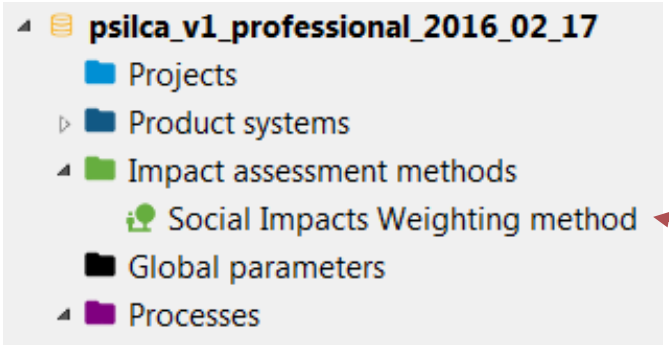
$$\frac{Compensation\ of\ employees\ (in\ \$\ per\ country - specific\ sector\ and\ year)}{Gross\ output\ (in\ \$\ per\ country - specific\ sector\ and\ year)}$$

Life Cycle Impact Assessment

- Overall social impacts are calculated by aggregating the scaled social risks of all involved processes along the life cycle (product system):

→ Scaled by price (inputs), amount of worker hours and impact factors

- Impact factors are set initially in a rudimentary LCIA method: “Social Impacts Weighting method”



Screenshot from openLCA

Life Cycle Impact Assessment

Characterization:

Calculation of the relevance based on equivalent factors

Usually the following factors are used

Risk level	Factor
Very low risk	0.25
Low risk	0.5
Medium risk	1
High risk	2
Very high risk	5
No risk	0
No data	0.5

- Measured in *medium risk hours,* i.e. all impacts related to medium risk

Life Cycle Impact Assessment

Impact factors (Example for the impact category “Biomass Consumption”):

Impact factors

Impact category: Biomass consumption

Flow	Category	Flow property	Unit	Factor
Extraction of biomass (related to area); high risk	Local Community/Access to material resources	Duration	BM med risk hours/h	3.0
Extraction of biomass (related to area); low risk	Local Community/Access to material resources	Duration	BM med risk hours/h	0.75
Extraction of biomass (related to area); medium risk	Local Community/Access to material resources	Duration	BM med risk hours/h	1.5
Extraction of biomass (related to area); no data	Local Community/Access to material resources	Duration	BM med risk hours/h	0.75
Extraction of biomass (related to area); very high risk	Local Community/Access to material resources	Duration	BM med risk hours/h	7.5
Extraction of biomass (related to area); very low risk	Local Community/Access to material resources	Duration	BM med risk hours/h	0.375
Extraction of biomass (related to population); high risk	Local Community/Access to material resources	Duration	BM med risk hours/h	2.0
Extraction of biomass (related to population); low risk	Local Community/Access to material resources	Duration	BM med risk hours/h	0.5
Extraction of biomass (related to population); medium risk	Local Community/Access to material resources	Duration	BM med risk hours/h	1.0
Extraction of biomass (related to population); no data	Local Community/Access to material resources	Duration	BM med risk hours/h	0.5
Extraction of biomass (related to population); very high risk	Local Community/Access to material resources	Duration	BM med risk hours/h	5.0
Extraction of biomass (related to population); very low risk	Local Community/Access to material resources	Duration	BM med risk hours/h	0.25

Screenshot from openLCA

PSILCA variants

PSILCA variants

- Database available in 3 different variants – Starter, Professional, Developer – distinguished by:

  - Completeness of data (regarding the valuation basis)
  - Data quality information
  - Applied cut-off-criterion

PSILCA variants

Features

	Starter	Professional	Developer
Risk-assessed indicators	✓	✓	✓
General information about sources	✓	✓	✓
Raw values (initial values)	-	✓	✓
Information about data quality per process	-	-	✓
Possibility to change risk levels on process level	✓	✓	✓
Possibility to change overall risk evaluation scheme	-	✓	✓
Cut-off	1E-5	1E-7	none

PSILCA in SimaPro

PSILCA

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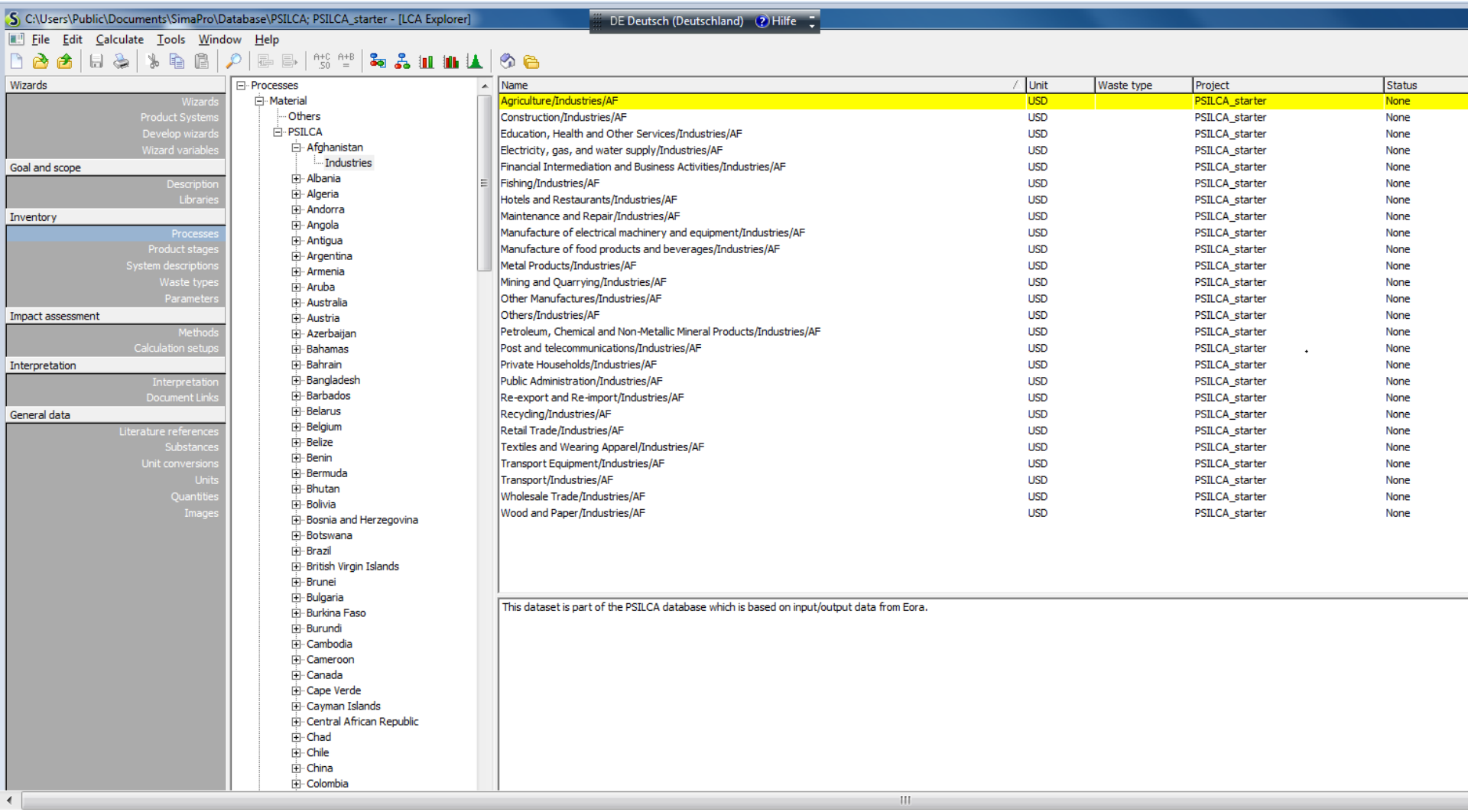
Processes



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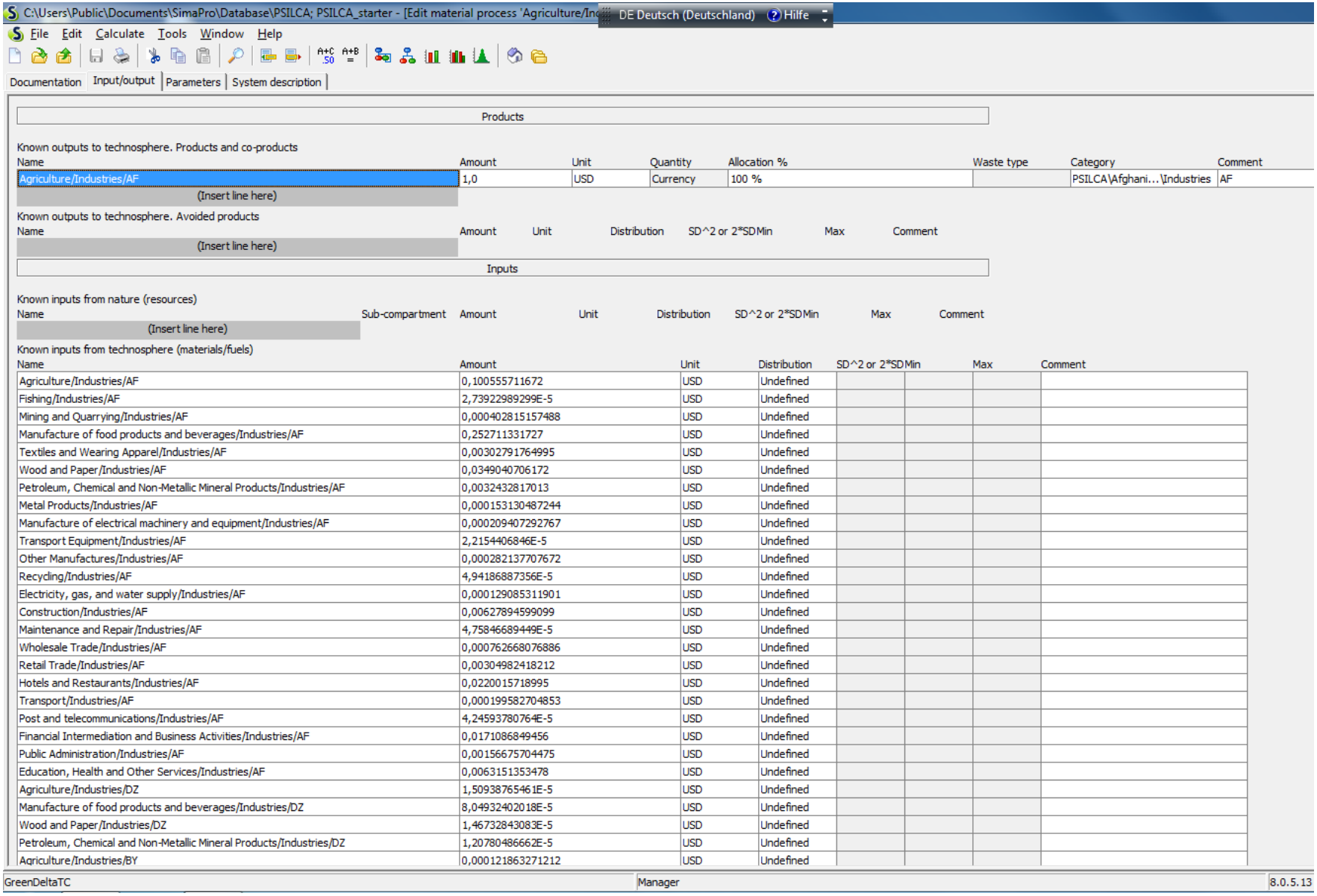
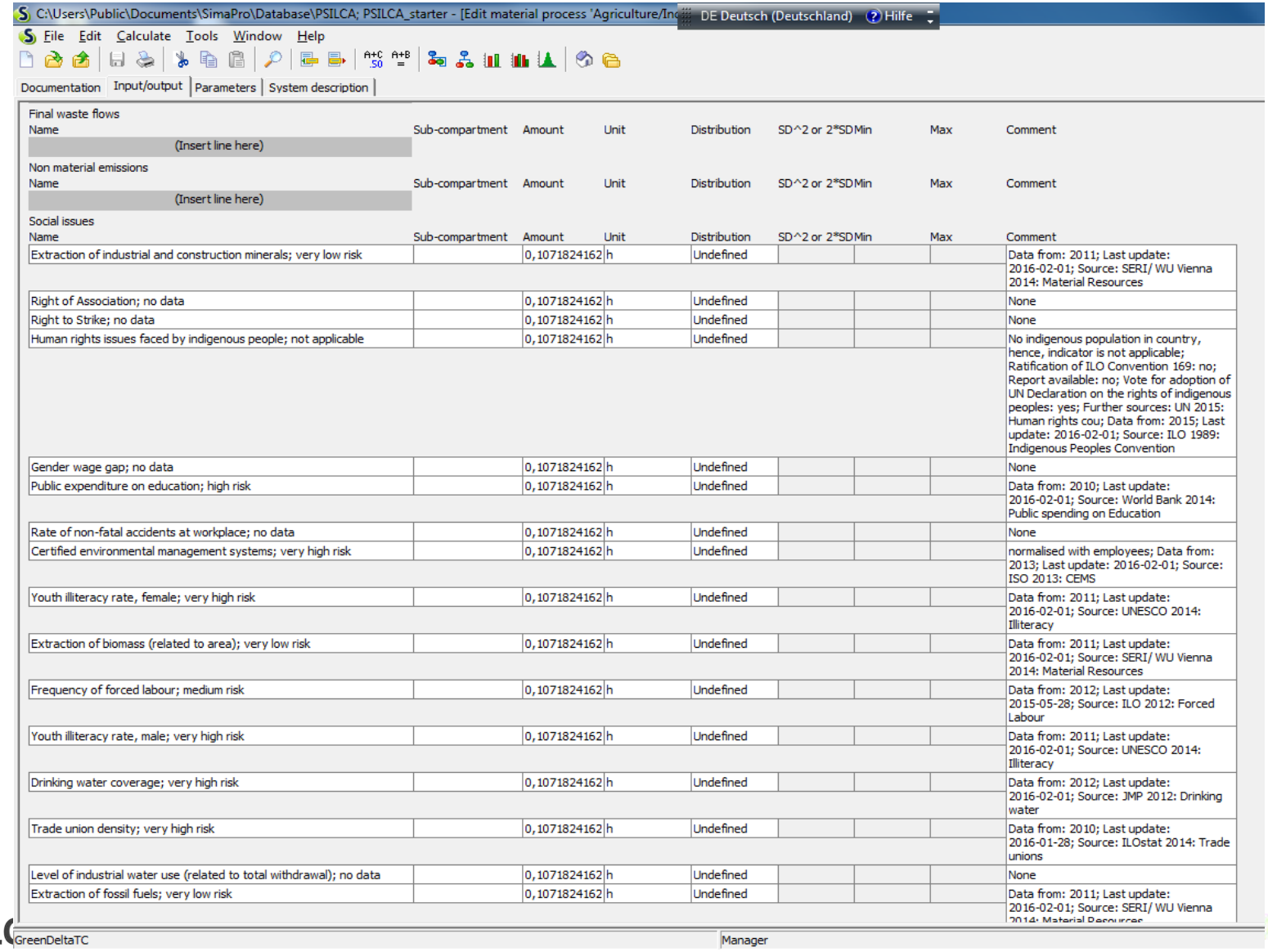
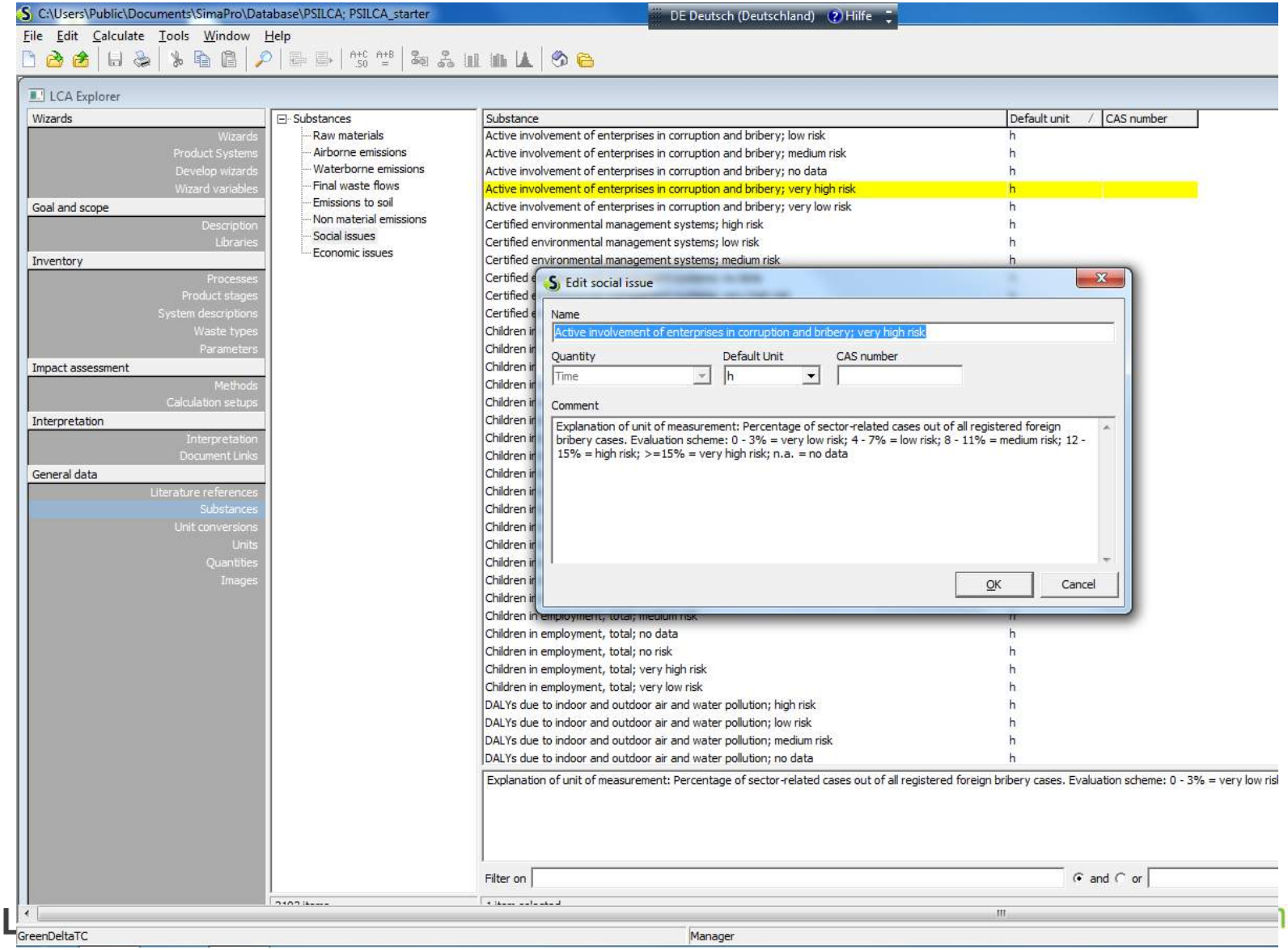
Process Inputs



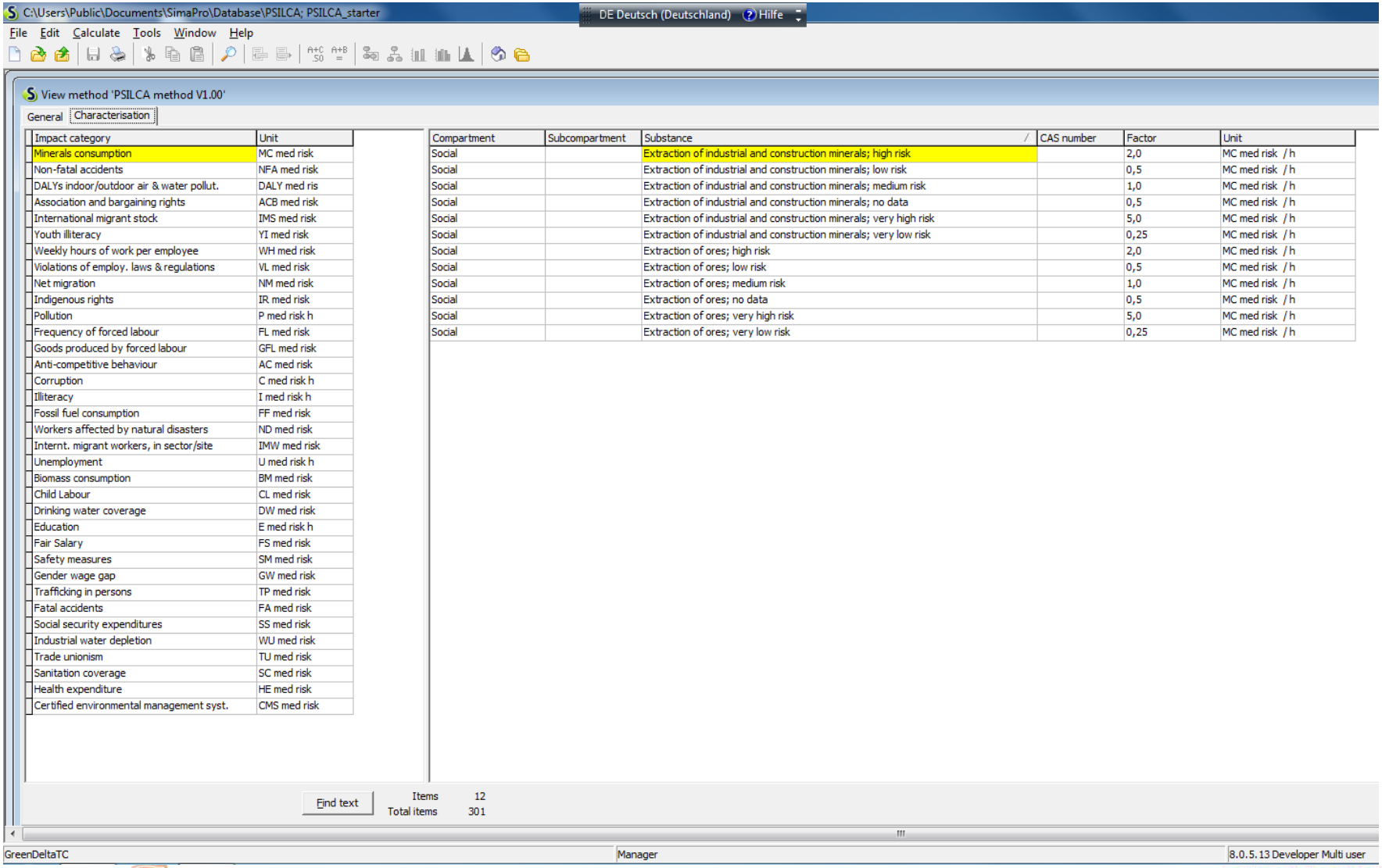
Process Outputs



Social Indicators



Life Cycle Impact Assessment



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Application

Application in policy

“Policy-type” application

- Entire economy/ specific industry sector in a country is assessed
- Either focused on chosen social impacts or “social performance” in general

→ Derive recommendations for political actors in key policy issues related to sustainable production and consumption, policy coherence for development, development cooperation, legislation...

Examples:

➢ Socially sustainable coffee import

➢ Legislation for sustainable construction (e.g. no child and forced labor)

“Policy-type” application

Example:

a) Socially sustainable car industry in Germany

For the purpose of a better development cooperation, it is interesting for NGOs or the Ministry of development to know what the main social impacts in this sector are along its life cycle!

→ *Consider the process “Passenger cars and parts – DE”*

→ *Example calculated with Starter DB (no additional cut-off inserted)* ***in openLCA***

Results: Statistics

Statistics of product system (Starter type):

- Total of 14,839 connected processes
- Processes with highest number of input links are *Railway Equipment, Combustible Shales, Fishing*

Product system statistics

General statistics:

Number of processes	14839
Number of process links	13218267
Connected graph / can calculate?	yes
Technology matrix	14839 x 14839
Reference process	Construction

Recalculate

Processes with highest in-degree (linked inputs):

	Number of input links	Process
●	9812	Railway equipment
●	9812	Others
●	9812	Combustible Shales

Results: Impacts

- Categories with its impacts along the entire life cycle:

LCIA Results

LCIA Results

Impact category	Result	Reference unit
Anti-competitive behaviour or violation of anti-trust and monopoly legislation	0.01100	AC med risk hours
Association and bargaining rights	0.02619	ACB med risk hours
Biomass consumption	0.10104	BM med risk hours
Certified environmental management system	0.05856	CMS med risk hours
Child Labour	0.03712	CL med risk hours
Corruption	0.07981	C med risk hours
DALYs due to indoor and outdoor air and water pollution	0.00840	DALY med risk hours
Drinking water coverage	0.01564	DW med risk hours
Education	0.02808	E med risk hours
Fair Salary	0.08111	FS med risk hours
Fatal accidents	0.01554	FA med risk hours
Fossil fuel consumption	0.01472	FF med risk hours
Frequency of forced labour	0.01929	FL med risk hours
Gender wage gap	0.03237	GW med risk hours
Goods produced by forced labour	0.00013	GFL med risk hours
Health expenditure	0.06909	HE med risk hours
Illiteracy	0.06476	I med risk hours
Indigenous rights	0.02538	IR med risk hours

Results: Process contributions

- German *Passenger cars and parts*, Chinese *Wholesale and retail trade*, South African *General Government* sectors most contribute to the impact category "Fair Salary"

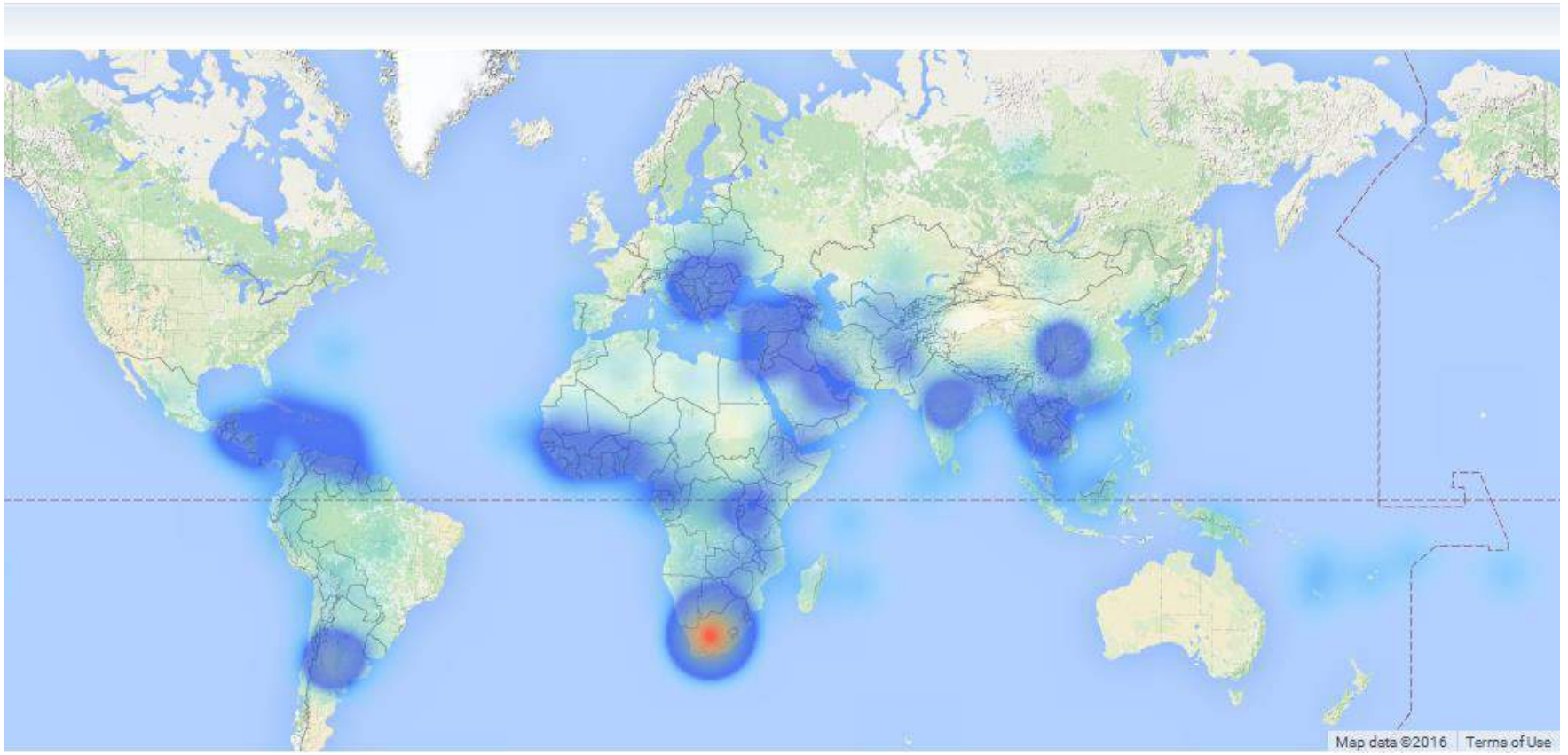
Direct contributions to impact category results

Impact category: Fair Salary

Contribution	Process	Amount	Unit
13.40%	Passenger cars and parts - DE	0.01087	FS med risk hours
01.78%	Wholesale and retail trade - CN	0.00144	FS med risk hours
01.54%	Construction - CN	0.00125	FS med risk hours
01.25%	General Government - ZA	0.00101	FS med risk hours
01.21%	General Government - ZA	0.00098	FS med risk hours
01.20%	Trade - IN	0.00097	FS med risk hours
00.88%	Construction - IN	0.00071	FS med risk hours
00.82%	Manufacture of motor vehicles, trailers and semi-trailers - TR	0.00066	FS med risk hours
00.81%	Other transport - IN	0.00066	FS med risk hours
00.81%	Construction - IN	0.00066	FS med risk hours
00.76%	Other transport - IN	0.00062	FS med risk hours
00.73%	Public administration and other sectors - CN	0.00059	FS med risk hours
00.73%	Manufacture of motor vehicles, trailers and semi-trailers - TR	0.00059	FS med risk hours

Results: Country contributions

- Largest shares of impacts of *Child Labour* are originated in South Africa, Argentina and China



Results: Flow contributions

- Impact of “Association and bargaining rights” mainly originates in the flows (risk- assessed indicators) “Right to strike; very high risk”, “Right of Association; high risk” and “Right to strike; low risk”

Flow contributions

Impact category: Association and bargaining rights

Contribution	Flow	Category	Sub-category	Amount	Unit
37.00%	Right to Strike; very high risk	Workers	Freedom of association and collective bargaining	0.00969	ACB med risk hours
13.87%	Right of Association; high risk	Workers	Freedom of association and collective bargaining	0.00363	ACB med risk hours
09.75%	Right to Strike; low risk	Workers	Freedom of association and collective bargaining	0.00255	ACB med risk hours
09.66%	Right of Collective bargaining; low risk	Workers	Freedom of association and collective bargaining	0.00253	ACB med risk hours
06.75%	Right of Association; no data	Workers	Freedom of association and collective bargaining	0.00177	ACB med risk hours
06.75%	Right to Strike; no data	Workers	Freedom of association and collective bargaining	0.00177	ACB med risk hours
06.75%	Right of Collective bargaining; no data	Workers	Freedom of association and collective bargaining	0.00177	ACB med risk hours
05.32%	Right to Strike; high risk	Workers	Freedom of association and collective bargaining	0.00139	ACB med risk hours
01.82%	Right of Association; low risk	Workers	Freedom of association and collective bargaining	0.00048	ACB med risk hours
01.75%	Right of Collective bargaining; high risk	Workers	Freedom of association and collective bargaining	0.00046	ACB med risk hours
00.55%	Right of Collective bargaining; very high risk	Workers	Freedom of association and collective bargaining	0.00014	ACB med risk hours
00.03%	Right of Association; very high risk	Workers	Freedom of association and collective bargaining	8.22335E-6	ACB med risk hours

Conclusion

- useful to track social impacts along the whole life cycle of an industry sector → receive transparent information
- Social hotspots (e.g. regarding chosen impacts) can be detected
- Based upon the results recommendations and decisions can be derived:

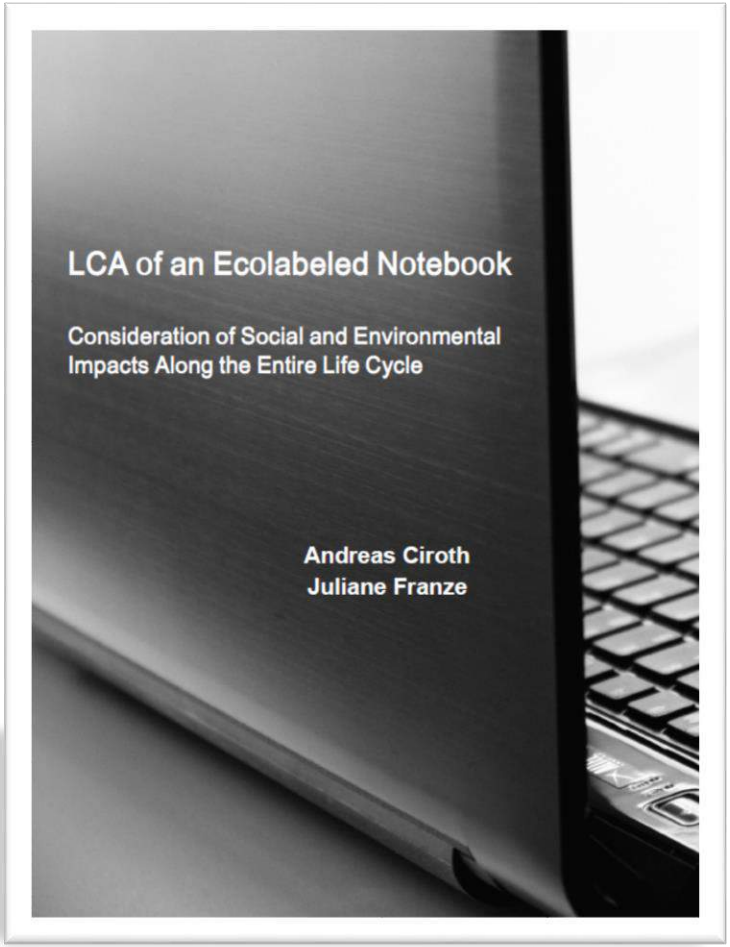
  - How high are specific social impacts? How can these conditions be improved (e.g. by NGOs or governmental programs)?
  - Where are the social hotspots?
  - Which countries should be looked at apart from Germany regarding specific impacts?

Hybrid case: S-LCA of a notebook

Hybrid case: Social LCA of a Notebook

- Based on:

Ciroth, A. and Franze, J. (2011): *LCA of an Ecolabeld Notebook. Consideration of Social and Environmental Impacts Along the Entire Life Cycle*



Goal and scope

Goal

- To identify social hotspots in the life cycle of the considered notebook
- To derive recommendations on policy and company level

- To illustrate the connection of case-specific data with generic data from PSILCA

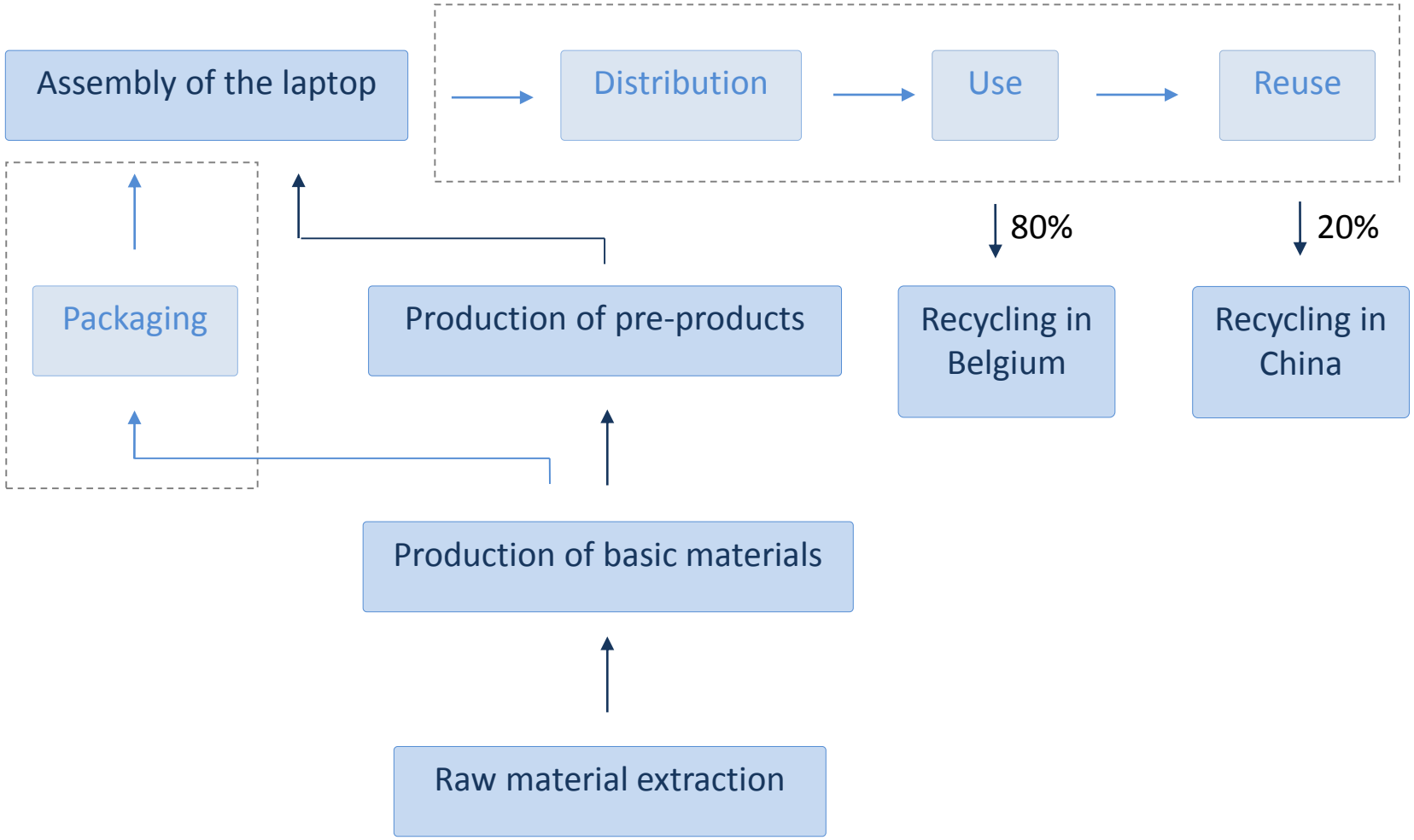
Function and functional unit

→ One unit of ASUSTeK UL50Ag notebook for office use:

- Light weight (2.4 kg) with 15.6'' display and LED backlight
- Long battery life (up to 12 hours)
- Intel® CoreTM 2 Duo processor with 2*1.3 GHz with 2*1.3 GHz, 4096 MB RAM, and 500 GB hard drive space

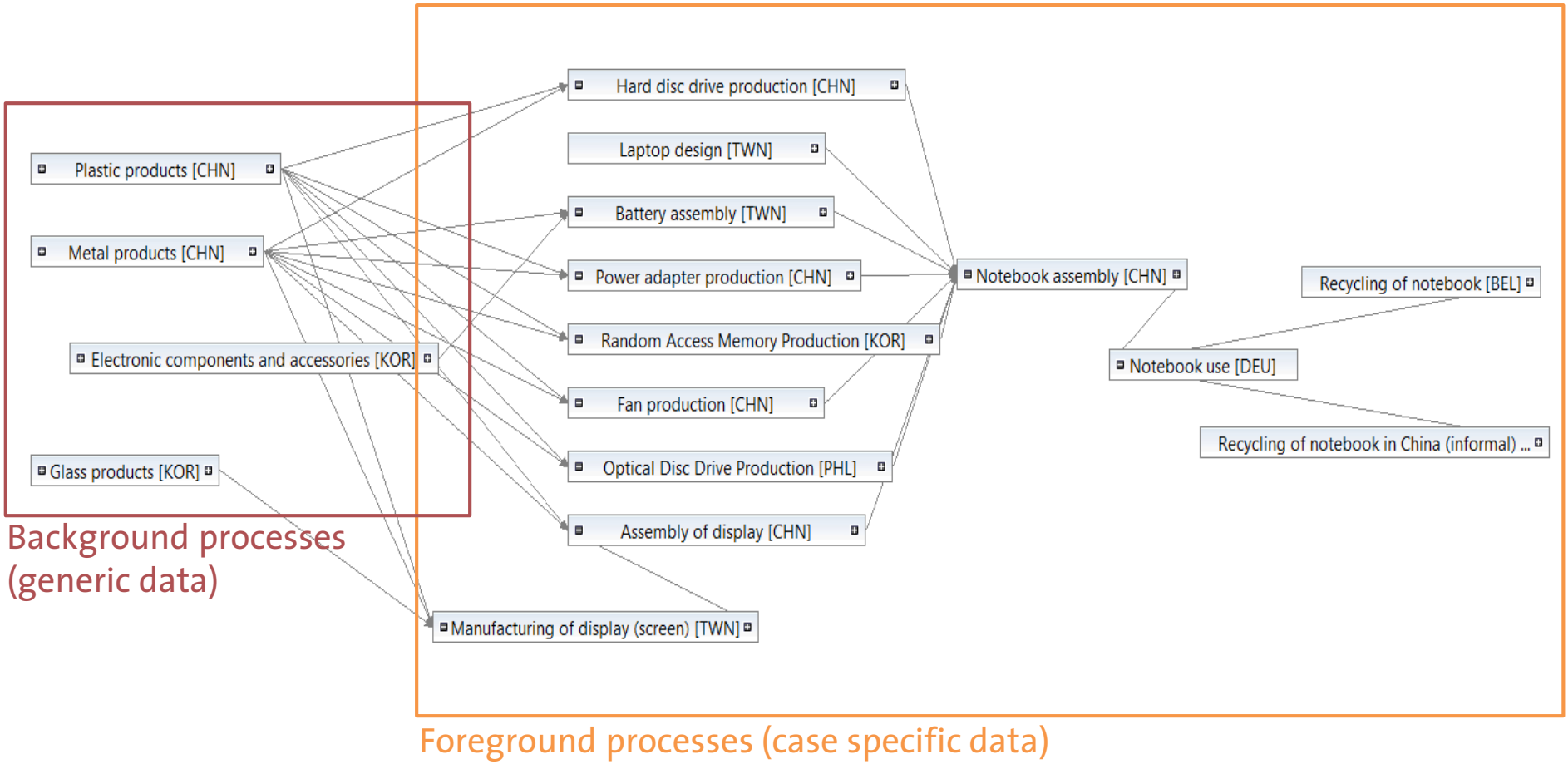
- Further features:
  - 3 USB 2.0 ports
  - optical DVD drive
  - 5 in 1 card reader
  - W-LAN and Bluetooth
  - 0.3 mega pixel webcam
- Modern design
- …

Product system and system boundaries



Modelled product system (part)

Flow chart of the product system for S-LCA:



PSILCA

GreenDelta

Considered indicators (part)

Subcategory	Indicator in Ciroth; Franze 2011	Corresponding indicator in PSILCA
Child labour	**Percentage of child labour in country/ sector/ organization**	**Children in employment, female; Children in employment, male; Children in employment, total**
Forced labour	Frequency of forced labour in country/ sector/ enterprise; Description of kind of forced labour in the company	Frequency of forced labour; Goods produced by forced labour; Trafficking in persons
Fair salary	**Specification of living wage and minimum wage in the country**; Wage level of the worker with lowest income and description of payment performance of the sector	Sector average wage per month; **Minimum wage per month; Living wage, per month**
Discrimination	**Ratio of salary of women to wages of men in the sector**	**Gender wage gap**

Inventory

Data sources for combined case study

- Data on social aspects for foreground processes taken from Ciroth; Franze 2011 (and PSILCA database):
  - company-owned data, reports from accepted NGOs, governmental organizations, literature, interviews with employees...

- Prices of the components (as reference flows):
  http://www.newegg.com/; http://www.alibaba.com/...
- Mass and parts of input material of pre-products: ecoinvent
- Social aspects for background processes: PSILCA

Social Life Cycle Inventory example

Inventory data in original study (part of S-LCI table for process "Optical disc drive from SEPHIL")

Subcategory	Indicator	Status
Forced labour	Frequency of forced labour in country/sector/enterprise	The law prohibits forced or compulsory labour. Nevertheless, according to reports, there are cases of forced labour in the country, in particular regarding children.[971] The electronic sector is not connected to forced labour.[972] No evidence found on cases of forced labour in this company.
	Description of kind of forced labour in the company	-
Fair salary	Specification of living wage and minimum wage in the country	The minimum wage depends on region and size of the organisation. The minimum wage in Calamba City in the province Laguna amounts for non-agricultural work 298 PHP per day (5.10 EUR).[973] This wage is insufficient and does not equate a living wage. According to trade unions and NGOs, a small family needs 700 – 900 PHP per day. In addition, violation of minimum wage standards and the employment of temporary staff to avoid the payment of benefits are common.[974]
	Wage level of the worker with lowest income and description of payment performance of the sector/ enterprise	298 PHP/day plus overtime payment of 44 - 50 PHP/hour[975]
Working time	Hours of work per employee and month in average	The Philippine law provides a work week of 48 hours, but does not stipulate a maximum for overtime hours.[976] Because of the low wage level the majority of workers are forced to do overtime. In peak season employees often work 7 days a week, 12 hours a day. In low season the working time amounts around 55 - 66 hours per week.[977]
	Number of days without work per week	0 - 1 day off per week[978]
	Description of how overtime	Workers are indirectly forced to do overtime

PSILCA

Ciroth; Franze 2011, p.286

Alignment of case specific data with PSILCA scheme

Issue: Type of collected data (qualitative, (semi-)quantitative) differs for many indicators between case study and PSILCA

→ Adaptation/ alignment of case specific data to PSILCA scheme:

Specific inventory data per production process is assessed by risk level definition schemes of PSILCA indicators

Alignment with PSILCA scheme

Ex.: Process "Optical Disc Drive Production", original indicator: "Specification of living wage and minimum wage in the country"

Data in Ciroth; Franze 2011, p. 286

Status: „[...] minimum wage in Calamba City [...is] for non-agricultural work **298 PHP per day** (5.10 EUR). This wage is insufficient and does not equate a living wage. According to trade unions and NGOs, **a small family needs 700 – 900 PHP per day.** In addition, violation of minimum wage standards and the employment of temporary staff to avoid the payment of benefits are common."

→ *Ratio Living Wage/ Minimum Wage = 700 PHP/298 PHP= 2.349*

→ *Minimum wage per month in USD = 189.928 (31.11.2011)*

Alignment with PSILCA scheme

Risk assessment basis for PSILCA („Minimum wage“)

Risk that minimum wage is too low to assure a dignified life

Living-Wage – Minimum-Wage – **ratio >= 1,2** OR ratio >= 1 **and MW<300 USD** → very high risk;
Ratio = 1- <1,2 and MW >= 300USD OR ratio = 0,8-<1 and MW <300USD → high risk;
Ratio = 0,8-<1 and MW >300USD → medium risk;
Ratio = 0,5- <0,8 → low risk;
Ratio <0,5 → very low risk;
n.a. → no data

Conversion to PSILCA scheme

Assessed indicator **“Minimum wage per month; very high risk”**

Process in openLCA

Process “Optical Disc Drive Production” and its risk assessed indicators in openLCA

Outputs

Flow	Category	Amount	Unit
Children in employment, female; no risk	Workers/Child labour	Production_time	h
Children in employment, male; no risk	Workers/Child labour	Production_time	h
Children in employment, total; no risk	Workers/Child labour	Production_time	h
DALYs due to indoor and outdoor air and water pollution; high risk	Workers/Health and Safety (Workers)	Production_time	h
Frequency of forced labour; very low risk	Workers/Forced Labour	Production_time	h
Gender wage gap; high risk	Workers/Discrimination	Production_time	h
Goods produced by forced labour; very low risk	Workers/Forced Labour	Production_time	h
International Migrant Stock; very low risk	Local Community/Migration	Production_time	h
International migrant workers in the sector; medium risk	Local Community/Migration	Production_time	h
Living wage, per month; medium risk	Workers/Fair Salary	Production_time	h
Minimum wage, per month; very high risk	Workers/Fair Salary	Production_time	h
Net migration rate; very low risk	Local Community/Migration	Production_time	h
Optical Disc Drive	Notebook Case study/Notebook Production	1.00000	Item(s)
Presence of anti-competitive behaviour or violation of anti-trust and ...	Value Chain Actors/Fair Competition	Production_time	h
Sector average wage, per month; high risk	Workers/Fair Salary	Production_time	h
Social security expenditures; very high risk	Workers/Social benefits, legal issues	Production_time	h
Trafficking in persons; medium risk	Workers/Forced Labour	Production_time	h
Workers affected by natural disasters; very high risk	Workers/Health and Safety (Workers)	Production_time	h

Activity variable

Issue: Social aspects (i.e. ordinal risk levels) of the specific processes cannot be directly added up over the life cycle

→ Production/ Working time (as activity variable) has to be calculated in order to reflect the share of each unit process (and, hence, the respective social aspects) related to the life cycle

Activity variable

$$Working\ time = \underbrace{\frac{Unit\ labour\ costs}{Mean\ hourly\ wage}}_{\text{Worker hours per \$ output}} * price\ of\ product$$

- *Unit labour costs* = compensation of employees per 1 USD output within sector (e.g. taken from a matching process (sector) in Eora)
- *Mean hourly wage* = calculated with specific data from Ciroth; Franze 2011
- *Price of product:* per item; purchase prices mainly taken from http://www.newegg.com/; 20% considered as labour costs

Activity variable

Ex.: Production time for process “Optical Disc Drive Production” (PHL)

- One Optical disc drive costs USD 22.99 → 20% as labor cost (http://www.newegg.com/Product/Product.aspx?Item=9SIA7BJ35V1123&cm_re=optical_dvd_toshiba-_-9SIA7BJ35V1123-_-Product)

$$Working\ time = \frac{Unit\ labour\ costs\ “Electronic\ computing\ equipment - PHL”}{Mean\ hourly\ wage\ at\ SEPHIL\ in\ the\ Philippines} * \text{price of ODD}$$

$$= \frac{0.107681292982398\ USD/USD}{0.82772\ USD/hr} * 22.99\ \text{USD} * 0.2 = \mathbf{0.598\ hrs}$$

Activity variable

Ex.: Production time for process “Optical Disc Drive Production” (PHL)

Outputs

Flow	Category	Amount	Unit
Children in employment, female; no risk	Workers/Child labour	Production_time	h
Children in employment, male; no risk	Workers/Child labour	Production_time	h
Children in employment, total; no risk	Workers/Child labour	Production_time	h
DALYs due to indoor and outdoor air and water pollution; high risk	Workers/Health and Safety (Workers)	Production_time	h
Frequency of forced labour; very low risk	Workers/Forced Labour	Production_time	h
Gender wage gap; high risk	Workers/Discrimination	Production_time	h
Goods produced by forced labour; very low risk	Workers/Forced Labour	Production_time	h
International Migrant Stock; very low risk	Local Community/Migration	Production_time	h

Parameters

Global parameters

Input parameters

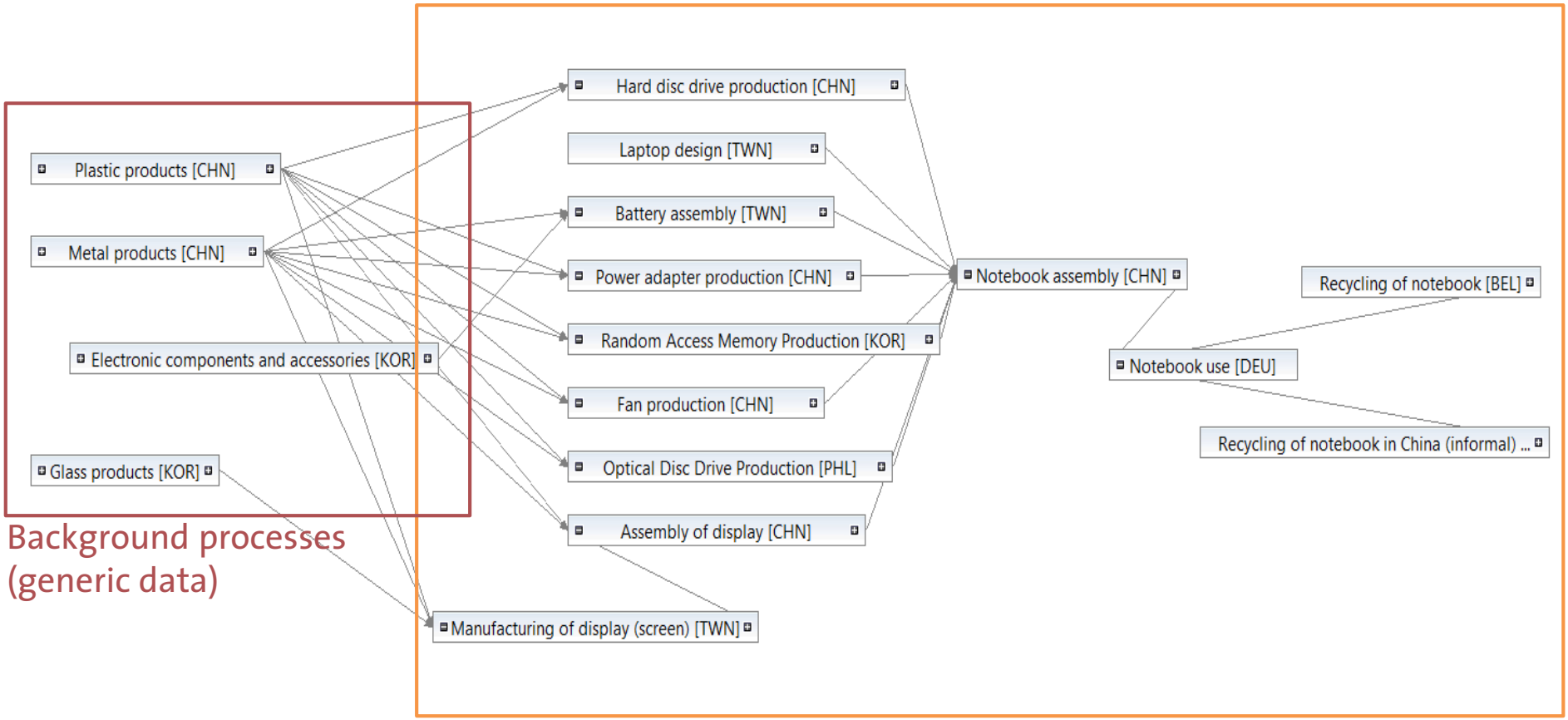
Name	Value	Uncertainty	Description
Price_disc	4.598	none	Labour cost of optical disc drive prod...

Dependent parameters

Name	Formula	Value	Description
Production_time	0.13009386384574252162567051659982*Price_disc	0.598171585962724	Working time in hours

Connection of processes

Flow chart of the product system for S-LCA:



Connection of foreground processes

→ Connection via prices (i.e. labor costs assumed as 20% of purchase price)

- Prices for specific processes are set in the reference flow and, therefore, define the value of one item:

Flow: Optical Disc Drive

Flow properties

Name	Conversion factor	Reference unit	Formula	Is reference
Market value, bulk prices	4.598	USD	1.0 Item(s) = 4.598 USD	☐
Number of items	**1.0**	**Item(s)**	**1.0 Item(s) = 1.0 Item(s)**	☑

- Prices also appear as parameters in the process:

Parameters

Global parameters

Input parameters

Name	Value	Uncertainty	Description
Price_disc	4.598	none	Labour cost of optical disc drive prod...

Connection of foreground processes

→ hence, the inputs of processes are measured in items (reference flow) and prices (due to its conversion factor)

Process: Notebook assembly

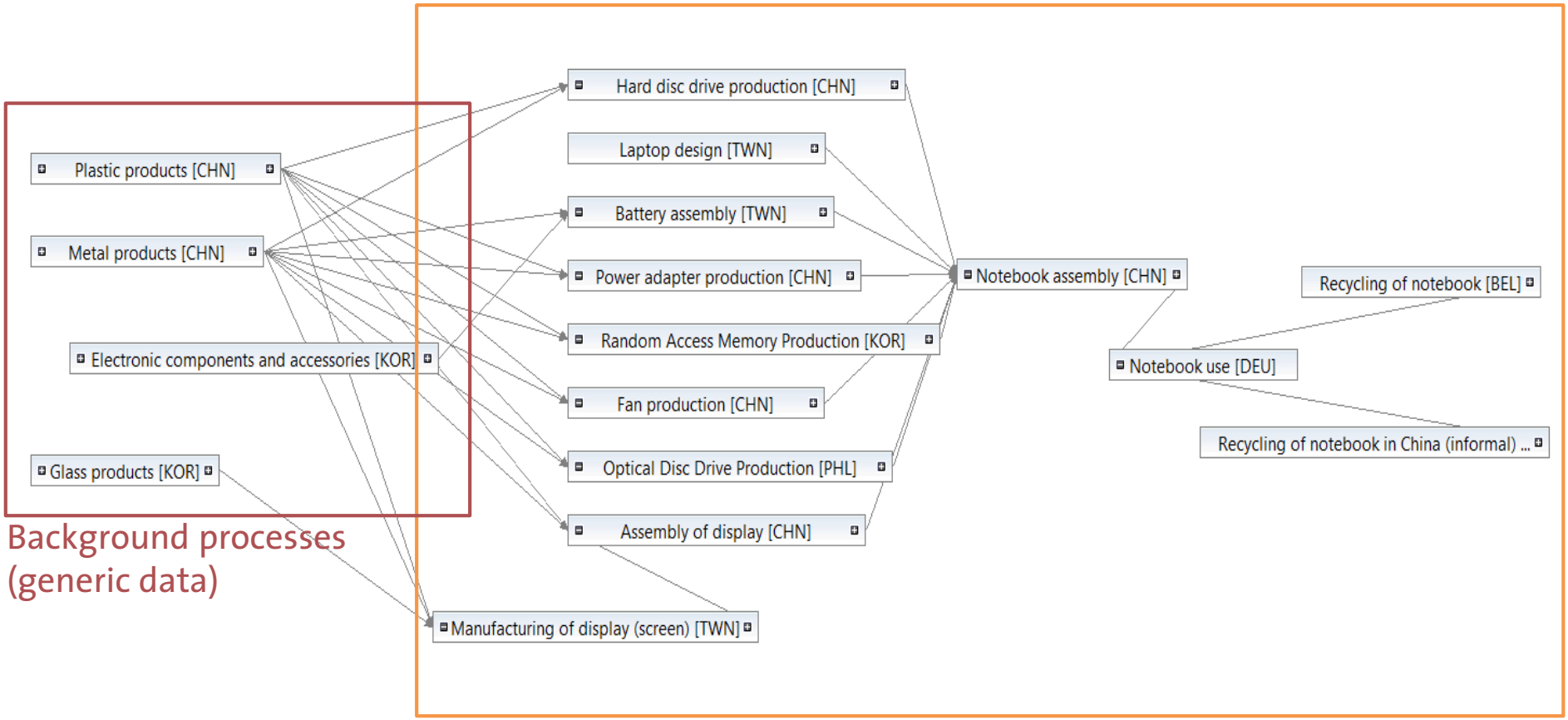
Inputs

Flow	Category	Amount	Unit	Costs	Uncertainty
Optical Disc Drive	Notebook Case study/Notebook Production	1.00000	Item(s)		none
Power adapter	Notebook Case study/Notebook Production	1.00000	Item(s)		none
Battery pack final	Notebook Case study/Notebook Production	1.00000	Item(s)		none
Random Access Memory	Notebook Case study/Notebook Production	2.00000	Item(s)		none
Assembled display final	Notebook Case study/Notebook Production	1.00000	Item(s)		none
Fan	Notebook Case study/Notebook Production	1.00000	Item(s)		none
Hard disc drive	Notebook Case study/Notebook Production	1.00000	Item(s)		none
Laptop Design	Notebook Case study/Notebook Production	1.00000	Item(s)		none

→ Also generic processes of PSILCA can be connected via prices to case-specific processes

Connection to background processes

Flow chart of the product system for S-LCA:



Connection to background processes

Ex.: Plastic products from China as an input in the process "Optical Disc Drive Production" (PHL)

Share of plastic products in an optical disc drive:

- Calculated based on ecoinvent process "CD-ROM/DVD-ROM drive, laptop computer, at plant" (249 g):

→ ODD (in case weighs only 135.9 g) contains ca. 0.0688 kg plastics

- Mean price of plastics: ~ 1.8141 USD/kg
  (http://plasticker.de/preise/preise_ecebd.php)

→ Value of plastics in ODD = 0.1248 USD

Connection to background processes

Ex.: Plastic products from China as an input in the process "Optical Disc Drive Production" (PHL)

→ The amount of plastic products in the process "Optical Disc Drive Production" is modelled as an input of 0.1248 USD of the generic process in PSILCA "Manufacture of plastic products – CN"

Process: Optical Disc Drive Production

Inputs

Flow	Category	Amount	Unit	Costs	Uncertainty
Metal Products - CN	China/Commodities	0.43288	USD		none
Manufacture of plastic products - CN	China/Commodities	0.12479	USD		none

Inputs and outputs of process

Process: Notebook assembly

Inputs

Flow	Category	Amount	Unit	Costs	Uncertainty	Provider
Optical Disc Drive	Notebook Case study/Notebook Production	1.00000	Item(s)		none	
Power adapter	Notebook Case study/Notebook Production	1.00000	Item(s)		none	
Battery pack final	Notebook Case study/Notebook Production	1.00000	Item(s)		none	
Random Access Memory	Notebook Case study/Notebook Production	2.00000	Item(s)		none	
Assembled display final	Notebook Case study/Notebook Production	1.00000	Item(s)		none	
Fan	Notebook Case study/Notebook Production	1.00000	Item(s)		none	
Hard disc drive	Notebook Case study/Notebook Production	1.00000	Item(s)		none	
Laptop Design	Notebook Case study/Notebook Production	1.00000	Item(s)		none	

Outputs

Flow	Category	Amount	Unit
Notebook	Notebook Case study/Notebook Production	1.00000	Item(s)
Social security expenditures; medium risk	Workers/Social benefits, legal issues	Production_time	h
Presence of anti-competitive behaviour or violation of anti-trust and monop...	Value Chain Actors/Fair Competition	Production_time	h
Net migration rate; very low risk	Local Community/Migration	Production_time	h
Gender wage gap; no risk	Workers/Discrimination	Production_time	h
DALYs due to indoor and outdoor air and water pollution; very low risk	Workers/Health and Safety (Workers)	Production_time	h
Living wage, per month; low risk	Workers/Fair Salary	Production_time	h
Trafficking in persons; high risk	Workers/Forced Labour	Production_time	h
Children in employment, female; no risk	Workers/Child labour	Production_time	h
Children in employment, male; no risk	Workers/Child labour	Production_time	h
International migrant workers in the sector; high risk	Local Community/Migration	Production_time	h
Frequency of forced labour; very low risk	Workers/Forced Labour	Production_time	h
Sector average wage, per month; very high risk	Workers/Fair Salary	Production_time	h
Workers affected by natural disasters; low risk	Workers/Health and Safety (Workers)	Production_time	h
Minimum wage, per month; very high risk	Workers/Fair Salary	Production_time	h
Goods produced by forced labour; very low risk	Workers/Forced Labour	Production_time	h
Children in employment, total; no risk	Workers/Child labour	Production_time	h

Results

Statistics

Product system statistics

General statistics:

Number of processes	14852
Number of process links	13218296
Connected graph / can calculate?	yes
Technology matrix	14851 x 14851
Reference process	Notebook use

Recalculate

Processes with highest in-degree (linked inputs):

	Number of input links	Process
●	9812	Railway equipment
●	9812	Others
●	9812	Combustible Shales
●	9812	Re-export and Re-import
●	9812	Fishing

Analysis results

Risk of impact categories (in medium risk hours)

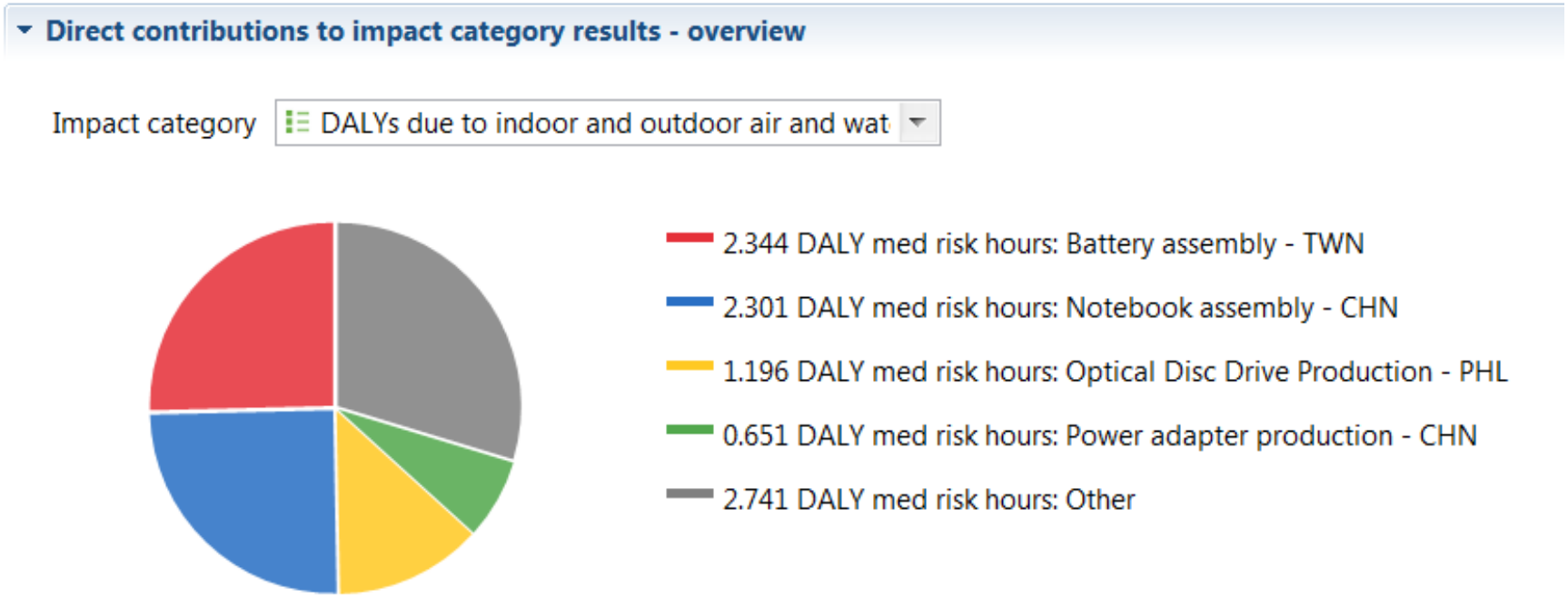
LCIA Results

LCIA Results

Impact category	Result	Reference unit
Fair Salary	192.74078	FS med risk hours
International migrant workers (in the sector/ site)	29.51540	IMW med risk hours
Trafficking in persons	27.95652	TP med risk hours
Association and bargaining rights	27.87860	ACB med risk hours
Social security expenditures	24.18055	SS med risk hours
Corruption	22.76317	C med risk hours
Sanitation coverage	19.39322	SC med risk hours
Pollution	19.15194	P med risk hours
Workers affected by natural disasters	16.32953	ND med risk hours
Health expenditure	15.03075	HE med risk hours
Illiteracy	12.31348	I med risk hours
Anti-competitive behaviour or violation of anti-trust and monopoly legislation	11.31520	AC med risk hours
Biomass consumption	9.82786	BM med risk hours
DALYs due to indoor and outdoor air and water pollution	9.23314	DALY med risk hours
Minerals consumption	8.91895	MC med risk hours
Industrial water depletion	8.78537	WU med risk hours
Indigenous rights	8.59808	IR med risk hours

Analysis results

Social hotspots (processes) regarding specific impacts (or flows)



Analysis results

Social hotspots (processes) regarding specific impacts (or flows)

Direct contributions to impact category results

Impact category: DALYs due to indoor and outdoor air and water pollution

Contribution	Process	Amount	Unit
25.39%	Battery assembly - TWN	2.34425	DALY med risk hours
24.92%	Notebook assembly - CHN	2.30055	DALY med risk hours
12.96%	Optical Disc Drive Production - PHL	1.19634	DALY med risk hours
07.05%	Power adapter production - CHN	0.65078	DALY med risk hours
02.95%	Metal Products - CN	0.27192	DALY med risk hours
02.63%	Manufacture of plastic products - CN	0.24287	DALY med risk hours
02.10%	Assembly of display - CHN	0.19365	DALY med risk hours
01.67%	Construction - CN	0.15398	DALY med risk hours
01.54%	Manufacturing of display (screen) - TWN	0.14232	DALY med risk hours
01.24%	Crop cultivation - CN	0.11483	DALY med risk hours
01.23%	Fan production - CHN	0.11383	DALY med risk hours

Analysis results

Impact assessment regarding the whole upstream chain

Impact assessment results

Process: P Battery assembly - TWN

Contribution	Impact category	Upstream incl. direct	Direct	Unit
42.84%	Certified environmental management system	1.59663	0.00000	CMS med risk hours
40.82%	International migrant stock	1.20282	0.58606	IMS med risk hours
37.04%	Trade unionism	2.18809	0.00000	TU med risk hours
34.06%	Youth illiteracy	1.70557	0.00000	YI med risk hours
32.15%	Non-fatal accidents	0.82220	0.00000	NFA med risk hours
31.74%	DALYs due to indoor and outdoor air and water pollution	2.93059	2.34425	DALY med risk hours
31.62%	Biomass consumption	3.10750	0.00000	BM med risk hours
31.00%	Fossil fuel consumption	0.38487	0.00000	FF med risk hours
30.36%	Health expenditure	4.56316	0.00000	HE med risk hours
30.12%	Illiteracy	3.70877	0.00000	I med risk hours

Analysis results

Impact assessment regarding the whole upstream chain

Contribution tree

Flow: Sanitation coverage; no data - Local Commun

Impact category: DALYs due to indoor and outdoor air and wat

Contribution	Process	Amount	Unit
100.00%	Notebook use - DEU	9.23314	DALY med risk hours
99.95%	Notebook assembly - CHN	9.22838	DALY med risk hours
31.74%	Battery assembly - TWN	2.93059	DALY med risk hours
13.49%	Optical Disc Drive Production - PHL	1.24581	DALY med risk hours
10.01%	Assembly of display - CHN	0.92466	DALY med risk hours
08.93%	Power adapter production - CHN	0.82410	DALY med risk hours
05.36%	Random Access Memory Production - KOR	0.49493	DALY med risk hours
04.21%	Fan production - CHN	0.38832	DALY med risk hours
00.94%	Hard disc drive production - CHN	0.08718	DALY med risk hours
00.35%	Laptop design - TWN	0.03223	DALY med risk hours
00.05%	Recycling of notebook - BEL	0.00477	DALY med risk hours
00.00%	Recycling of notebook in China (informal) - CHN	2.28800E-8	DALY med risk hours

Analysis results

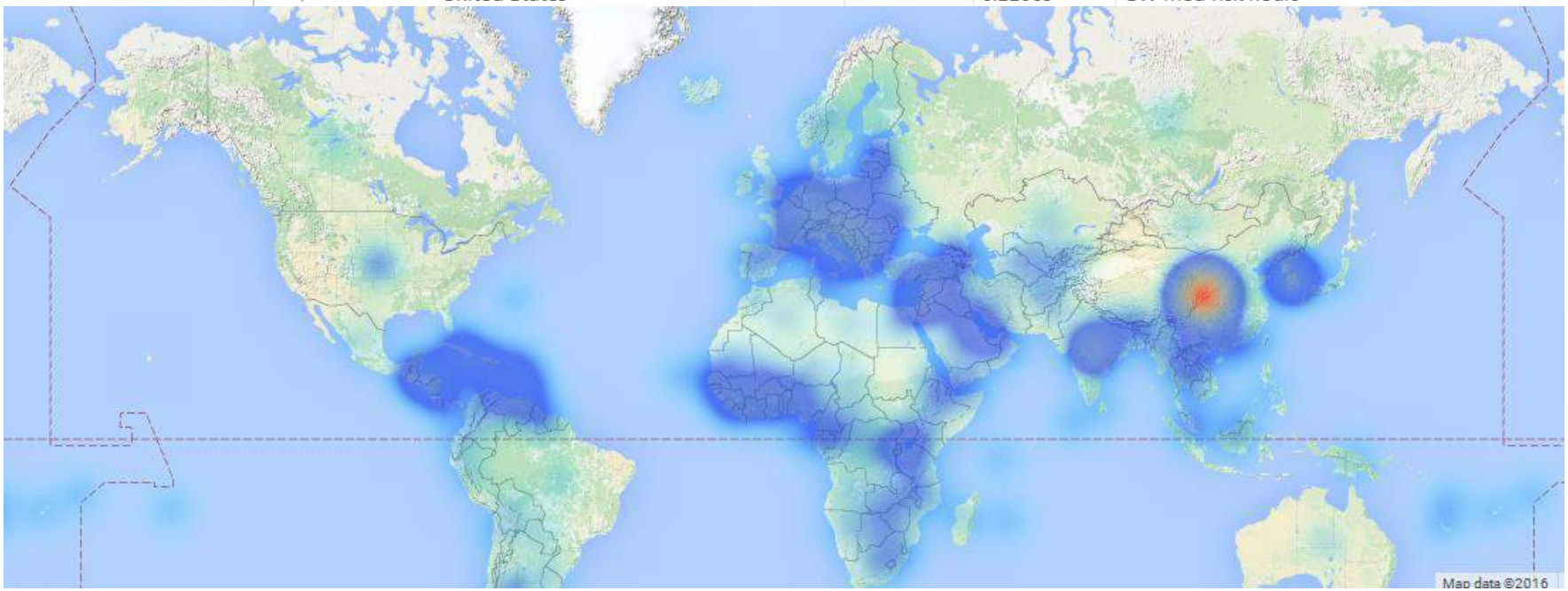
Social hotspots (countries) regarding specific impacts (or flows)

Flow — Sanitation coverage; no data - Local Commun

Impact category — Gender wage gap

Contribution tree for locations

Location	Process	Amount	Unit
China		1.80174	GW med risk hours
PHL		1.19634	GW med risk hours
Korea, Republic of		0.34768	GW med risk hours
India		0.29483	GW med risk hours
United States		0.11069	GW med risk hours



Analysis results

Group results

Results

Flows: Sanitation coverage; no data - Local Community/Safe and healthy living conditions

Impact categories: Fair Salary

Group	Amount	Unit
Notebook assembly	164.50788776966903	FS med risk hours
Other	28.23289042613464	FS med risk hours

1.645E2 FS med risk hours: Notebook assembly

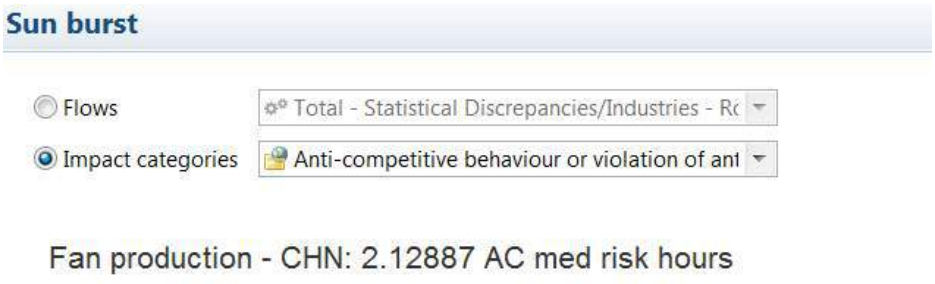
28.233 FS med risk hours: Other

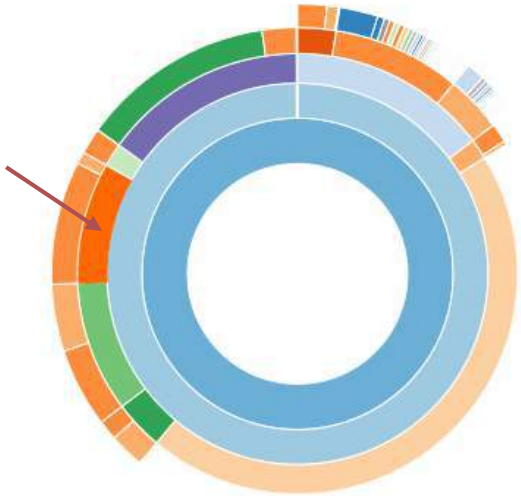
PSILCA

GreenDelta

Analysis results

Sun burst
(additional cut-off: 1E-7)





Current work

Organization

- Network of collaborators → data collection and provision; local customer support

- Scientific Advisory Council (SAC):
  - To ensure feedback on selected approach, method and on updates of database

- User Advisory Council (UAC):
  - To provide practical feedback and to steer the database development and maintenance

Outlook

- For some indicators, additionally positive aspects will be considered (e.g. *Respect of indigenous rights, Fair salary*):

  high opportunity, medium opportunity, low opportunity

- Calculations planned to be possible with raw amounts of indicators (not only risk levels and worker hours)

- Incorporate more indicators, also for consumers

Outlook (planned indicators)

Stakeholder	Subcategory	Indicator
WORKERS	Working time	Hours of work per employee, per day
	Working time	Standard weekly hours
	Working time	Standard daily hours
	Discrimination	Occurrence of discrimination
	Discrimination	Women in the labour force
	Discrimination	Men in the labour force
	Health and Safety	Occupational risks
VALUE CHAIN ACTORS	Fair competition	Presence of policies to prevent anti-competitive behaviour
	Promoting social responsibility	Presence of codes of conduct that protect human rights of workers among suppliers
	Promoting social responsibility	Membership in an initiative that promotes social responsibility along the supply chain
	Supplier relationships	Interaction of the companies with suppliers
SOCIETY	Contribution to economic development	Economic situation of the country
	Contribution to economic development	Contribution of the sector to economic development
	Health and Safety	Life expectancy at birth
	Prevention and mitigation of conflicts	Risk of conflicts with regard to the sector
LOCAL COMMUNITY	Access to material resources	Description of (potential) material resource conflicts
	Respect of indigenous rights	(Company´s) respect of indigenous rights
	Safe and healthy living conditions	Contribution of the sector to environmental load
	Safe and healthy living conditions	Management effort to improve environmental performance
	Local employment	Unemployment rate in the country
CONSUMERS	Health and Safety	Violations of mandatory health and safety standards
	Health and Safety	Presence of commissions or institutions to detect violations of standards and protect consumers from health and safety risks
	Health and Safety	Presence of management measures to assess consumer health and safety
	Transparency	Presence of business practices that are deceptive or unfair to consumers
	Transparency	Presence of certifications or labels for the product/sites sector
	Transparency	Presence of a law or norm regarding transparency (by country and/or sector)
	End of life responsibility	Strength of national legislation covering product disposal and recycling

More information

PSILCA manual:

Ciroth, A./ Eisfeldt, F. (2016): *PSILCA – A Product Social Impact Life Cycle Assessment database. Database version 1.0. Documentation*

http://www.openlca.org/documents/14826/6d439d91-ddf5-480f-9155-e4787eaa0b6b

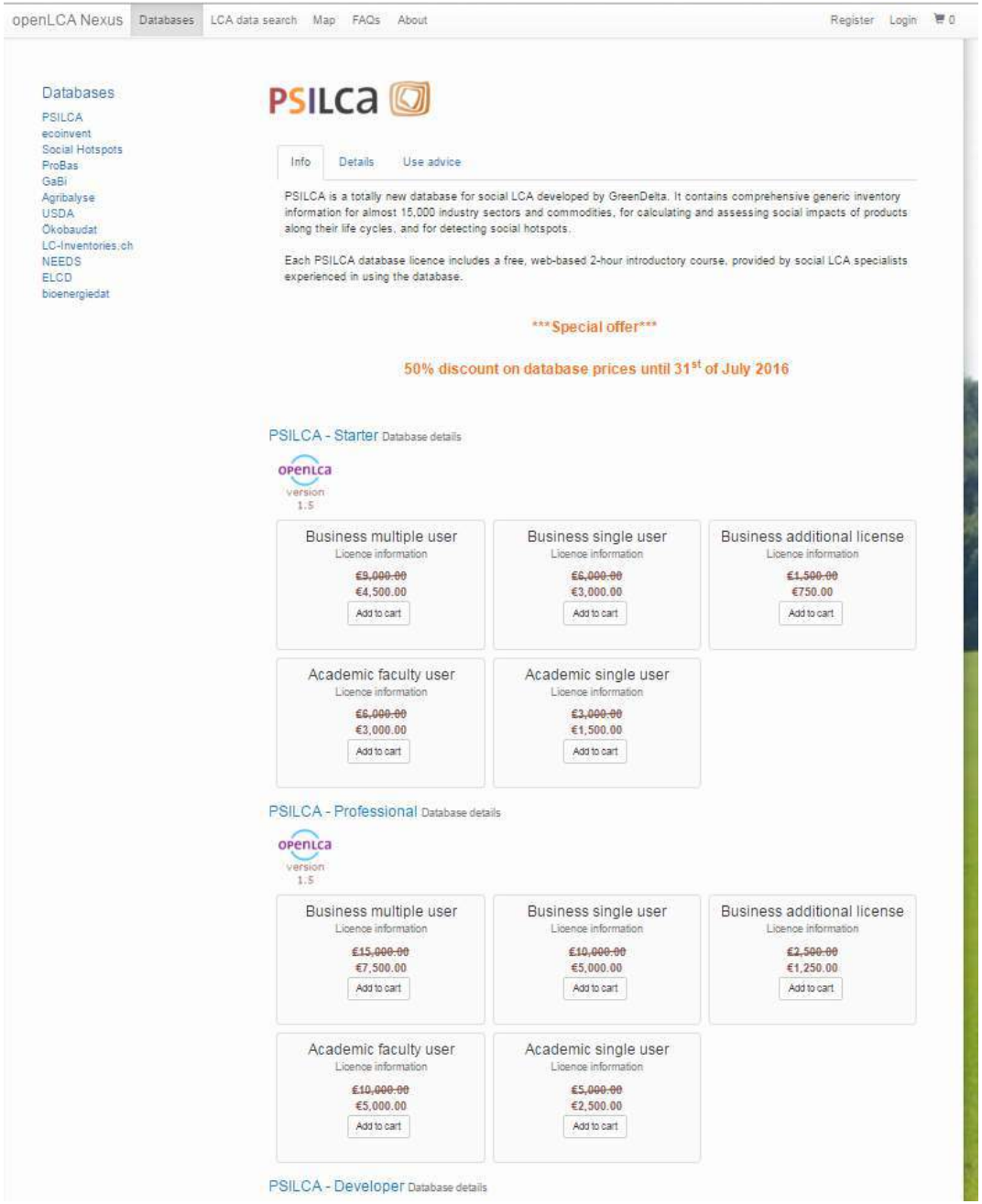
Purchase of PSILCA

Purchase

Prices and further description under:

https://nexus.openlca.org/database/PSILCA

50% discount on database prices until 31st of July 2016



Thank you!

GreenDeLTa
sustainability consulting + software

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www.greendelta.com

References

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Pictures of transition slides:

- Picture 1: http://www.dtoday.de/cms_media/module_img/749/374687_1_ressort_51f7b43cf3e48.jpg, last access: 27.08.2015
- Picture 2: https://c2.staticflickr.com/8/7206/6986180861_c5ebaf9634_b.jpg, last access: 27.10.2015