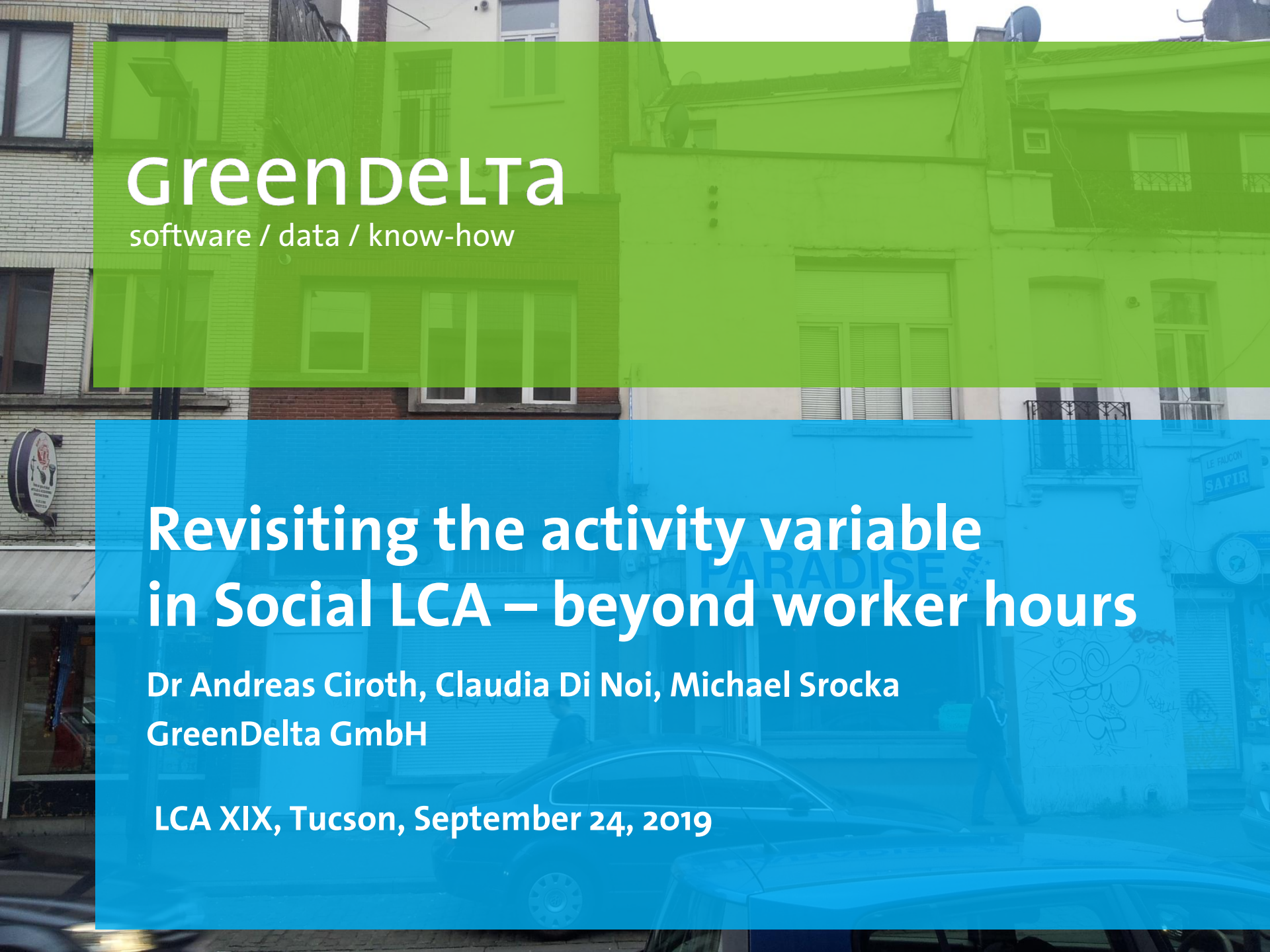
GreenDelta
software / data / know-how
Revisiting the activity variable
in Social LCA – beyond worker hours
Dr Andreas Ciroth, Claudia Di Noi, Michael Srocka
GreenDelta GmbH
LCA XIX, Tucson, September 24, 2019

Points for the talk

- The activity variable in social LCA
- An alternative for common indicators: direct quantification
- Example, PSILCA database
- Conclusions & discussion

The activity variable in Social LCA, revisited

The activity variable in social LCA

- Well-known:

  a) Indicators in social LCA divers, qualitative and quantitative

  b) social LCA without LC is somehow missing the point

→ there needs to be a way to deal with processes in a life cycle and to address the contribution of processes in a life cycle to a final life cycle result

→ Norris, 2006: “activity variable”:

  → worker hours, or value added, as quantitative figure for each process

The activity variable in social LCA, 2

→ Norris, 2006: "activity variable":

- worker hours, or value added, as quantitative figure for each process
- each indicator risk-assessed per process (low, medium, high, ..)
- and the assessment result expressed as one elementary flow

→ this indeed allows calculation of all types of indicators in LCA, with common LCA tools

→ used in the SHDB and in the PSILCA database, with worker hours

The activity variable in social LCA

PSILCA: construction, Bermuda

Construction - BM

Inputs/Outputs: Construction

Inputs

Outputs

Flow	Category	Amount	Unit
Active involvement of enterprises in corruption and bribery; no data	Value Chain Actors/Corrupt...	0.02778	h
Certified environmental management systems; very high risk	Local Community/Access t...	0.02778	h
Children in employment, female; no data	Workers/Child labour	0.02778	h
Children in employment, male; no data	Workers/Child labour	0.02778	h
Children in employment, total; no data	Workers/Child labour	0.02778	h
Construction - BM	**Bermuda/Industries**	**1.00000**	**USD**
DALYs due to indoor and outdoor air and water pollution; no data	Workers/Health and Safety...	0.02778	h
Drinking water coverage; no data	Local Community/Safe and...	0.02778	h
Evidence of violations of laws and employment regulations; high risk	Workers/Social benefits, le...	0.02778	h
Extraction of biomass (related to area); low risk	Local Community/Access t...	0.02778	h
Extraction of biomass (related to population); very low risk	Local Community/Access t...	0.02778	h
Extraction of fossil fuels; no data	Local Community/Access t...	0.02778	h
Extraction of industrial and construction minerals; high risk	Local Community/Access t...	0.02778	h
Extraction of ores; no data	Local Community/Access t...	0.02778	h
Frequency of forced labour; no data	Workers/Forced Labour	0.02778	h
Gender wage gap; medium risk	Workers/Discrimination	0.02778	h

SHDB: construction, Belarus

Construction/BLR U

Inputs/Outputs: Construction/BLR U

Inputs

Outputs

Flow	Category	Amount	Unit	C
% Rural Access to an Improved Source of Drinking Water:LR	Social/Unspecified	0.13445	work hours	
% Rural Access to an Improved source of Sanitation:LR	Social/Unspecified	0.13445	work hours	
% Total Access to an Improved Source of Drinking Water:LR	Social/Unspecified	0.13445	work hours	
% Total Access to an Improved source of Sanitation:MR	Social/Unspecified	0.13445	work hours	
% Urban Access to an Improved Source of Drinking Water:LR	Social/Unspecified	0.13445	work hours	
% Urban Access to an Improved source of Sanitation:LR	Social/Unspecified	0.13445	work hours	
Adult need leave:LR	Social/Unspecified	0.13445	work hours	
Age-standardized mortality rates for injuries (per 100,000 population):...	Social/Unspecified	0.13445	work hours	
Age-standardized mortality rates for NCD (per 100,000 population):MR	Social/Unspecified	0.13445	work hours	
Age-standardized MRs from communicable diseases (per 100,000 po...	Social/Unspecified	0.13445	work hours	
Asbestosis DALYs as a result of Workplace Exposure to PM, both gend...	Social/Unspecified	0.13445	work hours	
Asthma DALYs as a result of Workplace Exposure to PM, both genders...	Social/Unspecified	0.13445	work hours	
Average of Unemployment Percentage at the country level:LR	Social/Unspecified	0.13445	work hours	
Bertelsmann Transformation Index - Rule of law - Independent Judicia...	Social/Unspecified	0.13445	work hours	
Cardiovascular diseases, Estimated Age SDR (per 100,000):LR	Social/Unspecified	0.13445	work hours	
Cases of HIV (per 1000 adults 15-49 years):LR	Social/Unspecified	0.13445	work hours	
Cases of Tuberculosis (per 100,000 population):HR	Social/Unspecified	0.13445	work hours	
Center for Systemic Peace - State Fragility Index (0-25):LR	Social/Unspecified	0.13445	work hours	
Cerebrovascular disease, Estimated Age SDR (per 100,000):VH	Social/Unspecified	0.13445	work hours	
Child education leave:LR	Social/Unspecified	0.13445	work hours	
Child health leave:HR	Social/Unspecified	0.13445	work hours	
CIRI Human Rights Data Project - Independent Judiciary, (0,1,2):VH	Social/Unspecified	0.13445	work hours	
Collective bargaining coverage:ND	Social/Unspecified	0.13445	work hours	
Construction/BLR U	**SHDB/Belarus**	**1.00000**	**USD 2011**	

The activity variable in social LCA, 3

→ Norris, 2006: "activity variable":

- worker hours, or value added as quantitative figure for each process
- each indicator risk-assessed (low, medium, high, ..)
- and the assessment result expressed as one elementary flow

→ there are quite many indicators that have no link to the worker hours spent in a process: drinking water coverage; DALYs due to air pollution, ...

→ a lot of redundant information

→ the indicator result itself gets somewhat a hidden

The activity variable in social LCA, 3

→ Norris, 2006: "activity variable":

- worker hours, or value added as quantitative figure for each process
- each indicator risk-assessed (low, medium, high, ..)
- and the assessment result expressed as one elementary flow

→ there are quite many indicators that have no link to the worker hours spent in a process: drinking water coverage; DALYs due to air pollution, ...

→ a lot of redundant information

→ the indicator result itself gets somewhat a hidden

→ isn't there a more direct calculation possibility?

Direct quantification of social indicators in social LCA

A direct quantification of indicators in social LCA, explored

- Considering the indicators used in social LCA so far, often, a quantification is possible:
  - # of enterprises, of accidents, USD for education, ..
  - % of coverage of sanitation, illiteracy, ..
  - Yes/No (presence of indigenous population, ..)
  - rating scores (transparency index, ..)
  - ...

- There are rarely pure textual descriptions, and if they are, they can be turned into a quantifiable value (losing a bit of information)

A direct quantification of indicators in social LCA, explored;
Construction, Bermuda, PSICLA DB

Construction - BM

Social aspects: Construction

Social assessment

Name	Raw value	Risk level	Activity variable	Data quality	Comment	Source
Value Chain Actors						
Corruption						
Active involvement of enterprises i		No data	0.0277766732366273 [h, Workin...	(5;5;5;5;5)	Last update: 28-Jan-...	
Public sector corruption	44 [Score]	Very high risk	0.0277766732366273 [h, Workin...	(4;3;1;4;n.a.)	Data from: 2016; Las...	Transpa
Promoting social responsibility						
Social responsibility along the sup		Very high risk	0.0277766732366273 [h, Workin...	(5;5;5;5;5)	Last update: 31-Jul-2...	UN Glo
Fair Competition						
Presence of anti-competitive beha		No data	0.0277766732366273 [h, Workin...	(5;5;5;5;5)	Last update: 28-Aug...	
Workers						
Health and Safety (Workers)						
DALYs due to indoor and outdoor		No data	0.0277766732366273 [h, Workin...	(5;5;5;5;5)	Last update: 1-Feb-2...	
Workers affected by natural disast	0 [%]	Very low risk	0.0277766732366273 [h, Workin...	(2;1;2;1;4)	Data from: 2014; Las...	EM-DA
Rate of fatal accidents at workplac	61.4 [#/yr and 100k empl.]	Very high risk	0.0277766732366273 [h, Workin...	(2;2;5;1;1)	outdated? ;Data fro...	ILOstat
Presence of sufficient safety meas	0.005430858 [# per 100k empl.]	Very low risk	0.0277766732366273 [h, Workin...	(1;2;1;4;1)	Data from: 2017; Las...	USDOL
Rate of non-fatal accidents at work		No data	0.0277766732366273 [h, Workin...	(5;5;5;5;5)	Last update: 30-Apr-...	
Social benefits, legal issues						
Social security expenditures		No data	0.0277766732366273 [h, Workin...	(5;5;5;5;5)	Last update: 1-Feb-2...	
Evidence of violations of laws and	19.76834224 [# per 1k empl.]	High risk	0.0277766732366273 [h, Workin...	(2;1;1;5;5)	Data from: 2015; Las...	USDOL
Child labour						
Children in employment, female	0.4 [% of female children]	Very low risk	0.0277766732366273 [h, Workin...	(2;4;3;4;5)	Data from: 2014; Las...	World E
Children in employment, male	0.9 [% of male children]	Very low risk	0.0277766732366273 [h, Workin...	(2;4;3;4;5)	Data from: 2014; Las...	World E
Children in employment, total	0.7 [% of children]	Very low risk	0.0277766732366273 [h, Workin...	(2;4;3;4;5)	Data from: 2014; Las...	World E
Freedom of association and collective						
Right of Association		No data	0.0277766732366273 [h, Workin...	(5;5;5;5;5)	Last update: 30-Apr-...	
Trade union density	23 [%]	High risk	0.0277766732366273 [h, Workin...	(2;2;4;1;5)	Data from: 2012; Las...	ILOstat
Right to Strike		No data	0.0277766732366273 [h, Workin...	(5;5;5;5;5)	Last update: 30-Apr-...	
Right of Collective bargaining		No data	0.0277766732366273 [h, Workin...	(5;5;5;5;5)	Last update: 30-Apr-...	
Discrimination						
Men in the sectoral labour force	1.174417688 [ratio]	Very low risk	0.0277766732366273 [h, Workin...	(2;4;4;3;4)	Data calculated as av...	ILO 201
Gender wage gap		No data	0.0277766732366273 [h, Workin...	(5;5;5;5;5)	Last update: 30-Apr-...	
Women in the sectoral labour forc	0.749304861 [ratio]	Low risk	0.0277766732366273 [h, Workin...	(2;4;4;3;4)	Data calculated as av...	ILO 201
Forced Labour						

A direct quantification of indicators in social LCA, explored;

Construction, Bermuda, PSICLA DB

Construction - BM

Inputs/Outputs: Construction

Inputs

Outputs

Flow	Category	Amount	Unit
Certified environmental managem...	Local Community/Access t...	0.00000	# per 10k empl.
Children in employment, female	Workers/Child labour	0.40000	% of female children
Children in employment, male	Workers/Child labour	0.90000	% of male children
Children in employment, total	Workers/Child labour	0.70000	% of children
Construction - BM	**Bermuda/Industries**	**1.00000**	**USD**
Contribution of the sector to econ...	Society/Contribution to ec...	3.03300	% of GDP
Contribution of the sector to envir...	Local Community/Safe and...	7.22745E-6	kg
Contribution of the sector to envir...	Local Community/Safe and...	3.00007E-6	kg
Contribution of the sector to envir...	Local Community/Safe and...	6.95471E-6	kg
Contribution of the sector to envir...	Local Community/Safe and...	7.22745E-6	kg
Contribution of the sector to envir...	Local Community/Safe and...	7.22745E-6	kg
Contribution of the sector to envir...	Local Community/Safe and...	7.22745E-6	kg
Drinking water coverage	Local Community/Safe and...	99.90000	%
Evidence of violations of laws and ...	Workers/Social benefits, le...	19.76834	# per 1k empl.
Extraction of biomass (related to ar...	Local Community/Access t...	363.32680	t/km²
Extraction of biomass (related to p...	Local Community/Access t...	0.28840	t/cap
Extraction of industrial and constru...	Local Community/Access t...	10.10000	t/cap
Goods produced by forced labour	Workers/Forced Labour	0.00000	Y/N
Health expenditure, external resour...	Society/Health and Safety (...	0.20000	% of total
Health expenditure, out-of-pocket	Society/Health and Safety (...	13.30000	% of total
Health expenditure, public	Society/Health and Safety (...	49.60000	% of total

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A direct quantification of indicators in social LCA, explored

A quantification has two main issues

a. aggregation of results across processes in the life cycle

   (reason: % cannot be added up e.g., results are often relative, specific)

b. linking quantitative values to the process (!)

A direct quantification of indicators in social LCA, full calculation, construction, Bermuda (excerpt)

Name	Category	Sub-category	Amount	Unit	R	C	T	G	F
Active involvement of enterprises in corruption and bribery	Value Chain Actors	Corruption	0.12179	%	2	2	2	2	3
Certified environmental management systems	Local Community	Access to material resources	0.54070	# per 10k empl.	1	1	2	1	1
Children in employment, female	Workers	Child labour	0.54799	% of female children	2	4	3	4	5
Children in employment, male	Workers	Child labour	1.13073	% of male children	2	4	3	4	5
Children in employment, total	Workers	Child labour	0.89456	% of children	2	4	3	4	5
Contribution of the sector to economic development	Society	Contribution to economic development	9.72357	% of GDP	2	3	2	1	3
Contribution of the sector to environmental load, CO, I-AIR-CO_agg	Local Community	Safe and healthy living conditions	0.28577	kg	2	2	2	1	1
Contribution of the sector to environmental load, CO2-equiv, I-GHG-C	Local Community	Safe and healthy living conditions	33.86613	kg	2	2	2	1	1
Contribution of the sector to environmental load, NMVOC, I-AIR-NMV	Local Community	Safe and healthy living conditions	0.18154	kg	2	2	2	1	1
Contribution of the sector to environmental load, NOx, I-AIR-NOx_agg	Local Community	Safe and healthy living conditions	0.20726	kg	2	2	2	1	1
Contribution of the sector to environmental load, PM10, I-AIR-PM10_a	Local Community	Safe and healthy living conditions	0.14727	kg	2	2	2	1	1

PSILCA database, developer, version 2, in openLCA, cut-off 1e-6,

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A direct quantification of indicators in social LCA, full calculation, construction, Bermuda (excerpt)

Name	Category	Sub-category	Amount	Unit	R	C	T	G	F
Active involvement of enterprises in corruption and bribery	Value Chain Actors	Corruption	0.12179	%	2	2	2	2	3
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Children in employment, total	Workers	Child labour	0.89456	% of children	2	4	3	4	5
Contribution of the sector to economic development	Society	Contribution to economic development	9.72357	% of GDP	2	3	2	1	3
Contribution of the sector to environmental load, CO, I-AIR-CO_agg	Local Community	Safe and healthy living conditions	0.28577	kg	2	2	2	1	1
Contribution of the sector to environmental load, CO2-equiv, I-GHG-C	Local Community	Safe and healthy living conditions	33.86613	kg	2	2	2	1	1
Contribution of the sector to environmental load, NMVOC, I-AIR-NMV	Local Community	Safe and healthy living conditions	0.18154	kg	2	2	2	1	1
Contribution of the sector to environmental load, NOx, I-AIR-NOx_agg	Local Community	Safe and healthy living conditions	0.20726	kg	2	2	2	1	1
Contribution of the sector to environmental load, PM10, I-AIR-PM10_a	Local Community	Safe and healthy living conditions	0.14727	kg	2	2	2	1	1

General statistics

Number of processes	4770
Number of process links	5871
Connected graph / can calculate?	yes
Reference process	P Construction - BM

PSILCA database, developer, version 2, in openLCA, cut-off 1e-6,

GreenDelta

A direct quantification of indicators in social LCA, full calculation, construction, Bermuda (excerpt, sorted)

Name	Category	Sub-category	Amount	Unit	R	C	T	G	F
Life expectancy at birth	Society	Health and Safety (Society)	8.38605E5	h	2	1	2	1	
Sector average wage, per month	Workers	Fair Salary	9428.32500	USD	2	2	2	1	1
Living wage, per month	Workers	Fair Salary	1203.86124	USD	1	4	1	3	
Extraction of biomass (related to area)	Local Community	Access to material resources	413.89816	t/km²	2	1	4	1	
Drinking water coverage	Local Community	Safe and healthy living conditions	113.53127	%	2	3	2	1	
Sanitation coverage	Local Community	Safe and healthy living conditions	113.26452	%	2	3	2	1	
Rate of fatal accidents at workplace	Workers	Health and Safety (Workers)	61.78907	#/yr and 1...	2	2	5	1	1
Health expenditure, public	Society	Health and Safety (Society)	56.82162	% of total	2	2	4	3	
Public sector corruption	Value Chain Actors	Corruption	50.50173	Score	4	3	1	4	
Contribution of the sector to environmental loa	Local Community	Safe and healthy living conditions	33.86613	kg	2	2	2	1	1
International Migrant Stock	Local Community	Migration	32.89675	%	1	2	2	1	

A, proposed calculation: normalization by total amount of products in the life cycle

- Idea: every process contributes a certain amount of its product to the overall result, and contributes also with impacts
- Technically: Division of all results by the scaled diagonal of the technology matrix A (g_k: result, r_k: normalized result):

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

A direct quantification of indicators in social LCA,

Proposed calculation: normalization by total amount of products in the life cycle

in openLCA possible with a python script:

Python

```python
from org.openlca.app import App
from org.openlca.app.db import Cache
from org.openlca.app.editors import Editors
from org.openlca.app.results import ResultEditorInput
from org.openlca.app.results.analysis import AnalyzeEditor
from org.openlca.core.database import ProductSystemDao
from org.openlca.core.math import CalculationSetup, CalculationType, SystemCalculator

# calculate the normal inventory result
system = ProductSystemDao(db).getForRefId(
  "e14dff92-121a-4e1d-aa10-4cae6fc17d46")
setup = CalculationSetup(
  CalculationType.CONTRIBUTION_ANALYSIS, system)
calc = SystemCalculator(
  Cache.getMatrixCache(), App.getSolver())
result = calc.calculateFull(setup)

# calculate the total product amount (assuming
# the products can be summed up (e.g. are monitary))
# note, that A is already scaled in the result!
A = result.techMatrix
n = A.rows()
total = 0.0
for j in range(0, n):
  total += A.get(j, j)
log.info("total = {}", total)

# normalize the results
D = result.directFlowResults
U = result.upstreamFlowResults
g = result.totalFlowResults
m = D.rows()
for j in range(0, n):
  for i in range(0, m):
    D.set(i, j, D.get(i, j) / total)
    U.set(i, j, U.get(i, j) / total)
for i in range(0, m):
  g[i] /= total

# open the result
inp = ResultEditorInput.create(setup, result)
Editors.open(inp, AnalyzeEditor.ID)

```

A direct quantification of indicators in social LCA, full calculation, construction, Bermuda (excerpt, total product amount normalized calculation)

Outputs

Name	Category	Sub-category	Amount	Unit
Active involvement of enterprises in corruption and bribery	Value Chain Actors	Corruption	0.10888	%
Certified environmental management systems	Local Community	Access to material resources	0.48338	# per 10k empl.
Children in employment, female	Workers	Child labour	0.48990	% of female children
Children in employment, male	Workers	Child labour	1.01087	% of male children
Children in employment, total	Workers	Child labour	0.79973	% of children
Contribution of the sector to economic development	Society	Contribution to economic development	8.69283	% of GDP

A direct quantification of indicators in social LCA, full calculation, construction, Bermuda (excerpt, total product amount normalized calculation)

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Children in employment, total	Workers	Child labour	0.79973	% of children
Contribution of the sector to economic development	Society	Contribution to economic development	8.69283	% of GDP

non-normalized

Name	Category	Sub-category	Amount	Unit
Active involvement of enterprises in corruption and bribery	Value Chain Actors	Corruption	0.12179	%
Certified environmental management systems	Local Community	Access to material resources	0.54070	# per 10k empl.
Children in employment, female	Workers	Child labour	0.54799	% of female children
Children in employment, male	Workers	Child labour	1.13073	% of male children
Children in employment, total	Workers	Child labour	0.89456	% of children
Contribution of the sector to economic development	Society	Contribution to economic development	9.72357	% of GDP
Contribution of the sector to environmental load, CO, I-AIR-CO_agg	Local Community	Safe and healthy living conditions	0.28577	kg
Contribution of the sector to environmental load, CO2-equiv, I-GHG-C	Local Community	Safe and healthy living conditions	33.86613	kg
Contribution of the sector to environmental load, NMVOC, I-AIR-NMV	Local Community	Safe and healthy living conditions	0.18154	kg
Contribution of the sector to environmental load, NOx, I-AIR-NOx_agg	Local Community	Safe and healthy living conditions	0.20726	kg
Contribution of the sector to environmental load, PM10, I-AIR-PM10_a	Local Community	Safe and healthy living conditions	0.14727	kg

PSILCA database, developer, version 2, in openLCA, cut-off 1e-6,

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A, proposed calculation: normalization by total amount of products in the life cycle

- Disadvantage: everything is “averaged” – in the risk assessment approach, extreme values (very high, very low risk) are kept separately and not merged directly

Direct quantification of indicators in social LCA,

B, linking quantitative values to the process (!)

How can indicator values be linked to the output of a process?

Direct quantification of indicators in social LCA,

B, linking quantitative values to the process (!)

How can indicator values be linked to the output of a process?

In social LCA databases, we have two types of scopes for the collected indicator information

- country,
- sector in country

Often, sector in country is preferred (more specific information);

Sometimes, lack of information prevents use of sector specific indicators;

Sometimes, sector information does not make sense ("drinking water coverage")

Direct quantification of indicators in social LCA,

B, linking quantitative values to the process (!)

→ how is drinking water coverage (e.g.) linked to selling 1 USD of product in one country?

Inputs/Outputs: Construction

Inputs

Outputs

Flow	Category	Amount	Unit
Certified environmental management sys...	Local Community/Access to ma...	0.00000	# per 10k em...
Children in employment, female	Workers/Child labour	0.40000	% of female ...
Children in employment, male	Workers/Child labour	0.90000	% of male ch...
Children in employment, total	Workers/Child labour	0.70000	% of children
Construction - BM	**Bermuda/Industries**	**1.00000**	**USD**
Contribution of the sector to economic d...	Society/Contribution to econo...	3.03300	% of GDP
Contribution of the sector to environmen...	Local Community/Safe and heal...	7.22745E-6	kg
Contribution of the sector to environmen...	Local Community/Safe and heal...	3.00007E-6	kg
Contribution of the sector to environmen...	Local Community/Safe and heal...	6.95471E-6	kg
Contribution of the sector to environmen...	Local Community/Safe and heal...	7.22745E-6	kg
Contribution of the sector to environmen...	Local Community/Safe and heal...	7.22745E-6	kg
Contribution of the sector to environmen...	Local Community/Safe and heal...	7.22745E-6	kg
Drinking water coverage	Local Community/Safe and heal...	99.90000	%

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Direct quantification of indicators in social LCA,

B, linking quantitative values to the process (!)

→ how is drinking water coverage (e.g.) linked to selling 1 USD of product in one country?

- → more sales, more responsibility
- → this is of course very different from normal attributional LCA, where buying a product is assumed to reflect directly e.g. emissions

Direct quantification of indicators in social LCA,

B, linking quantitative values to the process (!)

→ how is 'drinking water coverage' (e.g.) linked to selling 1 USD of product in one country?

- → more sales, more responsibility
- → this is of course very different from normal attributional LCA, where buying a product is assumed to reflect directly e.g. emissions
- → for interpretation, a threshold is useful (target value, performance reference); this would also allow non-linear aggregation

Direct quantification of indicators in social LCA,

B, linking quantitative values to the process (!)

→ how is '**sector average wage, per month**' (e.g.) linked to selling 1 USD of product in one country?

- → more sales, more responsibility
- → direct link: share of personnel costs in product price
- → still not a causal relationship
- → for interpretation, a threshold is useful (target value, performance reference)

→ indicator values in processes should always be termed "risk" (or similar) to prevent the impression they are causal impacts of product consumption

Direct quantification of indicators in social LCA,

In the SHDB

→ indicator values are only available in risk-classes, not as raw values

→ Can still be coded as 1, 2, ...5, and then calculated

→ However, not really a direct quantification

Discussion and conclusions

Conclusion

- A direct quantification of social impacts in LCA is possible
- This allows to overcome an activity variable, provides more direct access to indicator values, and also seems useful for an Impact Assessment
- It requires a normalization of calculation results and an interpretation of quantitative values in each process
- For the normalization of calculation results, the total amount of all products in a product system is proposed
- A technical implementation is feasible
- The interpretation of values in each process depends on the scope of the indicator (sector-specific, country)

Conclusion, 2, and discussion

- The interpretation of values in each process depends on the scope of the indicator (sector-specific, country)
- In all cases, there seems less clear causality of indicators compared to environmental LCA
- This causality is stronger for more specific indicators
- This is common in Social LCA, but was not so clear with activity variable results
- A process-specific threshold, indicator-specific and maybe case-specific, seems to be useful to reflect vulnerabilities, and thus non-linear effects
- Indicator results should still be considered as risks, not as “directly caused” by the consumed product

Outlook

- I think there is room for research
- We are very open for collaboration on this topic

GreenDelta

software / data / know-how

Thank you very much!

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