GreenDelta

sustainability consulting + software

Updating data in a generic social LCA database

Andreas Ciroth

GreenDelta

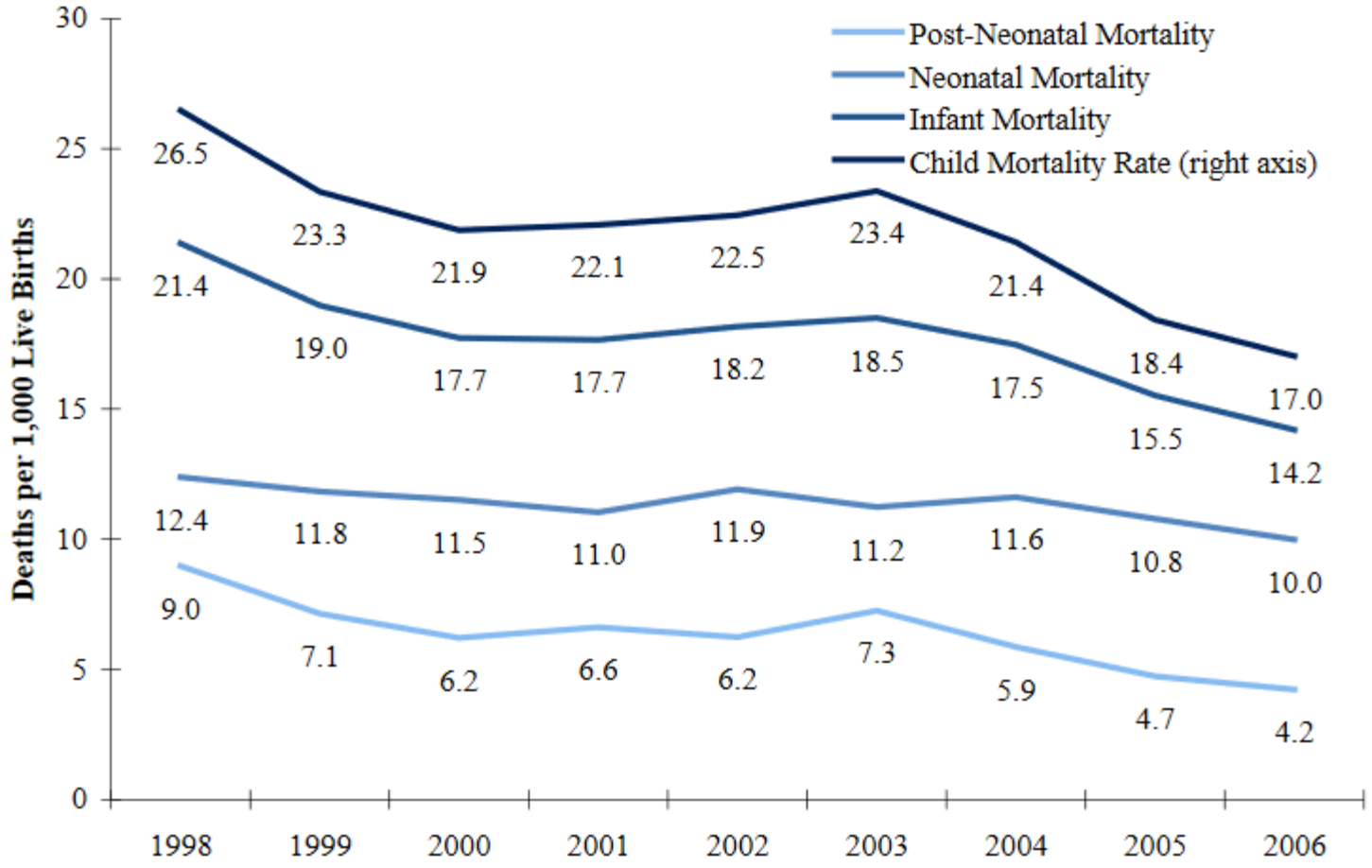
SLCA Boston, June 14, 2016

Updating data in a generic social LCA database

1. The need for updating social LCA data
2. Update cases
3. Approaches and infrastructure for the PSILCA database
4. Outlook, and an invitation

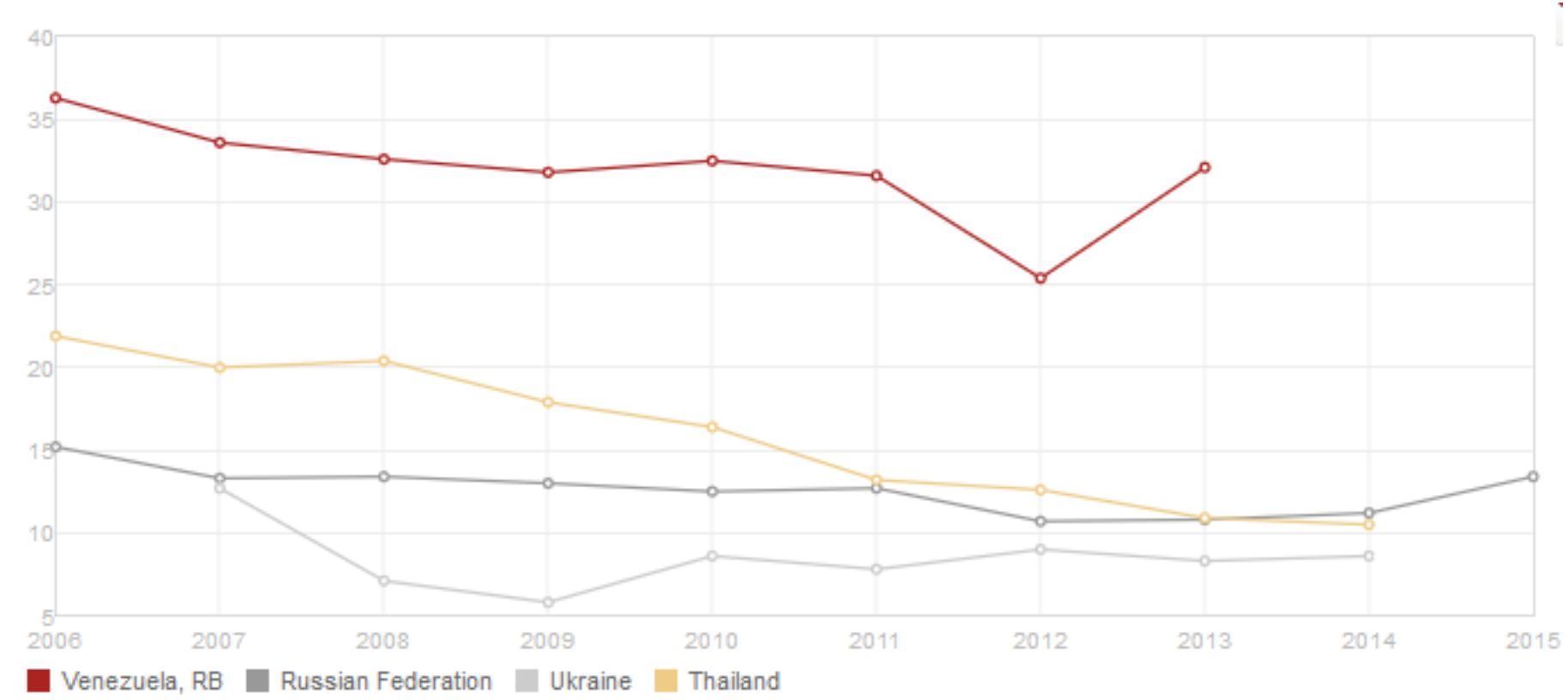
1 The need for updating social data

Updating social LCA data: infant & child mortality Venezuela 1998-2006



CEPR 2009: Weisbrot, M., Ray, R., Sandoval, L.: The Chávez Administration at 10 Years: The Economy and Social Indicators, p.11

Updating social LCA data:
Poverty headcount ratio at national poverty lines (% of population)



 Source: Worldbank

The need for updating social LCA data

- Social LCA data is difficult to collect, to assess, and "decays" faster than natural-science based data which environmental LCA aims for

  → For a comprehensive, generic social LCA database, it is essential to update the information regularly

  → "the information" covers both IO model / life cycle structure, and indicators

2 Social LCA data update cases

Social LCA data update cases (for a generic database)

Several cases can be distinguished, including:

Availability of ...

a) more recent or otherwise “better” information;

b) additional information for data that exists already in the database; (e.g. information about a specific indicator in a country and sector, from a different source);

c) data on a different level than previously existing in the database, e.g. a more detailed sector, a product

d) (deletion of outdated information without replacement)

Handling the update cases

a) Availability of more recent or otherwise “better” information

→replace previous data with new data

Handling the update cases

a) Availability of more recent or otherwise “better” information

→replace previous data with new data

b) Availability of additional information for data that exists already in the database

→ where possible extend the information in the database (additional source; more detailed description, ...)

→ influence on the data quality of the value
→ should be documented

Social LCA data update cases (for a generic database)

c) data on a different level than previously existing in the database, e.g. a more detailed sector, amore detailed product

→ More difficult case.

→ Has been treated in literature

(e.g. Wenz et al. 2014: Regional And Sectoral Disaggregation Of Multi-regional Input–output Tables – A Flexible Algorithm, Economic Systems Research, 2014, http://dx.doi.org/10.1080/09535314.2014.987731)

Social LCA data update cases (for a generic database)

c) data on a different level than previously existing in the database, e.g. a more detailed sector, a product

In a nutshell:

- Identify the related regions and sectors in IO database;
- Add new region, “subsector”
- Adjust by production volumes, inputs of related other sectors

Social LCA data update cases (for a generic database)

c) data on a different level than previously existing in the database, e.g. a more detailed sector, a product

In a nutshell:

- Identify the related regions and sectors in IO database;
- Add new region, “subsector”
- Adjust by production volumes, inputs of related other sectors

Two issues:

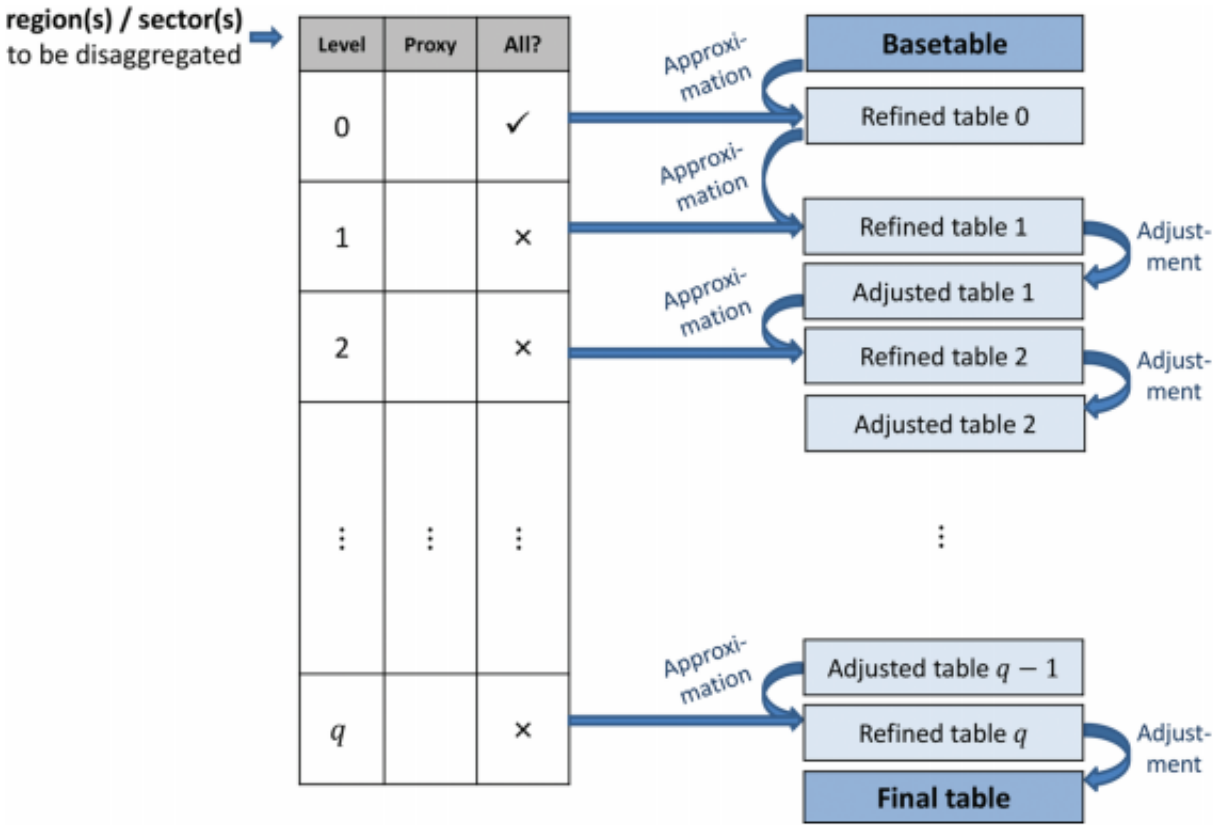
1) The database size increases (CSS table by one row and column)
2) Every change in the database “traces back” to other sectors -> iterative or backwards calculation and adjustments

Case c, adding detail: Wenzel et al. 2014 approximation hierarchy

TABLE 1. Refinement proxies for an outgoing flow together with their detail ranking as applied in this study and the associated approximation procedure.

Level $d=$	Refinement proxy $v^{(d)}_{ir\to js}(\lambda,\mu) :=$	Approximation $Z^{(d,\,\text{approx.})}_{i_\mu r_\lambda \to js} :=$
0	Equal distribution: $\lvert I_i\rvert \cdot \lvert R_r\rvert$	$\frac{Z_{ir\to js}}{\lvert I_i\rvert\cdot\lvert R_r\rvert}$
1	Population of subregion: POP_{r_λ}	$\left(\sum_{\lambda'=1}^{n} Z^{(d-1)}_{i_\mu r_{\lambda'}\to js}\right)\cdot\frac{\text{POP}_{r_\lambda}}{\text{POP}_r}$
2	Subregional GDP: GDP_{r_λ}	$\left(\sum_{\lambda'=1}^{n} Z^{(d-1)}_{i_\mu r_{\lambda'}\to js}\right)\cdot\frac{\text{GDP}_{r_\lambda}}{\text{GDP}_r}$
3	Regional GDP-by-sub-industry: $\text{GDP}_{i_\mu r}$	$\left(\sum_{\mu'=1}^{m} Z^{(d-1)}_{i_{\mu'} r_\lambda\to js}\right)\cdot\frac{\text{GDP}_{i_\mu r}}{\text{GDP}_{ir}}$
4	Subregional GDP-by-sub-industry: $\text{GDP}_{i_\mu r_\lambda}$	$Z_{ir\to js}\cdot\frac{\text{GDP}_{i_\mu r_\lambda}}{\text{GDP}_{ir}}$
5	Import of subsector by region: $Z_{i_\mu\to s}$	$\left(\sum_{\mu'=1}^{m} Z^{(d-1)}_{i_{\mu'} r_\lambda\to js}\right)\cdot\frac{Z_{i_\mu\to s}}{\sum_{r'}\sum_{f'} Z_{ir'\to f's}}$
6	Export from subregional subsector $Z_{i_\mu r_\lambda\to}$	$Z_{ir\to js}\cdot\frac{Z_{i_\mu r_\lambda\to}}{\sum_{f'}\sum_{s'} Z_{ir\to f's'}}$
7	Import of subsector by regional sector: $Z_{i_\mu\to js}$	$\left(\sum_{\mu'=1}^{m} Z^{(d-1)}_{i_{\mu'} r_\lambda\to js}\right)\cdot\frac{Z_{i_\mu\to js}}{\sum_{r'} Z_{ir'\to js}}$
8	Export from subregional subsector to region: $Z_{i_\mu r_\lambda\to s}$	$Z_{ir\to js}\cdot\frac{Z_{i_\mu r_\lambda\to s}}{\sum_{f'} Z_{ir\to f's}}$
9	$d = 5, 7, 8$ together: $Z_{i_\mu\to js}$, $Z_{i_\mu r_\lambda\to s}$ and $Z_{i_\mu\to s}$	$Z_{i_\mu\to js}\cdot\frac{Z_{i_\mu r_\lambda\to s}}{Z_{i_\mu\to s}}$ (Peters et al., 2011)
10	Exact flow: $Z_{i_\mu r_\lambda\to js}$	$Z_{i_\mu r_\lambda\to js}$

Case c, adding detail: Wenzel et al. 2014 approximation iteration



3 Approaches and infrastructure for the PSILCA database

The PSILCA database

comprehensive database for social LCA, transparent, for 196 countries, > 50 indicators, almost 16,000 sectors, reference year 2013 for IO, 2015 for indicators, created by GreenDelta 2013-2016, released beginning of 2016

- Provides raw indicator values before the assessment in risk levels; the assessment can be changed by the user -> transparent
- Built on top of the eora database (Lenzen et al.), really comprehensive MRIO, recent (data from 2013)
- Contains a data quality assessment of the indicator value

The PSILCA database

comprehensive database for social LCA, transparent, for 196 countries, > 50 indicators, almost 16,000 sectors, reference year 2013 for IO, 2015 for indicators, created by GreenDelta 2013-2016, released beginning of 2016

- Versions available for openLCA (starter, professional, developer) and SimaPro

Approaches and infrastructure for PSILCA database updates

- People
- Technology
- Infrastructure

Approaches and infrastructure for PSILCA database updates: People

- A network of data collectors has been established, so far some few, *starting* to get active (→ infrastructure and technology)
- Idea is to expand the network
  - Social LCA practitioners
  - NGOs
  - …
- Data collectors will get incentives
- Collected data will need to be moderated (→ infrastructure)

Approaches and infrastructure for PSILCA database updates: Technology

- Ability for the LCA software to deal with very large LC systems:
  - Improve for openLCA (now good and “best in class” but can be drastically improved)
  - Invite other software developers
- Ability for the LCA software to display data quality information for social indicators (see poster)

Approaches and infrastructure for PSILCA database update

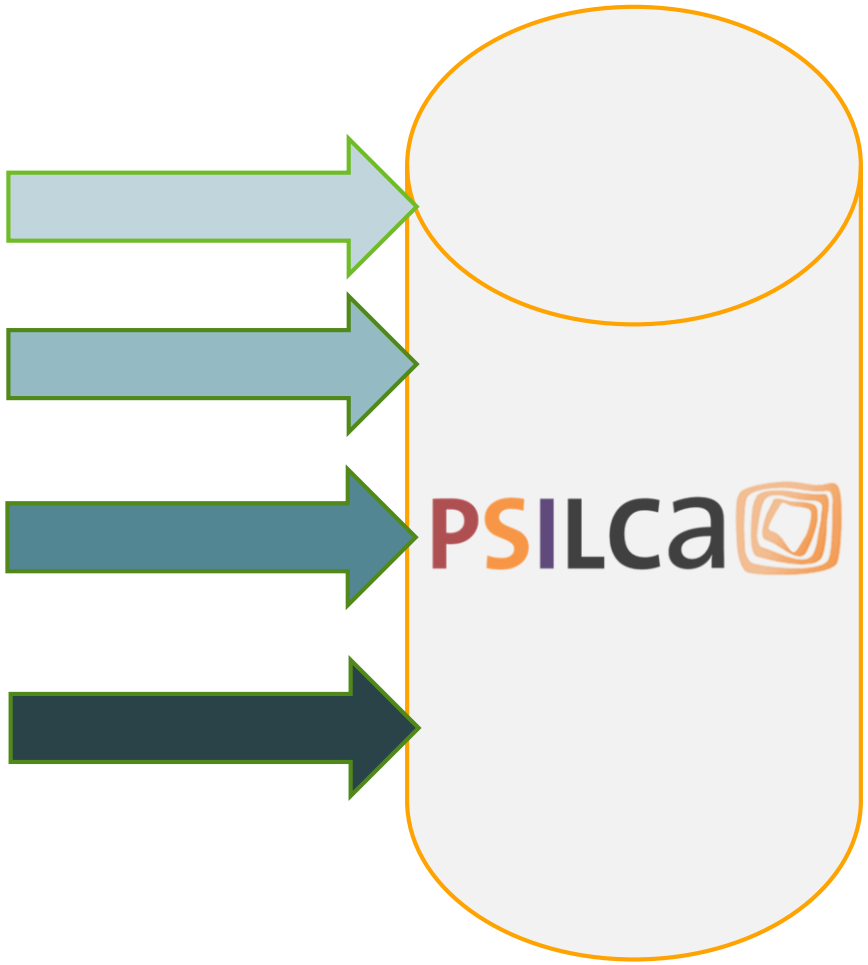
Technology: data pipelines

IO updates (eora database)

Worker hours / activity variables updates

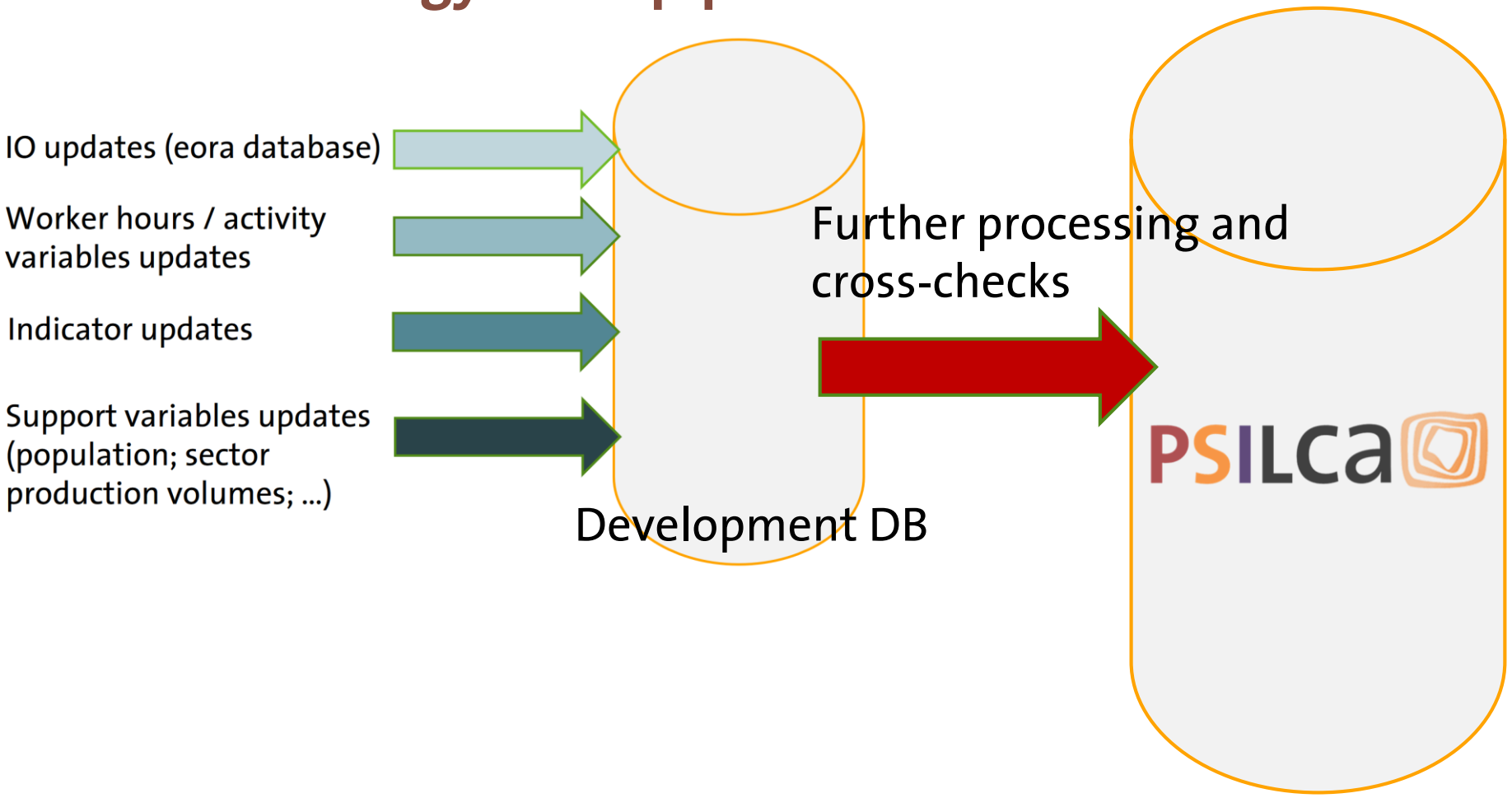
Indicator updates

Support variables updates (population; sector production volumes; ...)

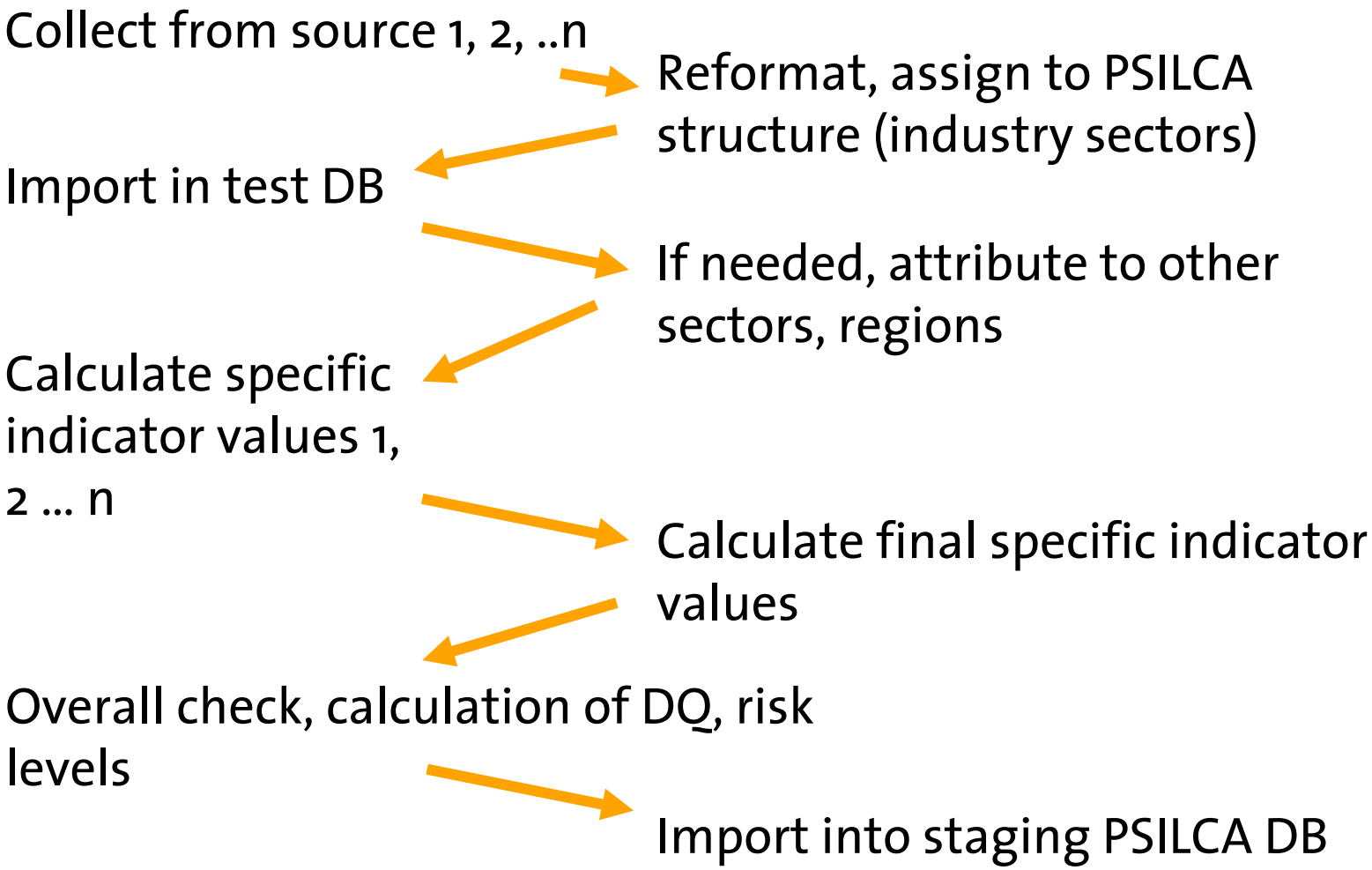


Approaches and infrastructure for PSILCA database update

Technology: data pipelines



Technology: data pipelines – e.g., indicator updates



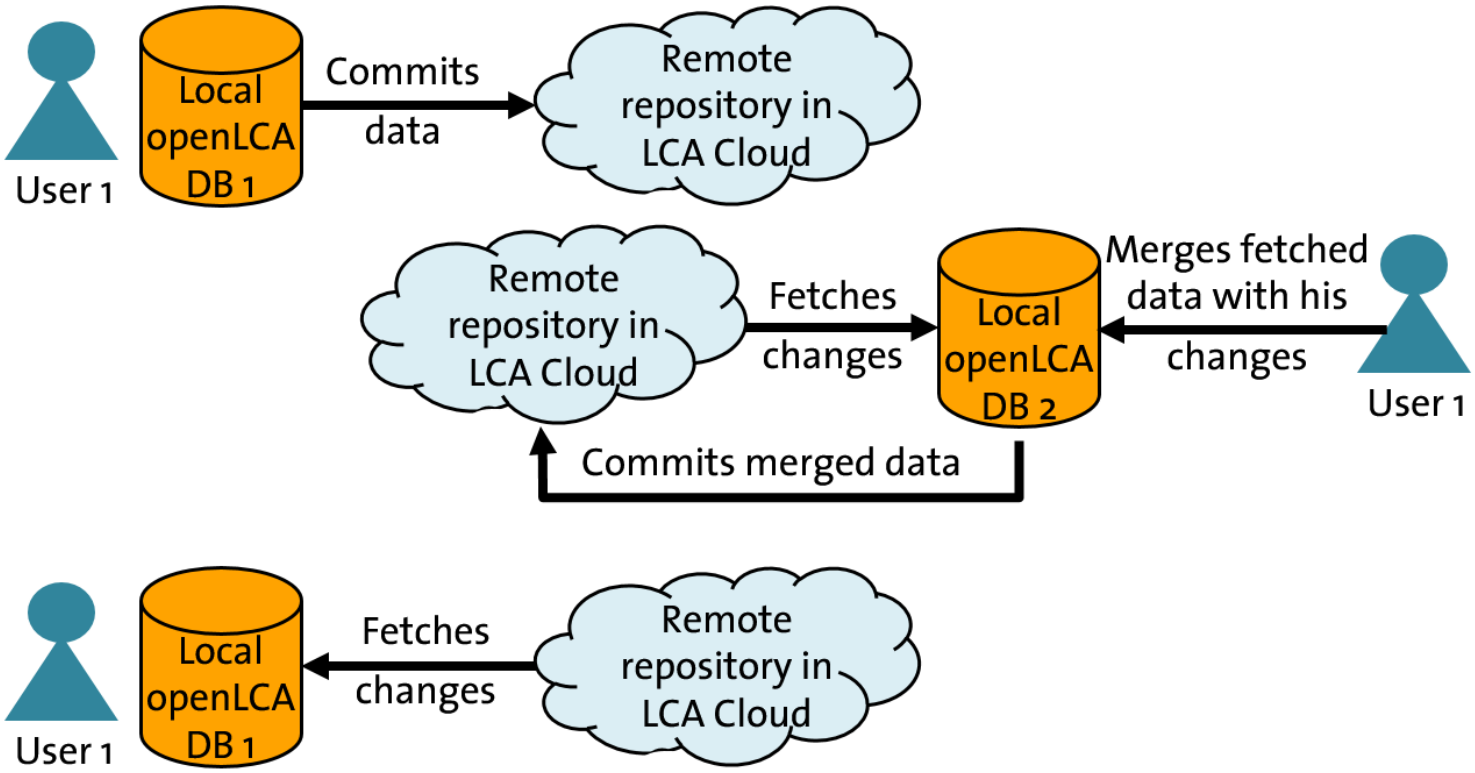
Technology & infrastructure: data pipelines

- Each step automated using SQL / Python, but with additional expert checks
- Decision points integrated, supported by queries
- Sources are very different for different indicators, and change
- Specific pipelines for every indicator, but patterns exist (similar elements and structure for some indicators)
- First two steps (collect, reformat, assign to DB structure) most crucial and “risky”, least automated

Infrastructure: Data submission and updates

- What we would like to work on: An information submission system for social data
- Based on the LCA collaboration server / LCA cloud (see Cr. Rodríguez, presentation SETAC Nantes, May 2016)

Infrastructure: Data submission and updates



Greve, S., Rodríguez, C., Ciroth, A., (2016): LCA Cloud: enhancing LCA data collaboration, presentation, SETAC Nantes

Infrastructure: Data submission and updates

- LCA Collaboration Server so far developed for submitting, sharing and synchronizing environmental LCA data

→ Adaptations required to reflect specific aspects of social data and data providers.

4 Outlook, invitation

Summary, Outlook

Social LC data needs to be updated frequently

- Life cycle and supply chain structure information
- Indicator values
- Supporting indicators required for the model

Three (to four) principal cases can be distinguished:

- Replace same with newer
- Replace with better
- Add new
- (Delete irrelevant)

Summary, Outlook

- **For a database, all four cases are feasible,** addition of new information (and deletion of old information) has most impacts on the entire structure and thus is more complicated
- **Technology and infrastructure ease social LCA data updates a lot, but cannot fully replace human expertise**
- I expect that in future, more and more information will become available, and updating and refining social data will become more demanding..
- ...and at the same time, technology has improved a lot, so more and more is possible

Invitation

- **If you are interested in providing social LC-related information…**
  - Case studies
  - Own observations
  - Observations in other languages
  - Feedback on existing data in the database
  - …
- **Then please come and see me; and see how we can together create an "ecosystem" of data providers for social LCA data**

GreenDelta

sustainability consulting + software

Thank you very much.

Contact: Dr. Andreas Ciroth

GreenDelta GmbH

Müllerstrasse 135, 13349 Berlin, Germany

ciroth@greendelta.com

www.greendelta.com