Use of SLCA for a Comparative Sustainability Analysis of Technologies

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**International Seminar on Social LCA, 6-7 May, Montréal
– SLCA methodologies –**

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Research demand

- (Intended) use of SLCA results in practice

- Use of SLCA within sustainability assessment

- Consideration of the whole life cycle

Objectives of the case study

- Analysis of social aspects of alternative products for decision support
  - Comparative technology analysis within a R&D project
  - Suitability of the SLCA guidelines
- Use of SLCA within Life Cycle Sustainability Assessment (LCSA)
  - LCSA* = LCA + LCC + SLCA
  - Identification of relevant social indicators for SLCA
- Use of SHDB to adress the life cycle

*(Klöpffer 2008; Finkbeiner 2010)
(UNEP/SETAC 2009, 2011; SHDB 2013)

Joint-research project: Integrated Water Resources Management (IWRM) in Gunung Kidul, Java, Indonesia (2008-2013)

Regional problems:

- Insufficient freshwater availabiliy & quality especially in dry season

IWRM-Goal:

- Development of appropriate technologies for water supply, water treatment and sanitation

➡ **Improvement of living conditions and contribution to sustainable development**

(Source: IWRM 2011)

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Water treatment: Situation in the investigation area

- None of the samples taken from different water sources meets drinking water quality
- Predominant technology: boiling of water

- **Field lab:**
  - Ultra filtration
  - UV-disinfection
  - Sand filtration
  - Chlorination

(Source: Matthies 2010)

Technologies proposed within the IWRM

- Central pre-treatment
- **Decentral treatment** (hygienization)
  → alternative technologies were tested in a
     field lab (in Germany) and will now
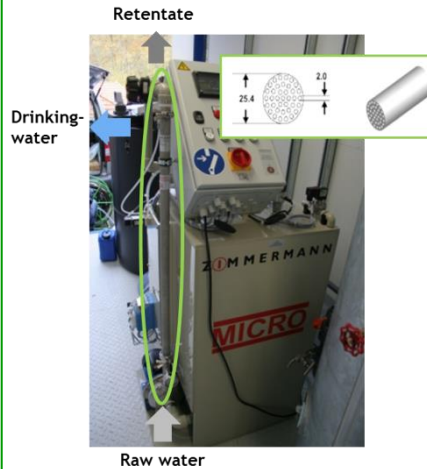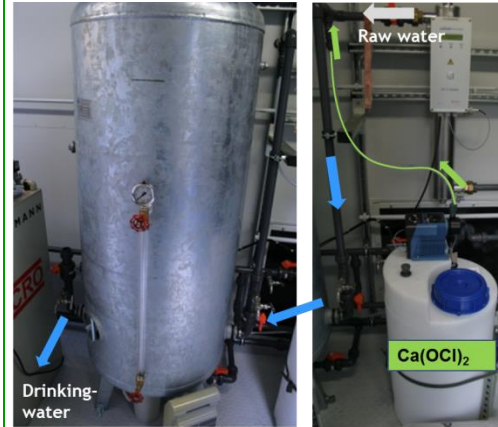   be adapted to conditions in Indonesia

(Source: Matthies 2010)
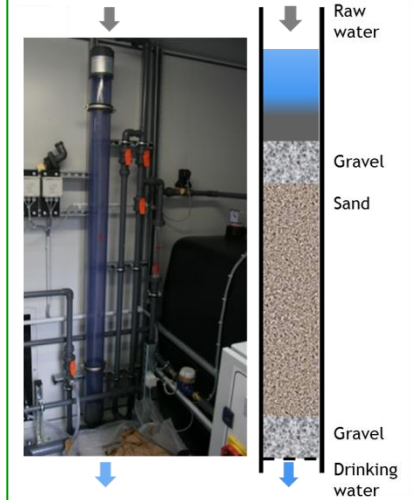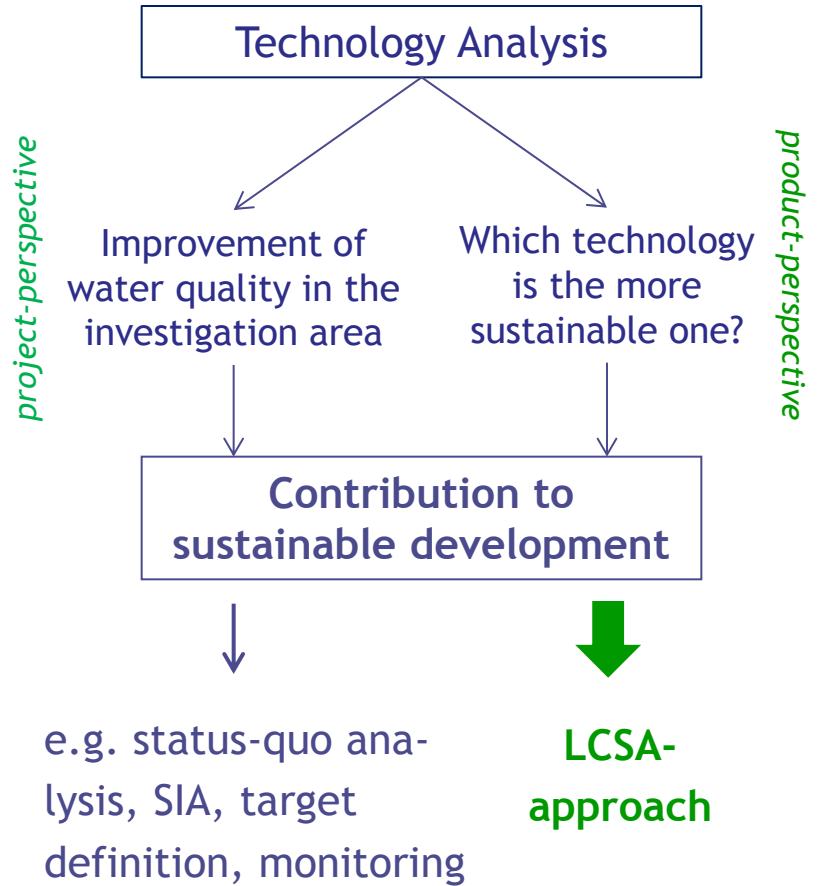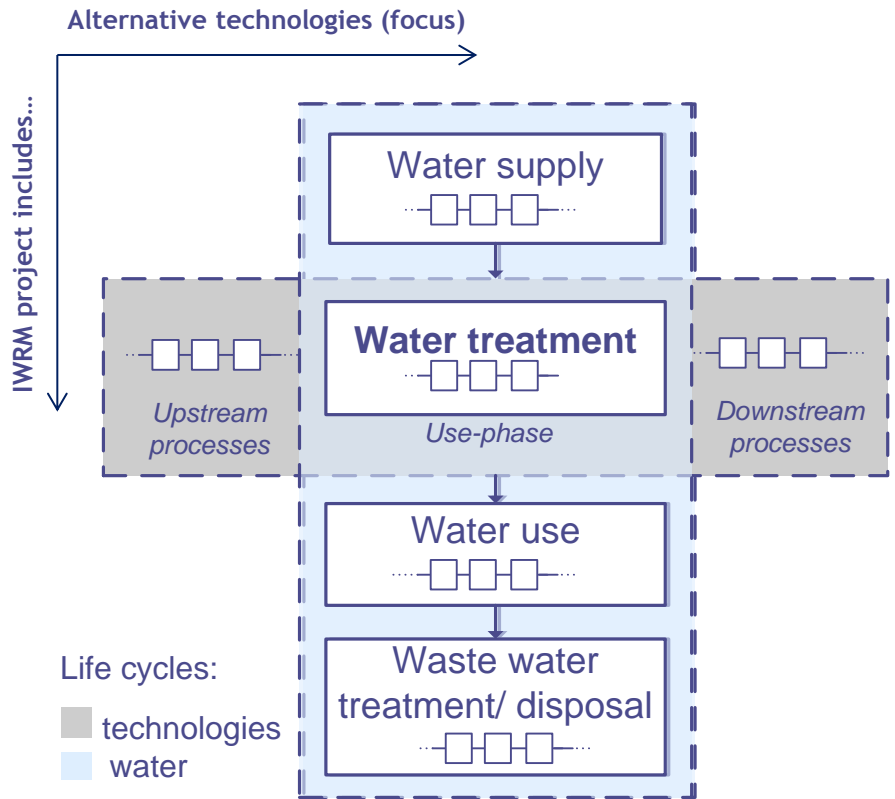
UV-disinfection

Ultrafiltration

Chlorination

Sand filtration

- Which social aspects can be analyzed within sustainability assessment?
- Which social aspects are relevant with regard to *comparing* alternative technologies complementary to LCA and LCC?

(Pictures adapted from Matthies 2010)

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Sustainability Assessment of Water Treatment Technologies

Alternative technologies (focus)

IWRM project includes...

Water supply

Upstream processes

Water treatment

Use-phase

Downstream processes

Water use

Waste water treatment/ disposal

Life cycles:
- technologies
- water

Technology Analysis

project-perspective   *product-perspective*

Improvement of water quality in the investigation area

Which technology is the more sustainable one?

Contribution to sustainable development

e.g. status-quo ana-lysis, SIA, target definition, monitoring

LCSA-approach

(adapted from Lehmann et al. 2011)

Provision of drinking water → Contribution to sustainable development

Functional unit: e.g. treatment (hygienization) of 1 m^3 water
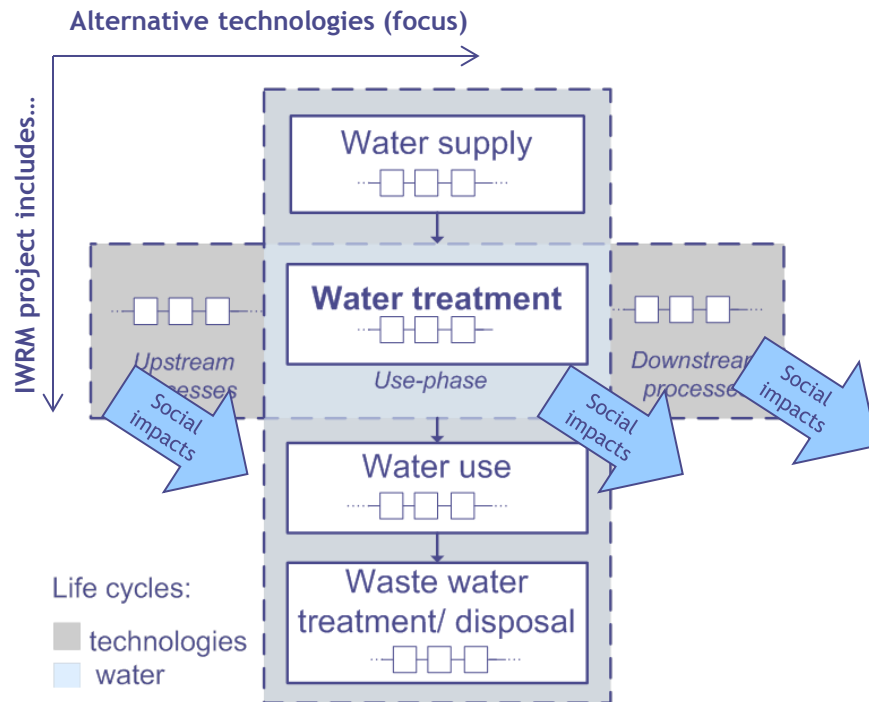
Social impacts due to the **function** are the same
→ not decision relevant

(adapted from Lehmann et al. 2011)

Social aspects are mainly related to the organization´s behaviour*

→ Hence: differences regarding the social performance as well

BUT

• Organizations in the use phase of the technologies are the same

• Companies along the life cycle are not (yet) known

Approach

1) Which social aspects are technology related?

2) Which social aspects refer to implementation?

3) Are sector data usable for a comparative LC-technology analysis ?

(* e.g. Jørgensen et al. 2008)

Technology related social aspects

Subcategories (Stakeholder)	Inventory Indicators
Local employment (Local community)	e.g. number of people employed locally to operate the technologies
Hours of work (Workers)	e.g. effort to treat a defined amount of water
Health and safety (Workers, Consumers)	e.g. number of accidents/ injuries; potential health risks
Safe and healthy living conditions (Local community)	e.g. presence/ strength of laws on construction safety regulations

Subcategory: Health & Safety

Stakeholder	Chlorination	Ultrafiltration	UV-disinfection
Consumer	• „Cl"-odour and taste • Potential by-products (THM; possibly too high residual Cl-content	• No effect on odour, taste • No by-products	• No effect on odour, taste • No by-products
Workers	• Potential risk when dealing with $Ca(OCl)_2$: Cl_2-formation, oxidizing, corrosive, irritant	• Potential health risk (depending on the cleaning agent)	• Potential risk when dealing with the UV-lamp

➢ The different water quality (odour/ taste of chlorinated water) may be relevant for consumers' acceptance

➢ Different risks for human health (and requirements for operation)

- 7/31 subcategories can be related to implementation

  – Community engagement

  – Cultural heritage

  – Feedback mechanism

  – Corruption

  – Access to immaterial resources

  – Access to material resources

  – Public commitment to sustainability issues

Indicators proposed for the subcategories are not sufficient for the case study
→ **Proposal of 11 additional indicators**

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Additional social Indicators	Characteristics in the IWRM investigation area
Are responsibilities (e.g. responsible institutions) for the technologies clearly defined, e.g. for water supply, -distribution, -treatment, sanitation[*]	Responsibilities not clearly defined, partly overlapping
Reported trust in institutions[**]	Considered as low
Fluctuation of personnel (amount)[*]	High fluctuation of personnel → Possible loss of knowledge → Changing responsibilities
…	…

Possible related SLCA subcategories:
* Access to immaterial resources
** Corruption

(Lehmann et al. 2013)

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- No site-specific data available
- Various processes along the life cycle of the alternative technologies
  → Sectors involved differ (qualitatively and quantitatively)

Are information provided on a sector level, e.g. from
Social Hotspot Database (SHDB),
useful for a comparative technology analysis?

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Social theme (~subcategories)	Indicator	Country	Sectors related to water treatment								
		Indonesia	Coal	Oil	Gas	Electricity	Chemicals	Transport	Machinery/ Equipment	Water
Labour laws and conventions	Risk that country does not ratify ILO conventions by sector	very high								
	Risk that country does not provide adequate labour laws by sector	medium								
	Potential of min.wage not being updated*	low								
Pop. living below poverty line	Potential of population living <2 $/day*	high								
Child labour	Risk of child labour, total	medium								
Forced labour	Risk of forced labour	high								
Working time	Risk of excessing working time by sector*	very high								
Freedom of Association	Risk that a country lacks or does not enforce freedom of association right*	medium								

* country level data only

- Medium to very high risks for social impacts → high improvement potential

- But, information is not useful for a comparative technolgy analysis

Social impacts occur mainly due to the organization´s behaviour*

→ hence: differences regarding the social performance as well

BUT

• Organizations in the use phase of the technologies are the same

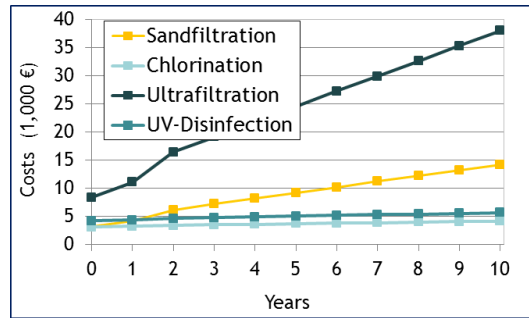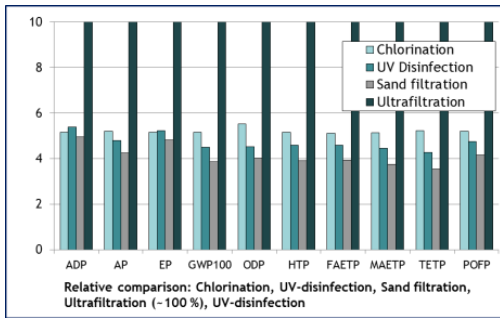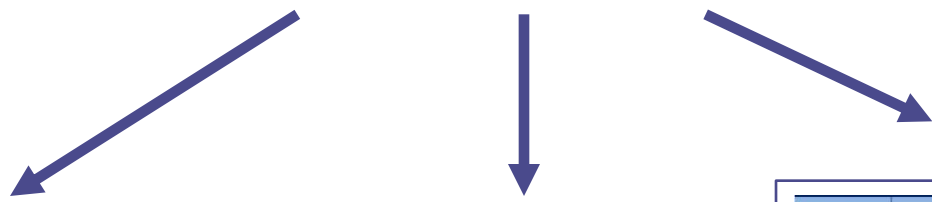• (Specific) companies along the life cycle are not (yet) known

Approach

1) Which social aspects are technology related?

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Conclusion and Outlook

1st study, which considers SLCA to analyze alternative technologies within LCSA

$$LCSA = LCA + LCC + SLCA$$

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Perspective	Technologies	
	best option ⟶	*worst option*
Environmental:	Chlorination, UV-disinfection	Ultrafiltration
Economic:	Chlorination, UV-disinfection	Ultrafiltration
Social:	*No clear recommendation*	

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Methodological challenges/ proposals

- Choice of indicators

  – Most subcategories/ indicators refer to organization´s behaviour

  → Identification of technology related indicators

- Social aspects

  – 7 subcategories refer to implementation, but indicators proposed are not sufficient to address implementation

  → Proposal of additional social indicators to address implementation

- Consideration of life cycle

  – SHDB delivers useful information, but decisions based on sector/ country level are questionnable

  → Use as a first step to identify hotspots

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Practical challenges within the IWRM project

- Lack of data
  - Data not (yet) available
  - Missing/ contradictory data recording
  - Sector specific data for Indonesia are partly missing in the (current) SHDB

- Use of the results in practice
  - Use-phase is (so far) of highest interest for decision makers

Outlook

- Further collection of site-specific data/ update with data from the field lab

- Detailed SLCA for the future selected technology, focussing on the identified hotspots

Thank you very much!

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(Source:Scholz et al 2004)

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