Carl Vadenbo is a project manager responsible for mission activities at the ecoinvent Association, a not-for-profit organization based in Switzerland. The ecoinvent Association is the publisher of the ecoinvent life cycle inventory (LCI) database. In his main role at the ecoinvent Association, Carl develops and leads projects and activities aimed at promoting the use and good practice of LCI worldwide. Other tasks include the coordination and support of various projects related to data entry and the continuous development of the ecoinvent database.

Carl Vadenbo

project manager

ecoinvent Association

LCA data and databases for a circular economy
- let's get to work!

Outline of presentation

- Starting point: what is LCA data and the ecoinvent LCI database?
- Data and capacity for life cycle-based sustainability assessments
  - The *Sustainable Recycling industries (SRI)* programme
  - Case study: LCA of 'worst practices' in metal recovery from e-waste
- National LCA database initiatives
  - Insights from the *Development of National LCA Database Roadmaps* project
  - How do we take it from here? (Suggestions welcome!)

Data for life cycle assessment (LCA)

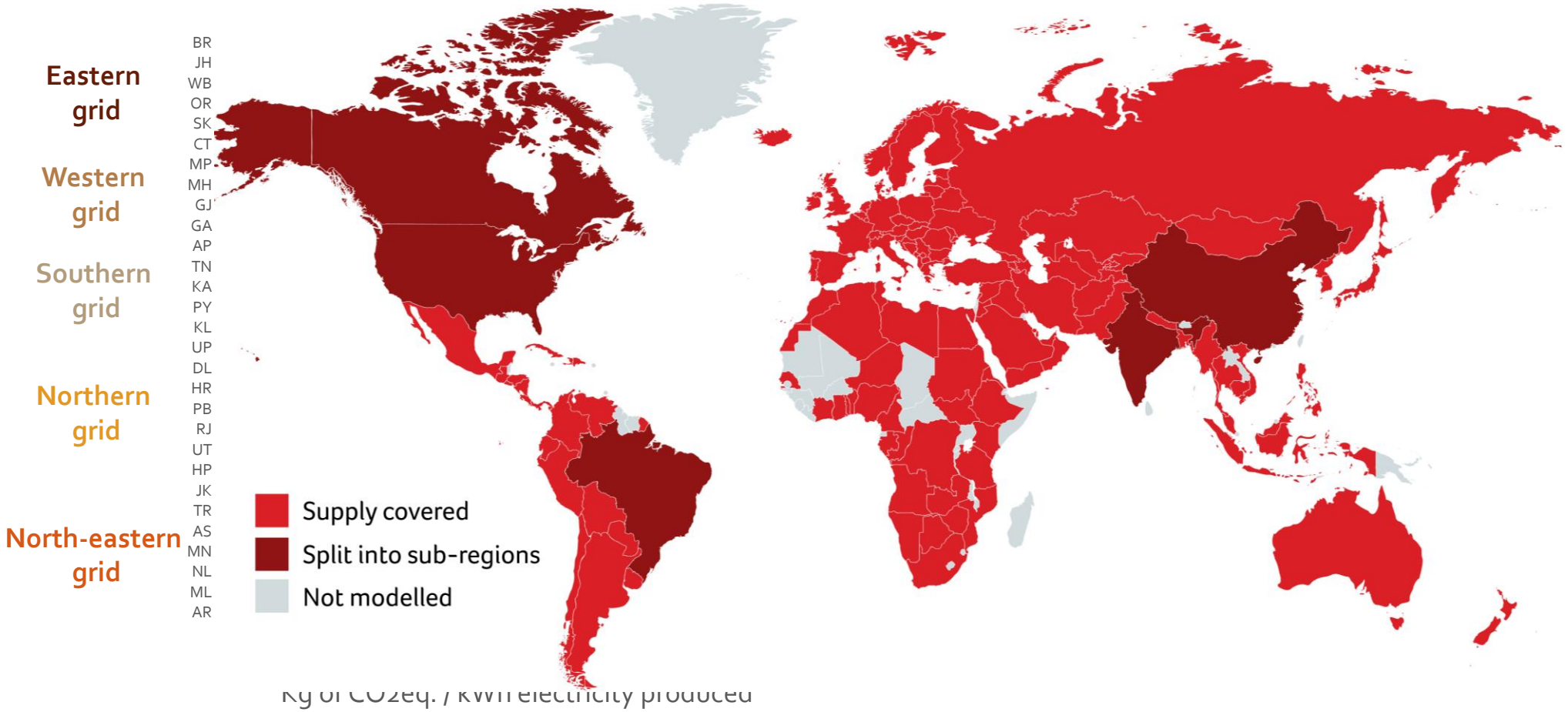
- LCA requires **life cycle inventory (LCI)** data of all parts of the supply chains
  → *labor- and data-intensive!*
- LCI databases provide **background data**, reducing efforts and improving the quality and consistency of results
- LCI data is a form of **digital infrastructure**
- LCA data on circular economy innovations, business models, practices, etc. **still scarce**

The ecoinvent database

- The ecoinvent LCI database is a **background database**, with **average data** on a wide range of goods, processes, and services
- Datasets represent average conditions on a (sub-)national or larger scope
  - Version 3.6 (September 2019) contains over 16'000 datasets for more than 3'000 products
  - Datasets for up to 140 countries
  - More than 300 impact assessment categories
  - A new release every year

The ecoinvent database – a global scope

Example: electricity supply in version 3.6



The *Sustainable Recycling Industries (SRI)* programme

- Motivation: sustainable supply chains in a global economy
- An initiative funded by the Swiss State Secretariat for Economic Affairs, SECO; duration 2014-2018 (first phase)
- Implemented through three connected components:
  - A. **Life Cycle Inventories** *(lead: ecoinvent Association)*
  - B. **Recycling Initiatives** *(lead: EMPA)*
  - C. **SRI Roundtable** *(lead: WRF)*

SRI SUSTAINABLE RECYCLING INDUSTRIES

funded by:

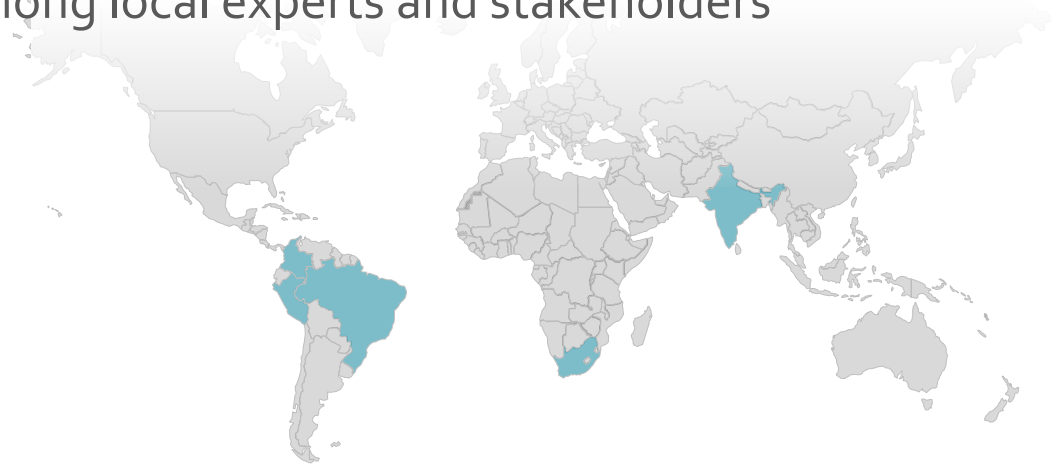
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Economic Affairs SECO

The SRI programme – objectives of the SRI-LCI component

- to **build capacity** for **life cycle-based sustainability assessments** and **metrics** in three regions: Latin America (BR, CO, PE), sub-Saharan Africa (ZA) and South Asia (IN)
- to support local stakeholders in **collecting and publishing LCI data** for industrial and agricultural activities
- to **foster** the formation of **competence networks** among local experts and stakeholders



The outputs of SRI-LCI in numbers

- Over **100 workshops** organized/supported
  - Introduction of life cycle-based assessments
  - State-of-the-art methods and tools
  - Data collection and review for science-based methods
- More than **1'500 training participants**
  - Training documents, guidelines, videos, etc. online
- **25 data collection projects** (30+ partners)
  - Over **1'700 inventory datasets** generated
- Several **tools** for data entry and inventory generation
- All generated material and data **available for free**:

https://www.ecoinvent.org/about/projects/sri-project/sri-project.html

Areas of application for SRI-LCI data

Example: supporting science-based targets in waste management

- **Range of waste 'treatment' options available** in ecoinvent
  - Municipal and hazardous waste incineration
  - Landfills (sanitary, unsanitary, inert and residual material)
  - Open burning / dumping
    - Including emissions of hazardous pollutants, like dioxin formation
  - Tailings impoundment
  - Recycling, e.g., for metals and major plastics
- **Disposal mixes** provided for many countries and regions
- Several tools for **waste- and technology-specific emissions**
- SRI included **quantitative assessments** of 'worst-' vs. 'best-practices' for metal recovery

Case study: 'worst-practices' in metal recovery

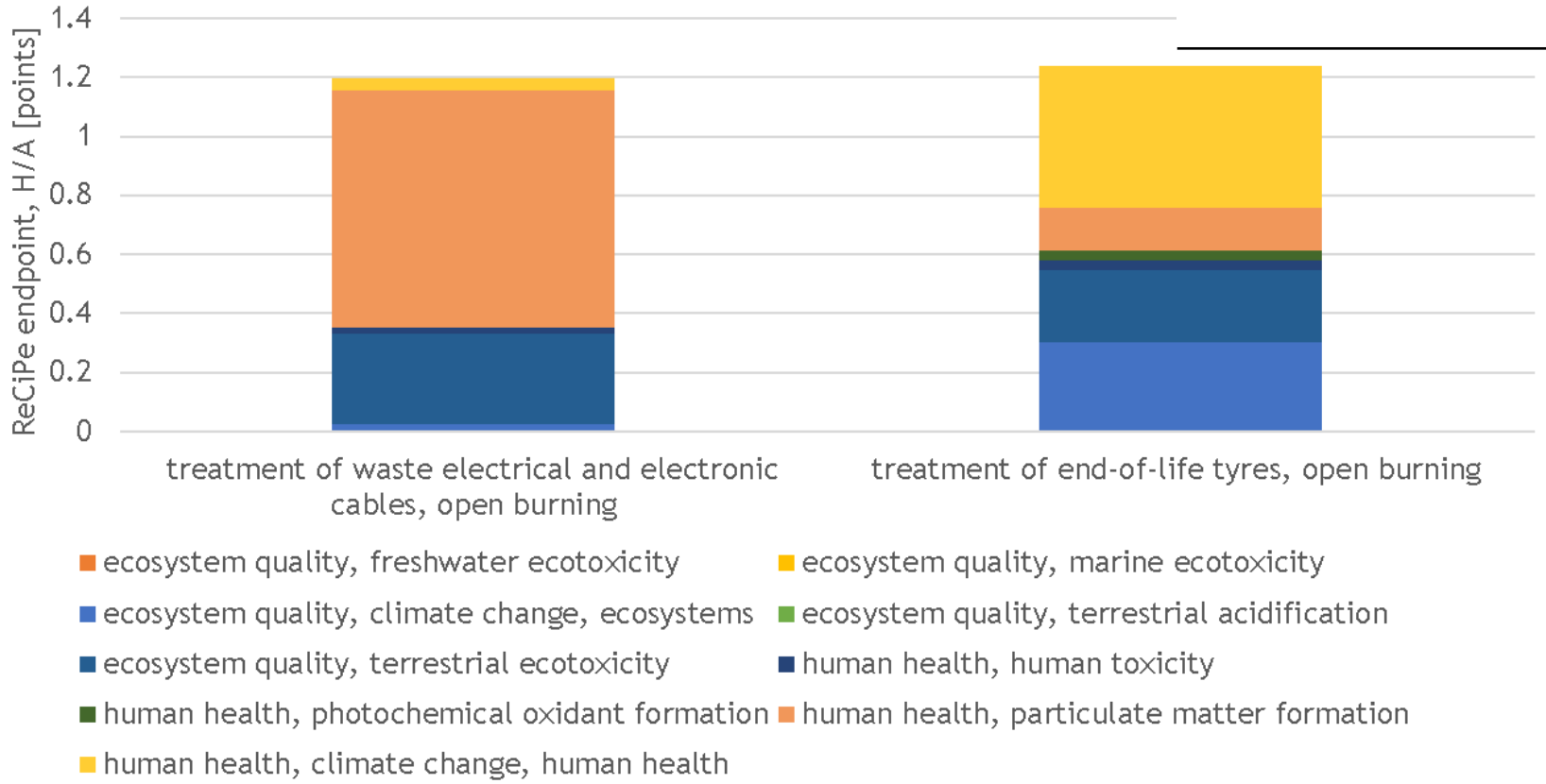
Starting point, goal and scope

- Study in collaboration between the ecoinvent Association and the WRF
- Well-understood that 'worst-practices' impact humans and environment negatively, but **scale and magnitude rarely quantified**
- Three case studies conducted
  - Uncontrolled vs. controlled dismantling of **end-of-life (EoL) refrigerators**
  - Open burning of **waste electrical and electronic cables**
  - Open burning of **end-of-life tyres (ELT)**
- **Functional unit**: 1 unit of average fridge dismantled / 1 kg of metal recovered (waste cables and ELTs)
- Expected potential life cycle impact on the environment and on human health estimated, but **not from direct exposure of individuals!**

‘Worst-practices’ in metal recovery

Results – waste cables and end-of-life tyres

Open burning of…	waste cables	EoL tyres
climate change, total	5%	**63%**
toxicity, total	27%	22%
particulate matter formation	**67%**	12%
rest	0%	3%



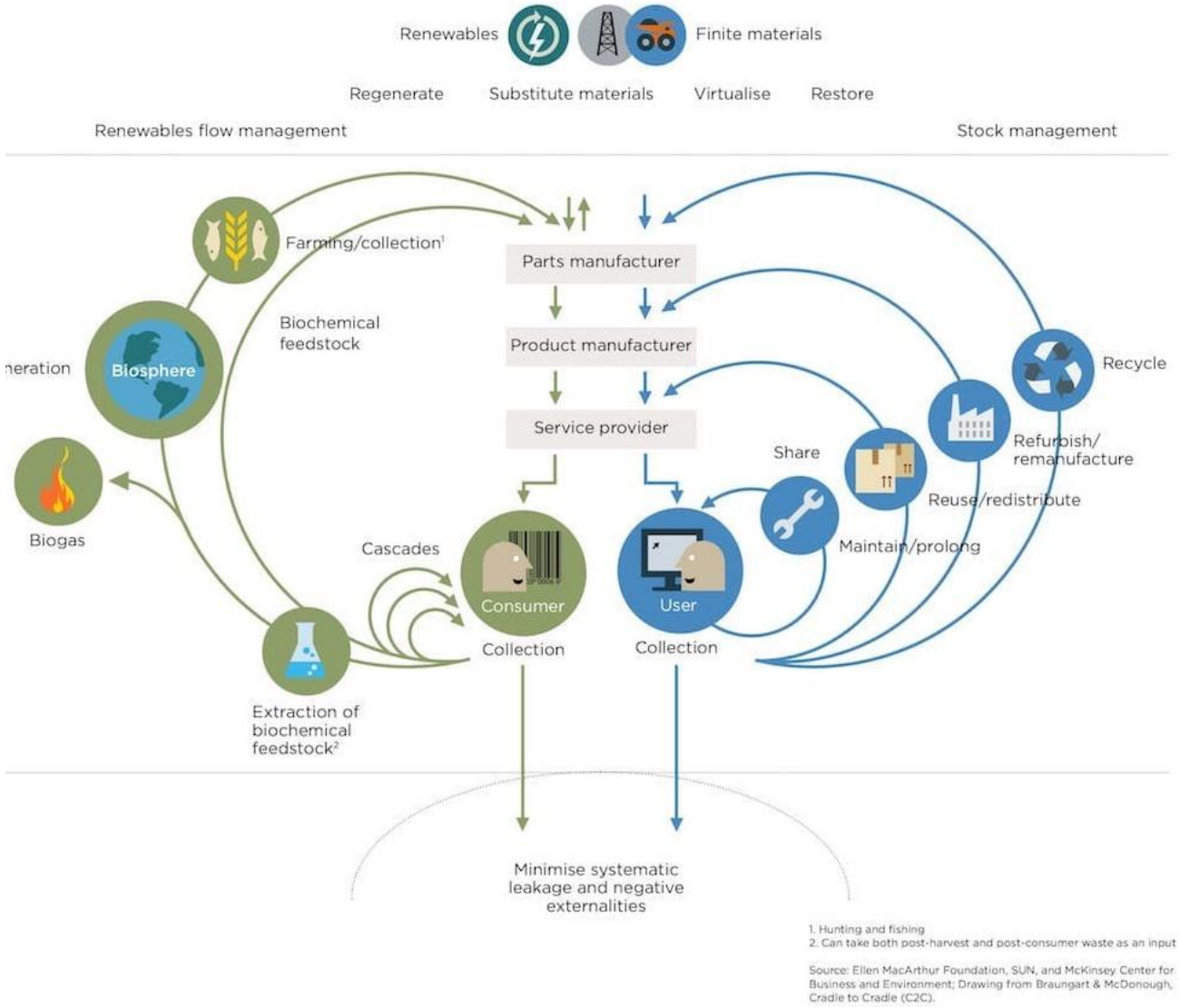
‘Worst-practices’ in metal recovery

Findings and conclusions

- Improper dismantling of end-of-life refrigerators may eliminate environmental gains of shifting to more energy efficient appliances
- Both manual and mechanical approaches for stripping cables offer alternatives to open burning → less burdens, higher copper quality
- Mechanical shredding and grinding of ELT represents low-cost treatment option able to eliminate most drawbacks of open burning

See also: International Organization for Standardization (ISO) IWA 19:2017 *Guidance principles for the sustainable management of secondary metals*;
Karcher et al. (2018) *From Worst to Good Practices in Secondary Metals Recovery FACT SHEETS*. WRF, St. Gallen.

LCA supports understanding and greening supply chains



- Life cycle thinking and LCI data are valuable resources in many applications:
  - LCA, environmental footprints & labels
  - Social assessments (S-LCA) and life cycle costing (LCC; economic analysis)
  - Prioritization of resource efficiency and cleaner production (RECP) efforts
  - Green economy and green public procurement
  - Circular economy innovation and assessment
  - Quantifying contributions towards UN's sustainable development goals (SDGs)
- But no single global database can do it all!

Project:

Development of National LCA Database Roadmaps

- Commissioned by UN Environment through the Life Cycle Initiative, under *Resource Efficiency through Application of Life cycle thinking (REAL)* project, funded by European Commission
- Duration: September 2018 – August 2018
- Project objectives
  - To develop national LCA database roadmaps in different countries, including improving access to available data where possible
  - To contribute to the development of the *Technical Helpdesk for National LCA Databases* to support database development globally

With financial support from:

European Commission

Commissioned by:

UN environment programme

Life Cycle Initiative

Project consortium

- **Project lead:** ecoinvent Association, Switzerland
- **Brazil:** Universidade Tecnológica Federal do Paraná (UTFPR)
- **Ecuador:** Escuela Superior Politécnica del Litoral (ESPOL); Escuela Politécnica Nacional (EPN); Ministry of Environment; Conservación Internacional Ecuador
- **India**: National Environmental Engineering Research Institute (NEERI); Confederation of Indian Industry (CII); Dr. Sanjeevan Bajaj
- **South Africa:** University of Cape Town (UCT)
- **Sri Lanka:** National Cleaner Production Centre Sri Lanka (NCPC-SL)
- **Uganda:** Uganda LCA Network

With financial support from: European Commission

Commissioned by: UN environment programme

Life Cycle Initiative

Why a national LCA database initiative?

Motivation

- Driver towards **mainstreaming life cycle thinking** and the practical application of LCA locally
- Data for LCA-based sustainability assessment as **vehicle for capacity building**
- **Ensure competitiveness** in global markets
  - for example under the European Commission's *Product Environmental Footprint (PEF)* initiative for 'green' products

Role and relevance

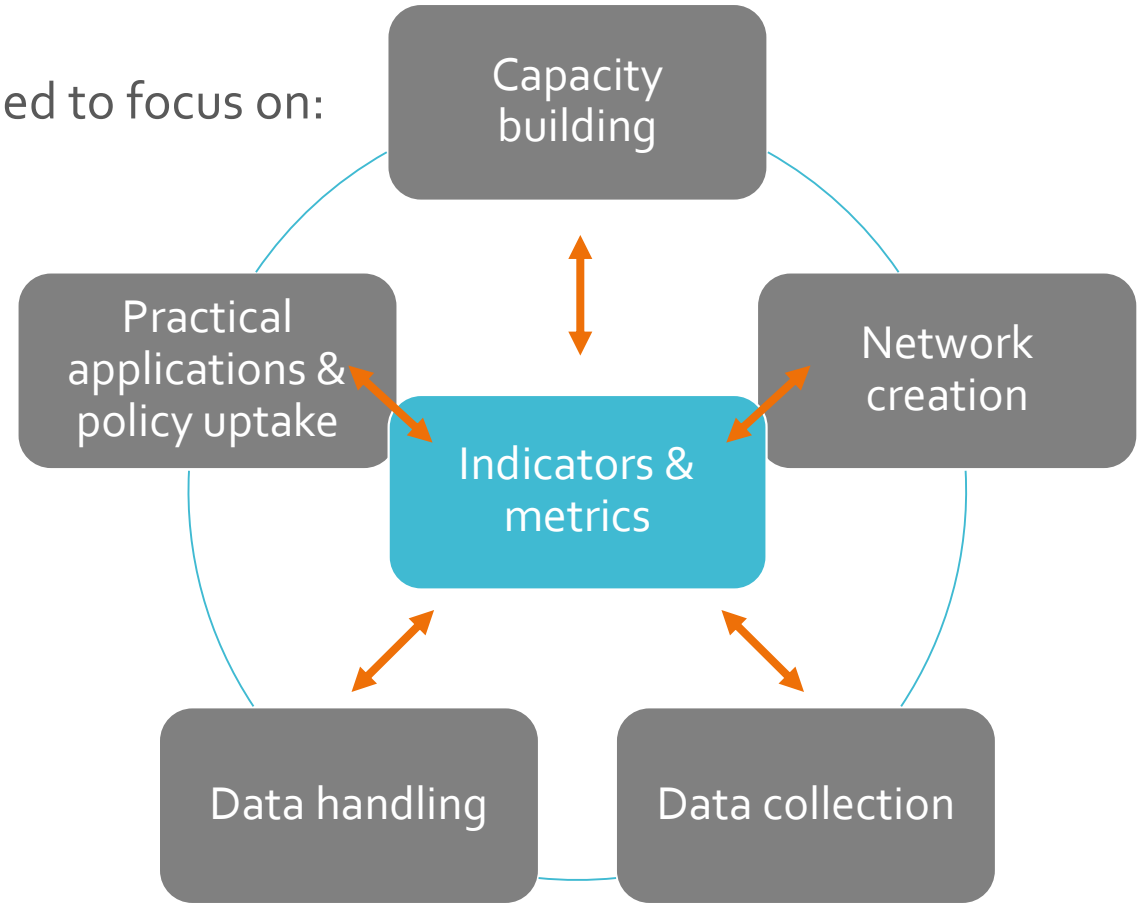
- Understanding of the **local situation** and **context**
- Flexible to **respond to local needs and priorities**
  - focus on activities, industries or sectors of **high relevance** to the local economy
  - **Engage** and align priorities with **key stakeholder** groups
- Ensure appropriate degree of **regionalization**
- **Support local decision makers** in business and public policy

Value creation

- **Improved data access and availability** through trust and recognition
- Ensures **consistency**, **reliability** and **interoperability** of data
  - maximize the utility and value of collected data
- **Local competence center** for capacity building, awareness raising and technical expertise

Concluding remarks

- Measure → manage! Life cycle thinking and data a prerequisite for a sustainable circular economy
- In response, national LCA database initiatives need to focus on:



International Conference on Resource Efficiency and Circular Economy

Thank You...!

ecoinvent Association

www.ecoinvent.org

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