Bio-based value chains in LCA

LCC Workshop – WASTE2ROAD

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Agenda

1. Dimensions of sustainability
2. Life Cycle Assessment
3. Bio-based value chains in LCA

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- Feasibility & Potential Studies
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Sustainability

- Tailor-made Life Cycle Assessments
- Customised Carbon Footprint Calculation Tools
- Social Impact Assessment & Social Acceptance
- Comprehensive Sustainability Assessments
- Sustainability Integrated Technology Development (SUITED)
- Critical Reviews

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- Comprehensive Communication & Dissemination in Research Projects
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- Target Price Analysis for Feedstock & Products
- Strategic Consulting for Industry, Policy & NGO's
- Political Framework, Measures & Instruments
- Standards, Certification & Labelling

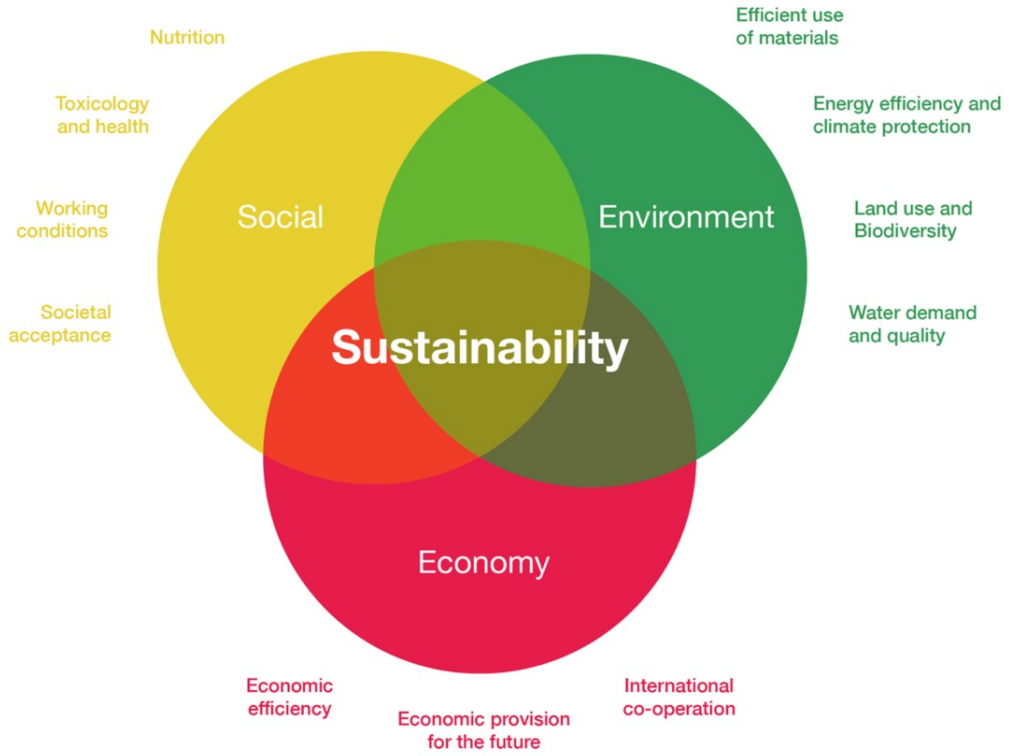
What does sustainability mean?

Gro Harlem Brundtland 1983: Sustainable development is defined as a *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*

UN – Sustainable Development Goals

Bildquelle: https://www.undp.org/content/undp/en/home/sustainable-development-goals.html

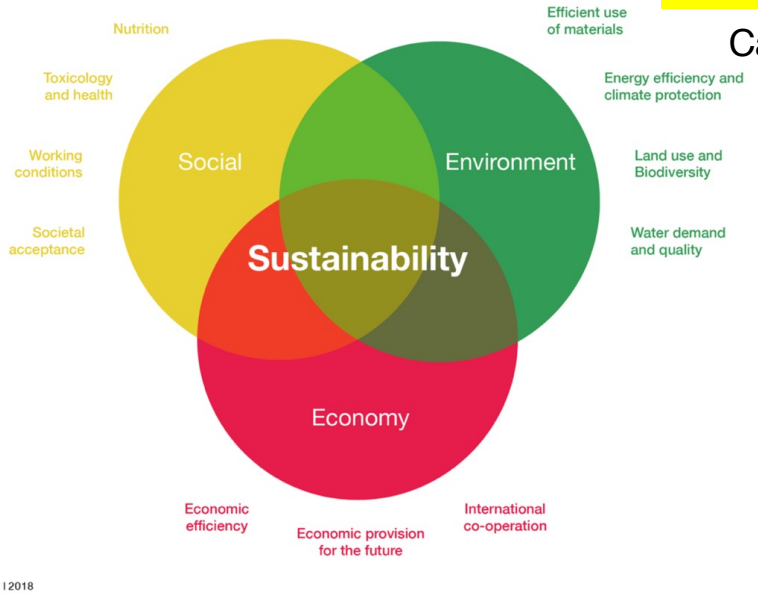
Dimensions of sustainability



Assessment methods

Social Life Cycle Assessment

Social Impact Assessment



Life Cycle Assessment (LCA)

Carbon Footprint (CFP)

Water Footprint (WFP)

Material Flow Analysis (MFA)

Environmental Product Declaration (EPD)

Product Environmental Footprint (PEF)

Holistic sustainability assessments

Life Cycle Sustainability Assessment (LCSA)
VDI 4605

Techno-Economic-Analysis (TEA)

Material Flow Cost Accounting (MFCA)

Total Cost of Ownership (TCO)

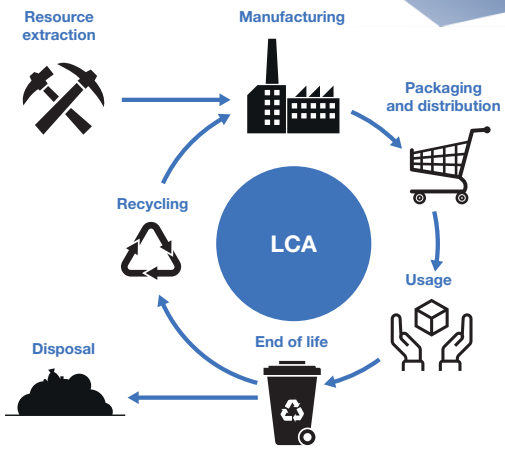
Life Cycle Costing

What is LCA?

- **Standardised method** for assessing the potential **environmental impact** of a product or service over its entire **life cycle**.

- The term **life cycle** begins with the extraction or cultivation of raw materials and ends with disposal or recycling.

- **Environmental impacts** include, for example, effects on the climate, land use, the use of resources and others...

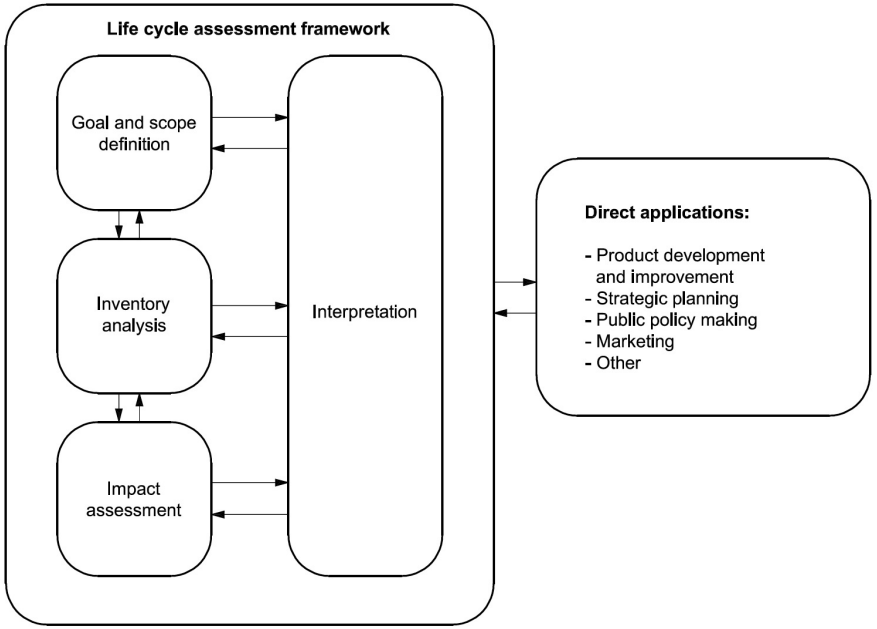


Impacts

Application of LCA

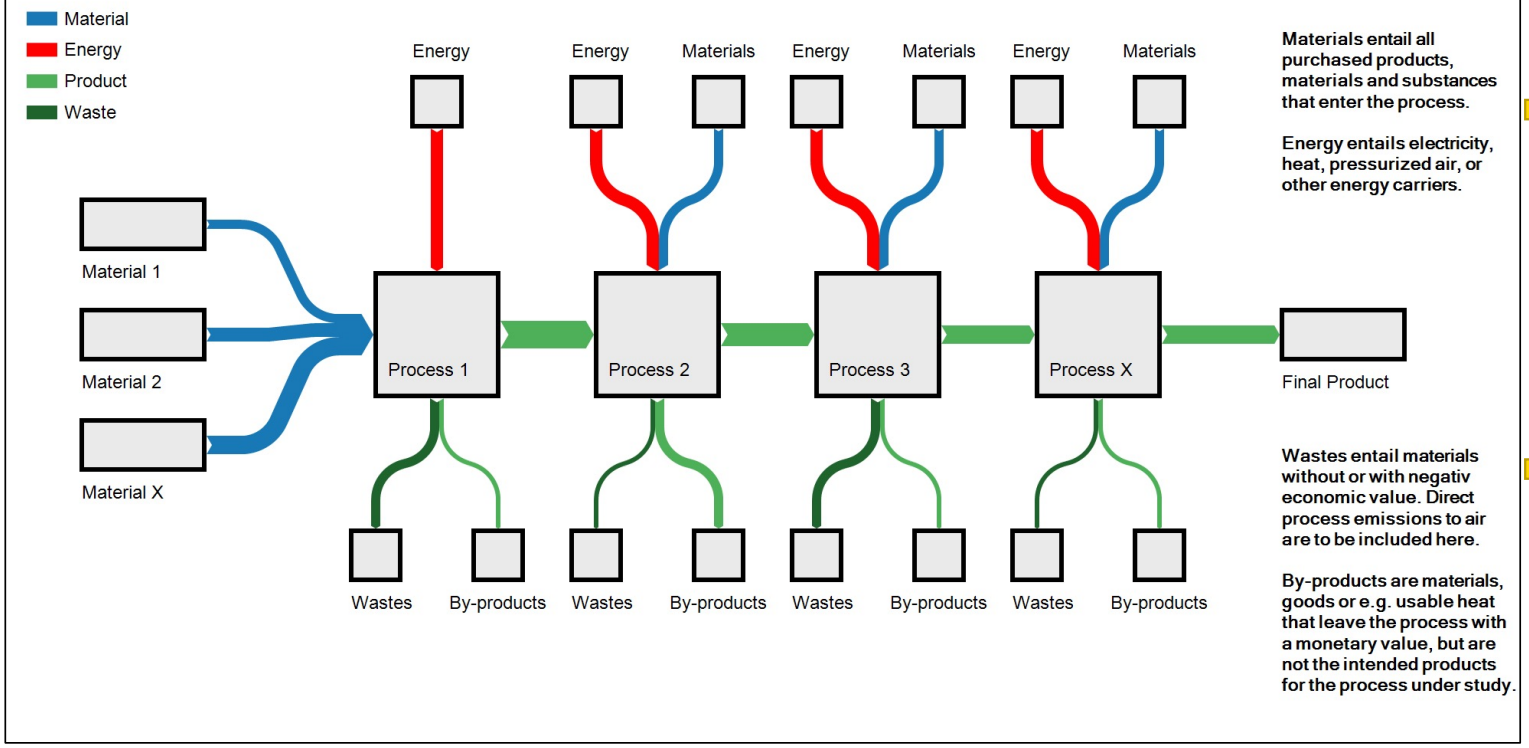
- ISO standardized methodology (ISO 14040 and 14044)

- Four phases of LCA:
  1. Goal and Scope
  2. Inventory analysis
  3. Impact assessment
  4. Interpretation



Life Cycle Inventory (Cradle to Gate)

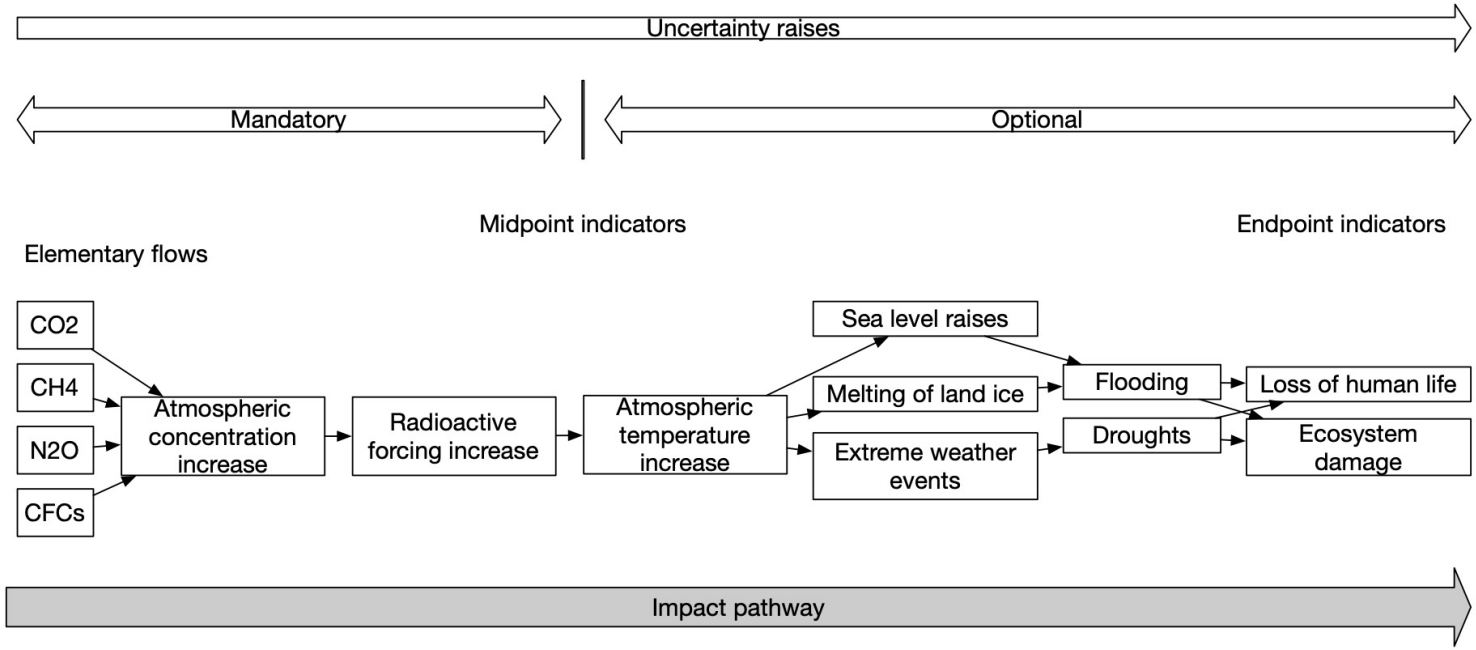
Exemplary flow chart for production processes



Assess associated monetary cost (LCC)

Assess associated environmental impacts (LCA)

LCIA (example: Global Warming Potential)



Various models and impact categories available

Challenge 1 – Different value chains, different impacts

	Bio-based products	Fossil-based products
Global Warming Potential	better	
Abiotic Depletion Potential	better	
Land use		better
Water use		better
Eutrophication		better
Biodiversity		better

Challenge 2 – Economies of scale

Bio-based products are often still in the early stages of development and thus on a laboratory scale or in pilot plants

Fossil production plants are on industrial scale, in use for decades and close to the process optimum

Challenge 3 – not a standardized methodology

- Similar but different methodologies
  - Life Cycle Assessment (LCA)
  - Product Environmental Footprint (PEF)
  - Recent JRC publication: “Life Cycle Assessment (LCA) of alternative feedstocks for plastics production”

- Policy-dependent assessments
  - RED II vs. conventional LCAs

  Main differences come from allocation and system boundaries

Challenge 4 – future developments

Bio-based products

- Higher yields in agriculture
- Energy from renewable sources

Fossil-based products

- Mining becomes more costly
- Credits for the combustion of fossil plastics will decrease

Thank you for your attention!

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Life Cycle Assessment

Sustainability

Renewable Carbon