國立臺北大學自然資源與環境管理研究所

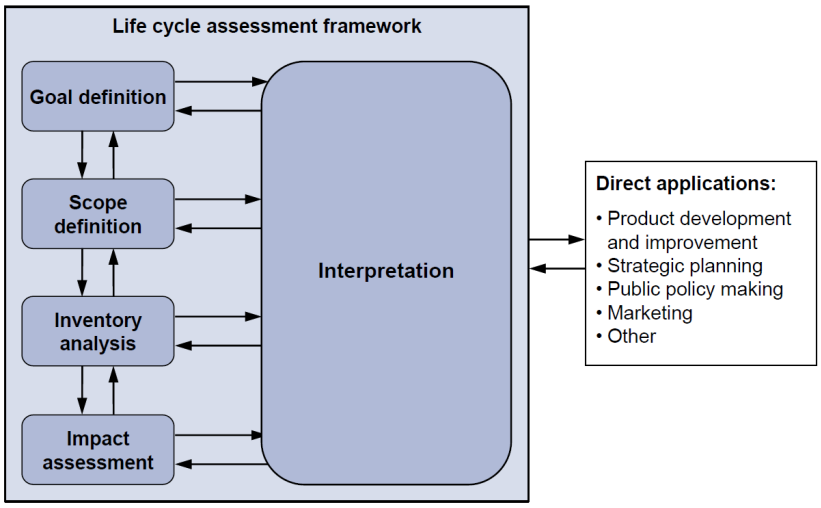
112 學年度第二學期『清潔生產與工業生態學』

課程進度(09~10)：生命週期評估－簡介、國際標準與評估步驟

Life Cycle Assessment: Introduction, International Standards, and Assessment Phases

- INTRODUCTION TO LIFE CYCLE ASSESSMENT (Hauschild et al., 2018: Chp.2&3)
  - □ Main Characteristics of LCA
    - ⇨ Takes a Life Cycle Perspective
    - ⇨ Covers a Broad Range of Environmental Issues
    - ⇨ Is Quantitative
    - ⇨ Is Based on Science
  - □ What LCA can and cannot answer
  - □ History of LCA: Selected events in LCA history
    - ⇨ Coca Cola's comparison of beverage containers
    - ⇨ Environmentally extended input/output analysis
    - ⇨ Resource and Environmental Profile Analysis or EcoBalance
    - ⇨ The SETAC framework (Code of Practice)
    - ⇨ The ISO-14040 Framework (ISO 14040~14044 => ISO 14040&14044)
    - ⇨ Life cycle sustainability assessment
    - ⇨ ILCD handbook
    - ⇨ Commission Recommendation (EU) 2021/2279 of 15 December 2021 on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations. (PEF and OEF)

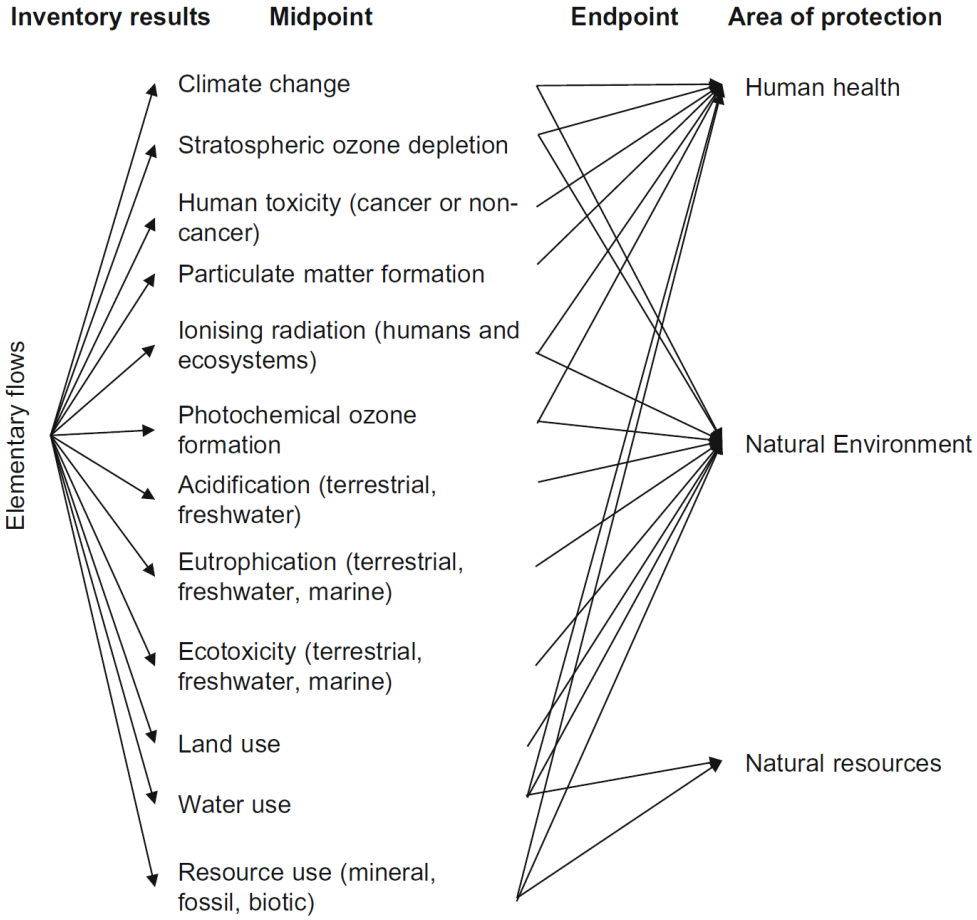
- INTRODUCTION TO LCA METHODOLOGY (Hauschild et al., 2018: Chp.6)
  - □ LCA Phases
    - ⇨ Goal Definition
    - ⇨ Scope Definition
    - ⇨ Inventory Analysis
    - ⇨ Impact Assessment
    - ⇨ Interpretation
  - □ Direction Applications
  - □ The Iterative Nature of LCA
    - ⇨ Sensitivity analysis
    - ⇨ Uncertainty analysis
  - □ Critical Review
  - □ Data Acquisition



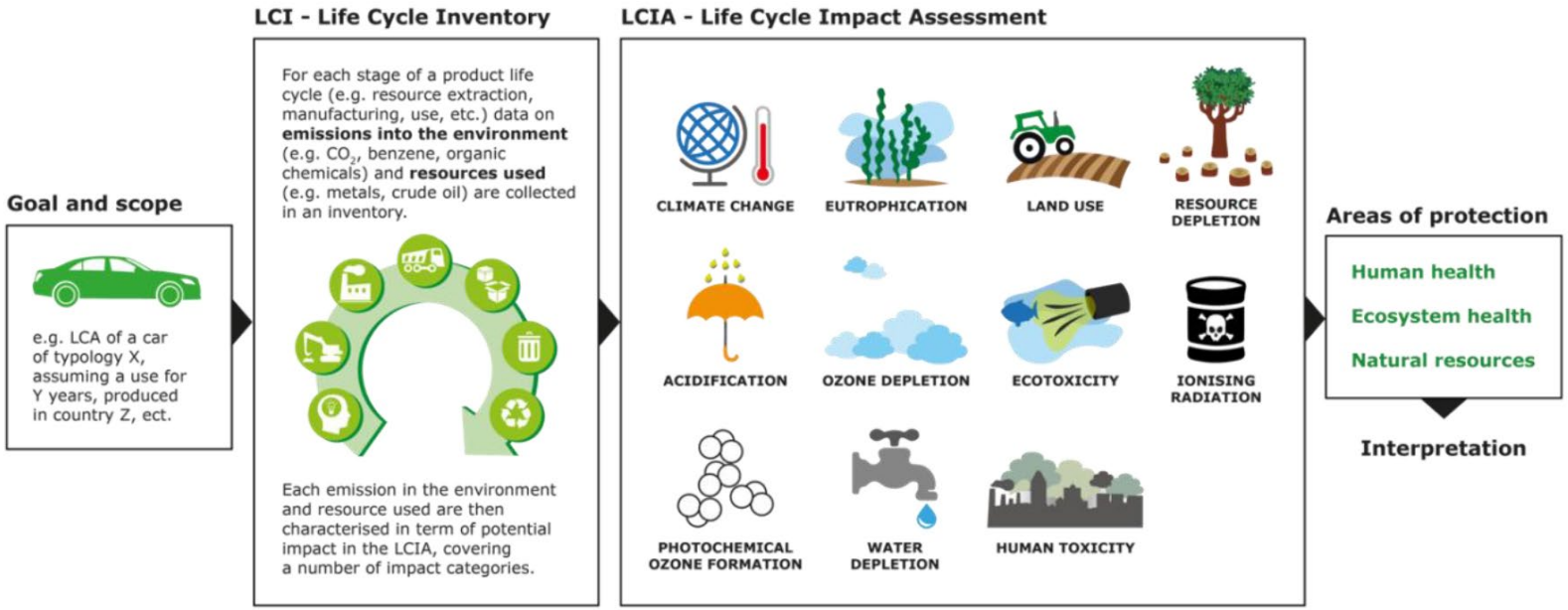
- GOAL AND SCOPE DEFINITION (Hauschild et al., 2018: Chp.7&8)
  - □ Flow, Process, and Product; Technosphere and Ecosphere
  - □ Upstream (extraction and production of raw materials and manufacturing)
  - □ Downstream (use, disposal, and recycling)
  - □ CBAM => not include downstream "embodied carbon"

- LIFE CYCLE INVENTORY ANALYSIS (Hauschild et al., 2018: Chp.9)

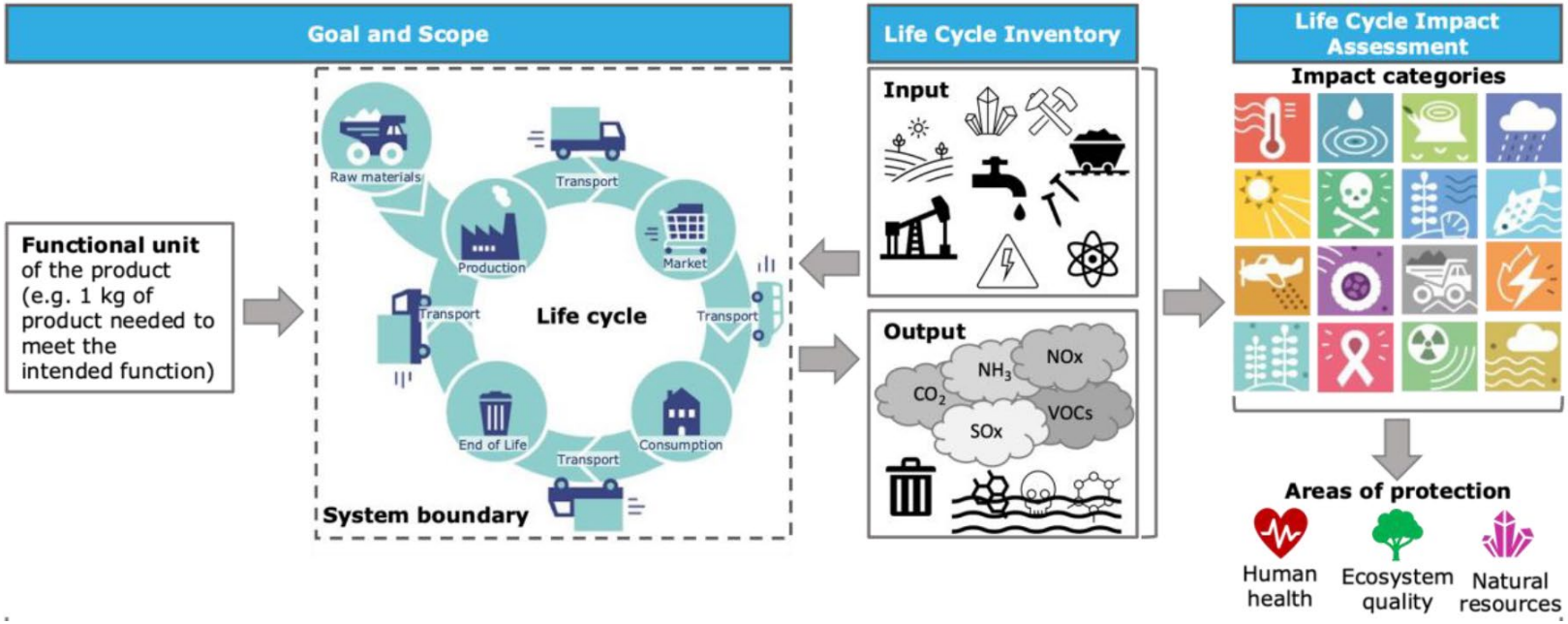
- LIFE CYCLE IMPACT ANALYSIS (Hauschild et al., 2018: Chp.10)
  - □ LCIA Mandatory Steps
    - ⇨ Selection of impact categories, category indicators and characterization models
    - ⇨ Classification
    - ⇨ Characterization
  - □ LCIA Optional Steps
    - ⇨ Normalization
    - ⇨ Weighting
    - ⇨ Grouping
  - □ LCIA Methods
    - ⇨ Midpoint LCIA methods => Elementary flow
    - ⇨ Endpoint LCIA methods => Area of Protection



  - □ Time Horizons and Temporal Variability
  - □ Spatial Variability and Regionalization
  - □ Units and Uncertainties
  - □ Footprints Versus LCA
    - ⇨ Ecological footprint focusing on land use
    - ⇨ Cumulative Energy Demand (CED) focusing on non-renewable energy
    - ⇨ Material Input Per unit of Service (MIPS) focusing on material use
    - ⇨ Water footprint, Carbon footprint, and Environmental footprint
    - ⇨ Chemical footprint; Phosphorus depletion footprint; Plastic footprint



https://eplca.jrc.ec.europa.eu/lifecycleassessment.html



Understanding Product Environmental Footprint and Organisation Environmental Footprint methods 2021

- ECODESIGN IMPLEMENTATION AND LCA (Hauschild et al., 2018: Chp.23)
  - □ Streamlining the LCA Process
    - ⇨ Simplified approaches aimed at integrating LCA into ecodesign
    - ⇨ Comprehensive LCA vs. Streamlined LCA or Simplified LCA
    - ⇨ Simplified LCA methods/tools
    - ⇨ Life Cycle Thinking and Life Cycle Management

- UPDATE OF ISO 14040 SERIES STANDARDS (TC-207 SC5)
  (https://www.iso.org/committee/54854/x/catalogue/p/1/u/0/w/0/d/0)
  - □ ISO 14040:2006 and ISO 14044:2006 (~~14040:1997; 14041:1998; 14042:2000; 14043:2000~~)
    - ⇨ ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework
    - ⇨ ISO 14040:2006/Amd 1:2020
    - ⇨ ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
    - ⇨ ISO 14044:2006/AMD 1:2017 – Amendment 1
    - ⇨ ISO 14044:2006/Amd 2:2020
    - ⇨ ISO 14045:2012 Environmental management – Eco-efficiency assessment of product systems – Principles, requirements and guidelines
    - ⇨ ISO 14046:2014 Environmental management – Water footprint – Principles, requirements and guidelines
    - ⇨ ISO 14055-1:2017 Environmental management – Guidelines for establishing good practices for combatting land degradation and desertification – Part 1: Good practices framework
  - □ Technical Specification (TS) and Technical Report
    - ⇨ ISO/TR 14047:2012 Environmental management – Life cycle assessment – Illustrative examples on how to apply ISO 14044 to impact assessment situations
    - ⇨ ISO/TS 14048:2002 Environnemental management – Life cycle assessment – Data documentation format
    - ⇨ ISO/TR 14049:2012 Environmental management – Environmental management – Life cycle assessment – Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis
    - ⇨ ISO/TR 14055-2:2022 Environmental management – Guidelines for establishing good practices for combatting land degradation and desertification – Part 2: Regional case studies
    - ⇨ ISO/TS 14071:2014 Environmental management – Life cycle assessment – Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006
    - ⇨ ISO/TS 14072:2014 Environmental management – Life cycle assessment – Requirements and guidelines for organizational life cycle assessment
    - ⇨ ISO/TR 14073:2017 Environmental management – Water footprint – Illustrative examples on how to apply ISO 14046
    - ⇨ ISO/TS 14074:2022 Environmental management – Life cycle assessment – Principles, requirements and guidelines for normalization, weighting and interpretation