國立臺北大學自然資源與環境管理研究所

108 學年度第二學期『清潔生產與工業生態』

課程進度(16)：工業生態學之展望：系統分析與情境模擬

Thinking Ahead: Systems Analysis and Scenario Simulation

- INTRODUCTION TO SYSTEMS ANALYSIS (G&A, Chp.15)
  - □ Industrial Ecology = Systems Analysis + Life Cycle Assessment
  - □ The Systems Concept
    - ⇨ A General Definition of a System: A Group of interacting, interdependent parts linked by exchanges of energy, matter, and/or information
    - ⇨ Simple Systems vs. Complex Systems => "Context"
    - ⇨ Linear Systems vs. Nonlinear Systems => Circularity?
    - ⇨ The "Butterfly Effect"
  - □ The Adaptive Cycle => Adaptive Management => Adaptation vs. Mitigation
  - □ "Holarchies"=> Holistic Hierarchies?
  - □ Adaptive Management of Technological Holarchies

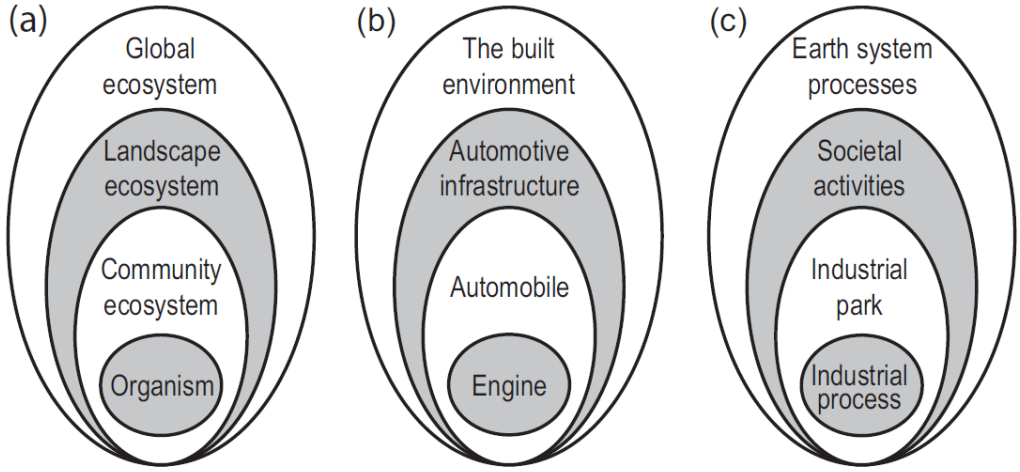
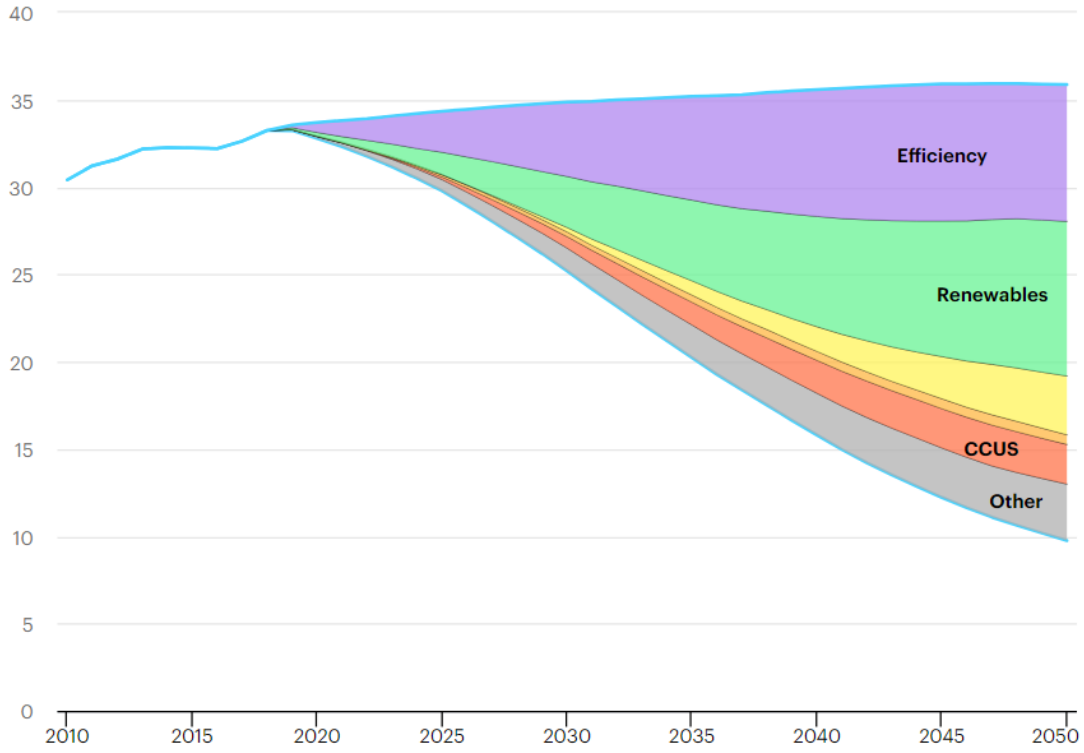


Figure 1.4 Examples of complex systems: (a) classical multilevel natural system; (b) technological system based on stocks of material in use; (c) technological–environmental system based on flows of materials and energy.

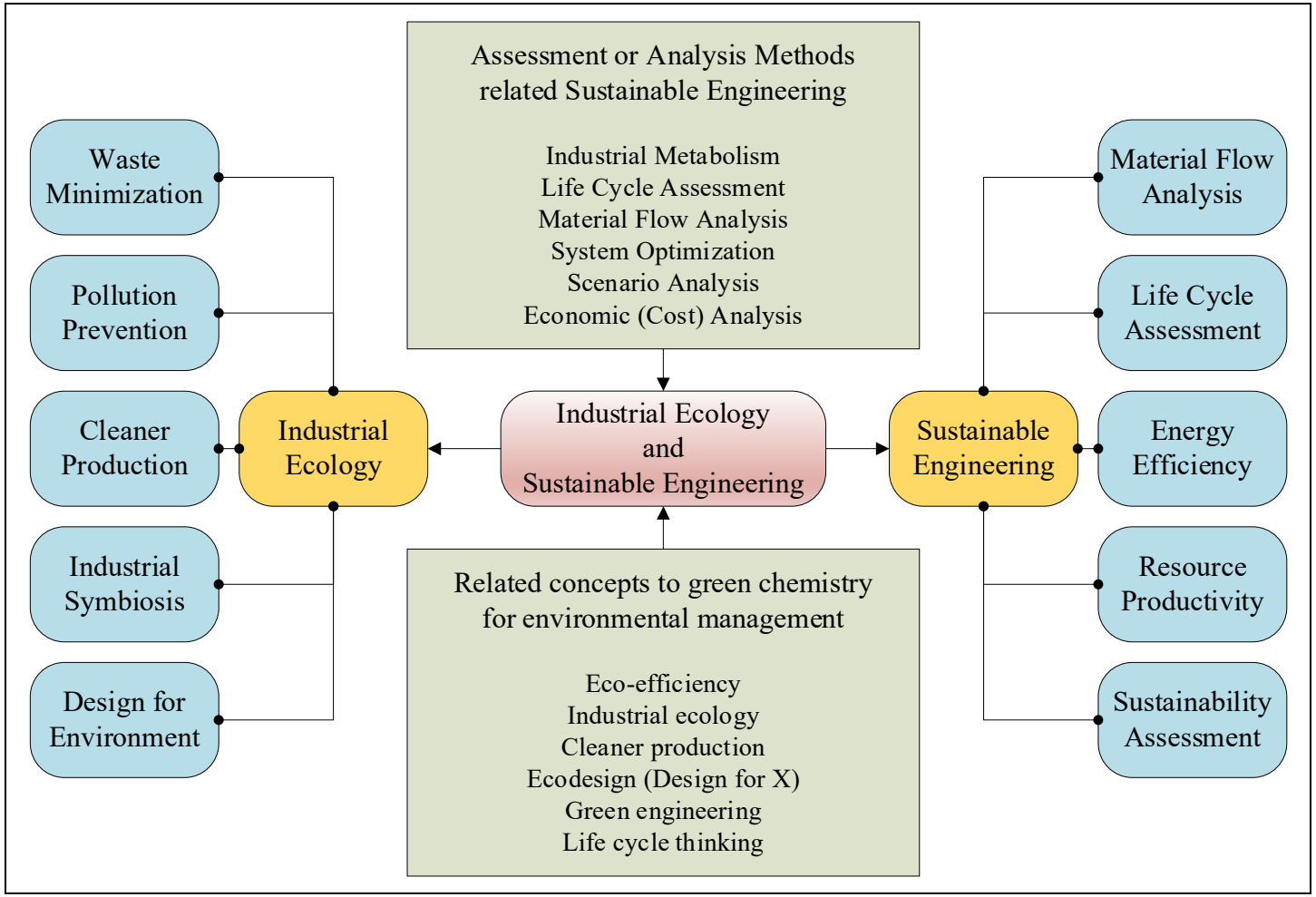
- MODELING IN INDUSTRIAL ECOLOGY SCENARIOS (G&A, Chp.22)
  - □ Industrial Ecology Model
    - ⇨ Conceptual Models vs. Mathematical Models
  - □ Building the Conceptual Model
    - ⇨ Class 1 Industrial Ecology Model: "Sequential Process"
    - ⇨ Class 2 Industrial Ecology Model: "Multifold Considerations?"
    - ⇨ Class 3 Industrial Ecology Model: "System Dynamics Model?"
  - □ Running and Evaluating Industrial Ecology Models
    - ⇨ Implementing the Model
    - ⇨ Model Validation vs. Parameter Verification
      => Accreditation, Certification, Validation, Verification (認證 驗證 確證 查證)

- INDUSTRIAL ECOLOGY SCENARIOS (G&A, Chp.23)
  - □ Industrial Ecology Scenario
    - ⇨ Conceptual Scenarios vs. Mathematical (Quantitative) Scenarios
  - □ Building the Scenario
    - ⇨ Evolutionary Behavior vs. Disruptive Behavior
    - ⇨ BAU – Business as Usual
    - ⇨ Decision Support vs. Decision Making
  - □ Examples and the Status of Industrial Ecology Scenarios
  - □ Describing Possible Future
    - ⇨ "Prediction" Models and Utility of Scenarios
    - ⇨ The IEA Scenarios (Sustainable Development Scenario vs. Stated Policies Scenario)
      https://www.iea.org/data-and-statistics/charts/co2-emissions-reductions-by-measure-in-the-sustainable-development-scenario-relative-to-the-stated-policies-scenario-2010-2050)



    - ⇨ Scenarios Analysis of TCFD => Related Scenarios of Climate Change

- INTRODUCTION TO SCENARIO ANALYSIS RECOMMEDED BY TCFD
  - □ Task Force on Climate-Related Financial Disclosures (TCFD)
    - ⇨ Overview of TCFD Recommendations
    - ⇨ Four Thematic Areas / Risk, Opportunity, and Impact / Disclosure Recommendations
  - □ Scenarios related to TCFD Recommendations
    - ⇨ 2°C (or lower) Scenario => Below 2°C Scenario
    - ⇨ UNEP FI: 1.5°C, 2°C, and 3°C scenario-based analysis => Changing Course
    - ⇨ IEA WEO (World Energy Outlook) and SSP (Shared Socioeconomic Pathways) Scenarios => Practical guide for Scenario Analysis in line with the TCFD recommendations (2nd ed.)
    - ⇨ °CICERO Center for International Climate Research => Sustainable Policy



Topics and Context of Industrial Ecology and Sustainable Engineering