Transition towards Bioeconomy

- Substitution for fossil resources in a wide range of sectors, e.g., health, energy, plastics, by employing **renewable biological resources**
- Technological innovation but also on the mobilization of increasing amounts of biomass
- Necessary adjustments along supply chains, involving a large number of actors and processes
- Potential socioeconomic and environmental impacts from adaptations in productive systems, ultimately governed by **regulatory frameworks and structures** at different scales (Fig 1).

Case study: production of bioplastics in Thailand

- **Polylactic Acid (PLA)** is the frontrunner in the renovation of bioplastics
- Large scale production only in a few locations: comparative advantages based on feedstock availability
- Thailand is the leading producing region, together with the US: 150,000 t/year of PLA from sugarcane
- **Strategic location** in Southeast Asia, close to plastic markets of China, Japan, Taiwan, and Korea
- Internationally competitive plastic industry, with over 3,000 companies in the market

Research questions:
- What are the institutional and regulatory frameworks that enhance bioplastic production in Thailand?
- What specific policies and legal structures, as well as public and private actors, are involved?
- What are the effects of governance changes and gaps on production patterns, from a life cycle perspective?

Framework for Life Cycle Governance Analysis (LCGA)

- **SCOPE**
  - Socioeconomic system
    - Process-based
    - Multinational supply chain
      - (enterprise)

- **D IMENSION**
  - Environmental
  - Social
  - Economic
  - Political

- **STRENGTHS**
  - Strong government support (R&D investment, tax incentives)
  - Guidance of the Thai Bioplastics Industry Association
  - Well-established plastic supply chain
  - Sugarcane and cassava readily available

- **GAPS**
  - Technological innovation to increase cost competitiveness (vs. Malaysia)
  - Research on agricultural byproducts (e.g., rice straw and husk, tree bark)
  - Support regimes for bioplastic usage
  - Policies promoting recyclability and biodegradability of plastics

- A framework for LCGA is proposed as an incremental procedure for multi-level governance assessment
- LCGA goes beyond firm-centered organizational and institutional approaches
- The case study identifies the need for national regulations for product specification, since global standards are rarely effective in national domains