

# **Production Methods for Biobased Plastics**

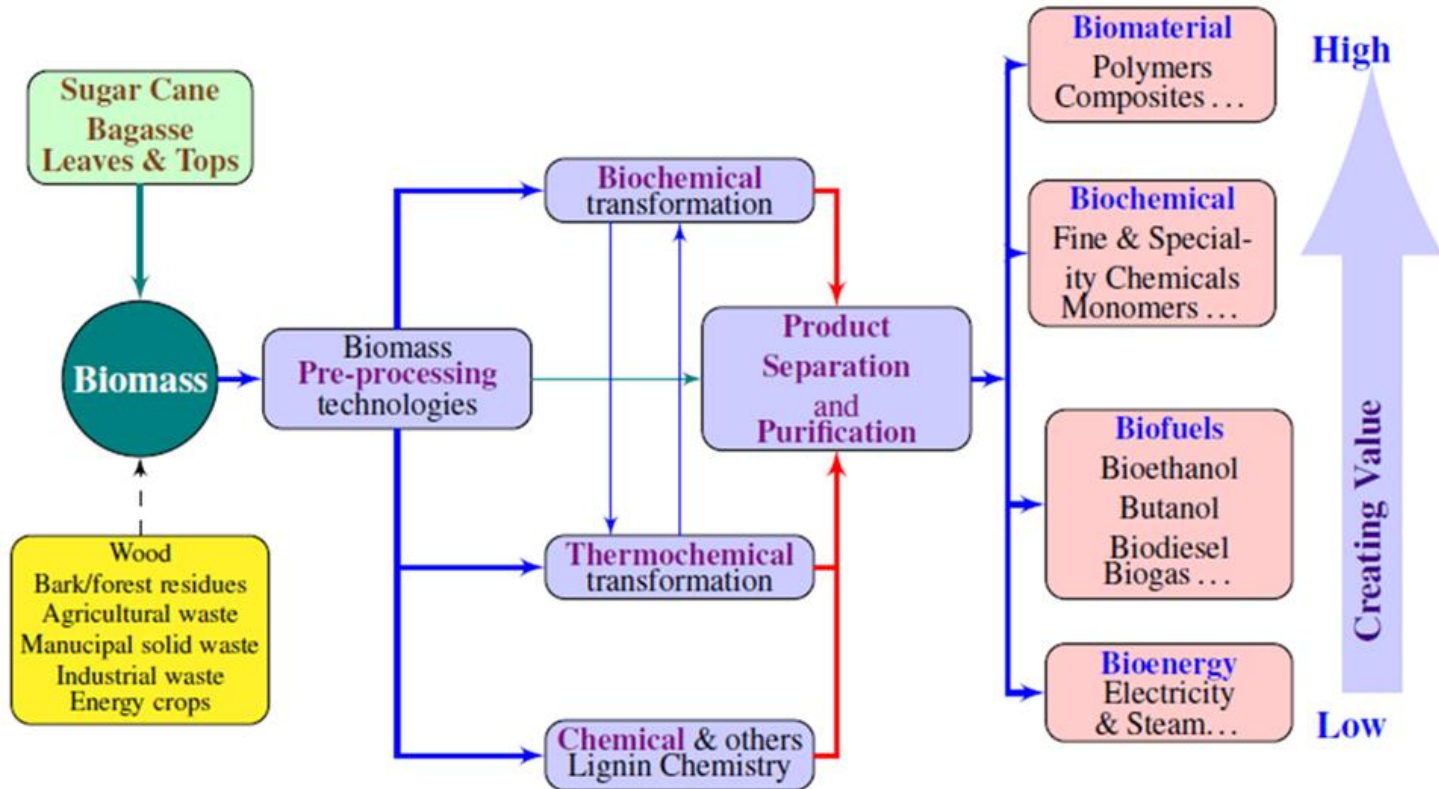
Bioplastics Roundtable Discussion  
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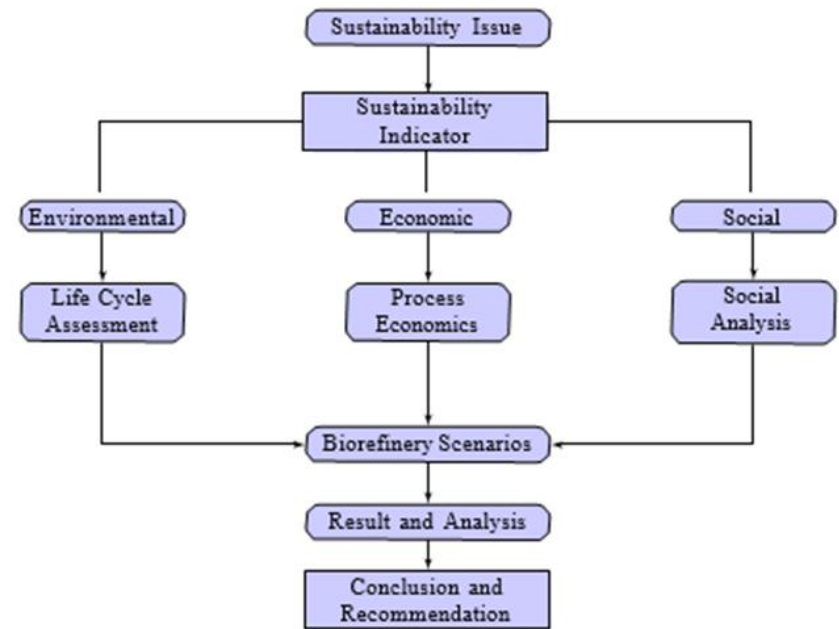
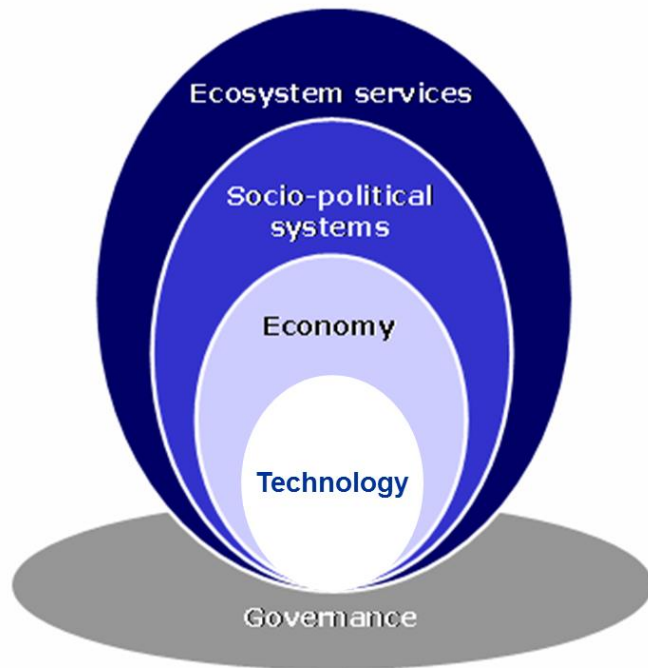
# Overview of current activities

- Technology development and assessment for bio-ethanol production
  - Ethanol is a key component of bio-based PE and PET production
  - Novel feedstocks, i.e. non-food grains, lignocelluloses
  - Energy crops and organic wastes
  - Techno-economic modelling for comparison of a wide range of production methods.
- Production of terephthalic acid (TPA) using organic wastes from the paper and pulp industry
  - Forestry residues and black liquors contain precursors for TPA production
  - Sampling and compositional analysis
  - Techno-economic modelling
- Bio-based polymers
  - Polymeric, water-insoluble xylans produced from lignocelluloses, for application as hydrogels or in composites
  - Fractionation of lignocelluloses to produce xylans, cellulose fibres and lignins for use in composite applications
  - Production of nanocelluloses from paper mill sludge
- Recovery of monomers from waste (bio)plastics
  - Pyrolysis processing of PE, PET and PS to recover chemical monomers for recycling into new plastic production

# Simulations for Assessment of Technology Options



# Simulations for Assessment of Technology Options



# Overview of current activities

- Technology assessments for new processes, through rigorous simulation and modelling
  - Simulations predict overall technical, environmental and economic performances of alternative processes
  - Lactic acid production from lignocelluloses, as precursor for polylactic acid production
  - Production of (poly)isoprene, butadiene and styrene from lignocelluloses
  - Production of TPA from bio-based aspartic acid
  - Simulation and assessment of multiproduct biorefineries, to identify preferred options

# Opportunities for a local bioplastics industry

- Create demand for bioplastics: Iles & Martin / Journal of Cleaner Production 45 (2013) 38-49:
  - Do not try to compete directly with fossil-based plastics on performance and price (production cost)
  - “... a business model for sustainability needs to communicate to societies the ways in which bioplastics can improve in the future.”
  - “business models to close the loop at the end of bioplastic life cycles, and to address agricultural production impacts that may far outweigh those of the processing and use stages“
  - “developing innovative business models helps create a sustainable value proposition ... to engage society to define ecological and social value”
- Valourisation of organic wastes/residues
- Expand agriculture to meeting growing demand for biobased products
- Import replacement and/or export of biobased products

# Obstacles to a local bioplastics industry

- Cost-competitiveness and/or performance of bioplastics compared to conventional plastics
- SA cost-competitiveness with large, global production facilities.
- Environmental benefits are not ensured by using bio-based resources
  - Inputs to manufacturing
  - Degradability and recycling suitability
  - Green Metrics of Sustainability and international market demands.

# Current gaps in knowledge

- Techno-economics and environment
  - Multiple potential products and production routes
  - Rigorous, comparative assessment of alternatives through simulations
  - Simulations should be based on technology performance at scale – limitations in technical information in public domain
  - Economics based on costing and technical performance
  - Does bio-based ensure that an environmental benefit is realised?
    - Life cycle emissions
    - Biodegradable for disposal purposes



# THANK YOU

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