Assessing the availability of bio-based materials in product design

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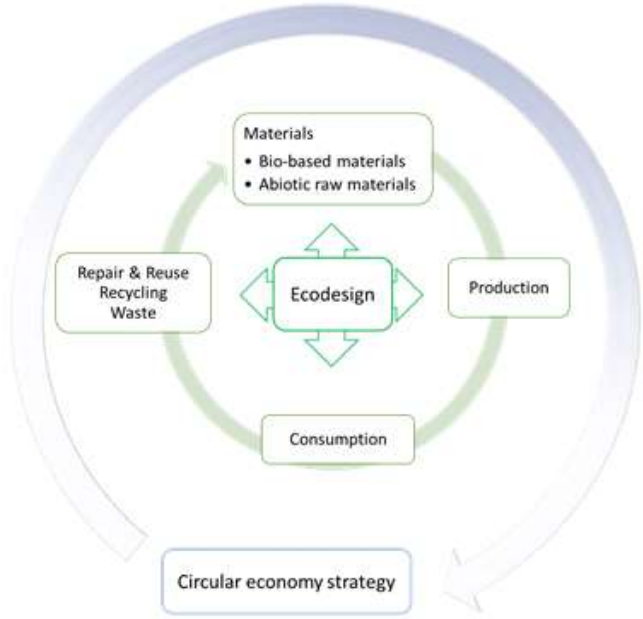
Agenda

- Ecodesign and circular economy
- Motivation to assess the availability of biotic resources and raw materials
- Approach to determine availability constraints
- Case study for biodiesel produced from rapeseed and soy beans
- Conclusion

Research question: How can the availability of bio-based materials be assessed in product design?

Bio-based materials in ecodesign and circular economy: current status

- Use of bio-based materials is one key aspect of ecodesign approaches (e.g. Design for Environment)
- They are considered as better than fossil raw materials
  - Due to their renewability bio-based materials are considered as inexhaustible
  - Bio-based materials have lower greenhouse gas emissions



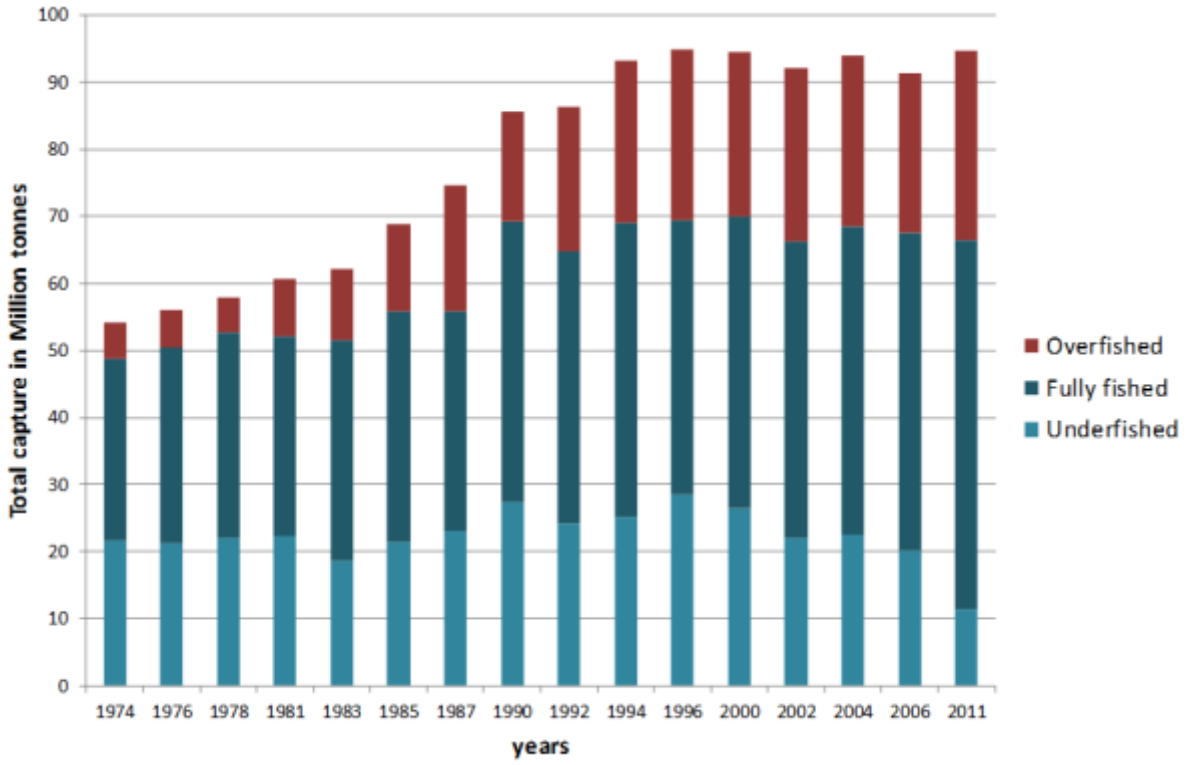
➢ Key strategy of eco-design: substituting fossil with bio-based materials

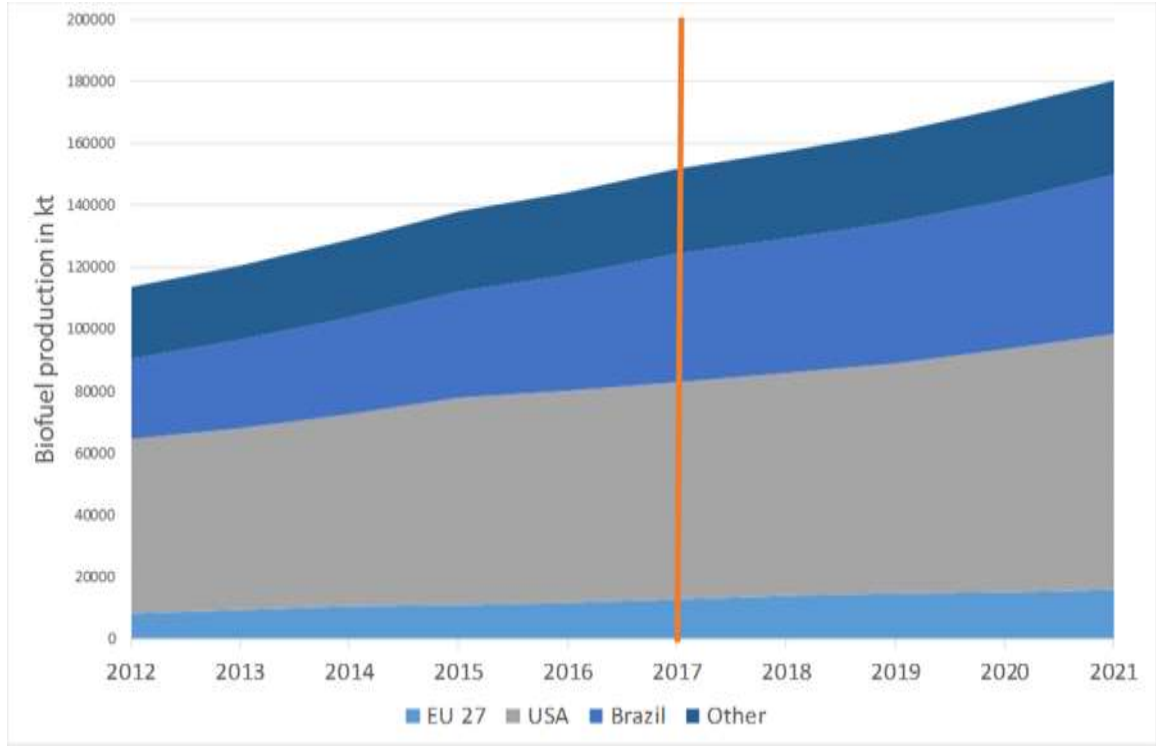
- This is also one important measures to support circular economy strategy of EU

- However, other important aspects relevant for bio-based materials are not considered
  - e.g. availability of bio-based raw materials

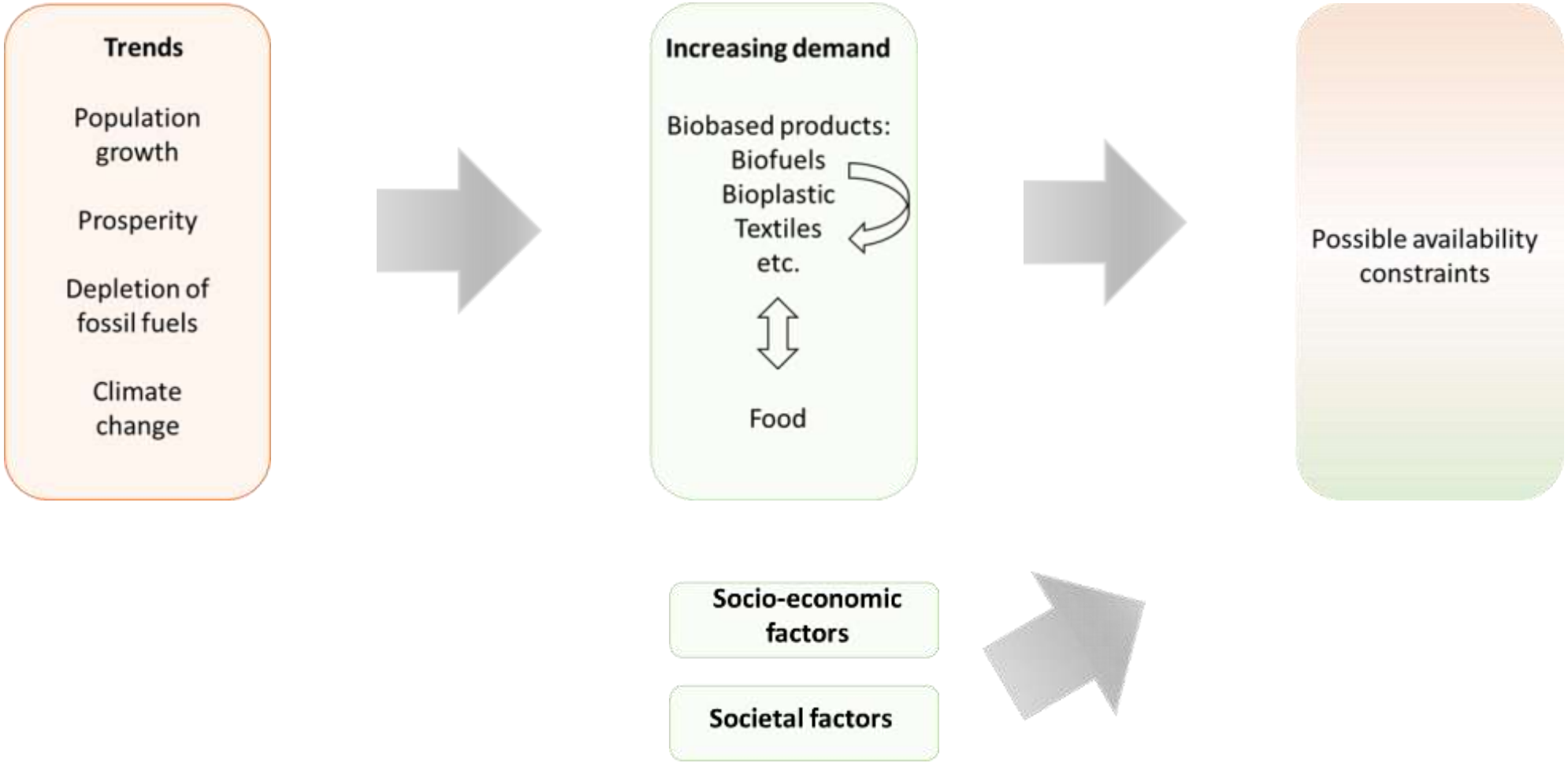
Availability of bio-based materials (1)

Consumption of bio-bases materials has risen in the last years and will most likely further increase



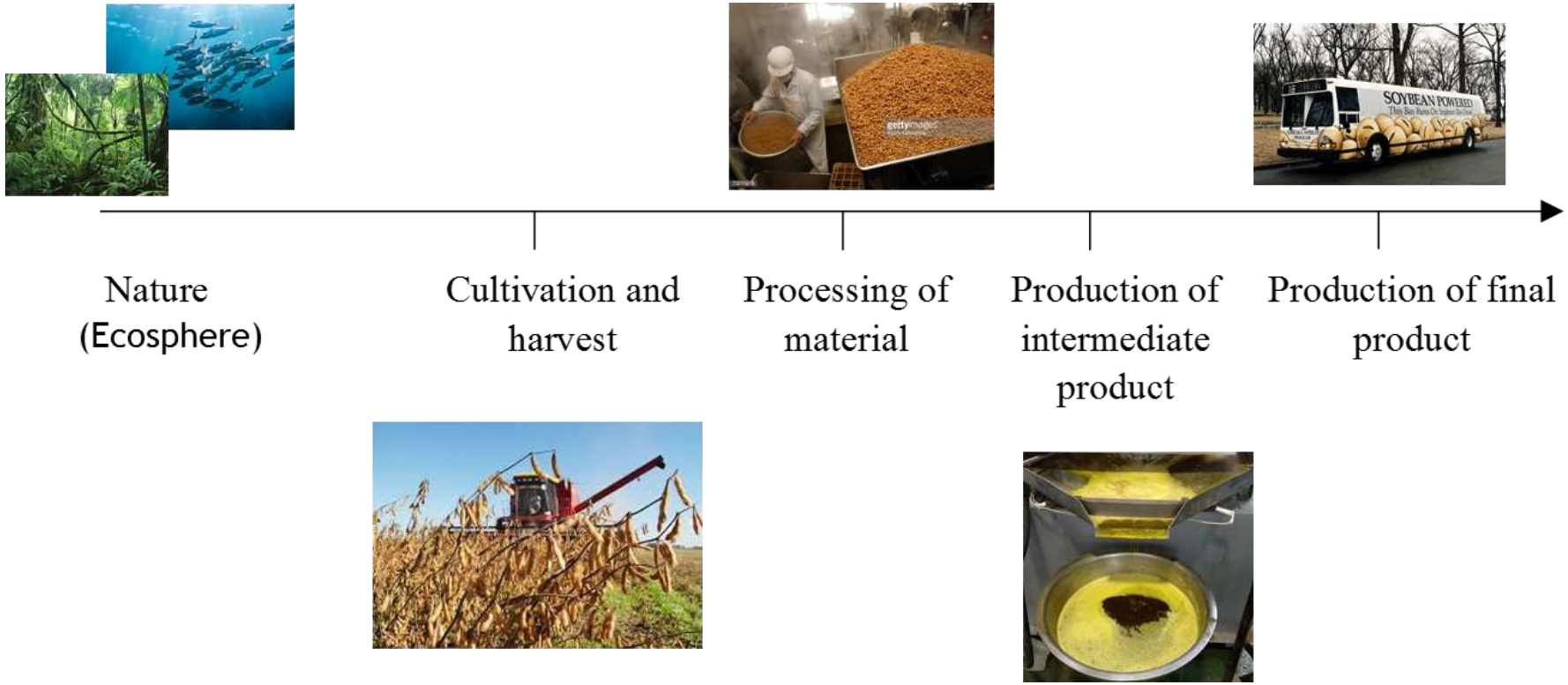


Availability of bio-based materials (2)



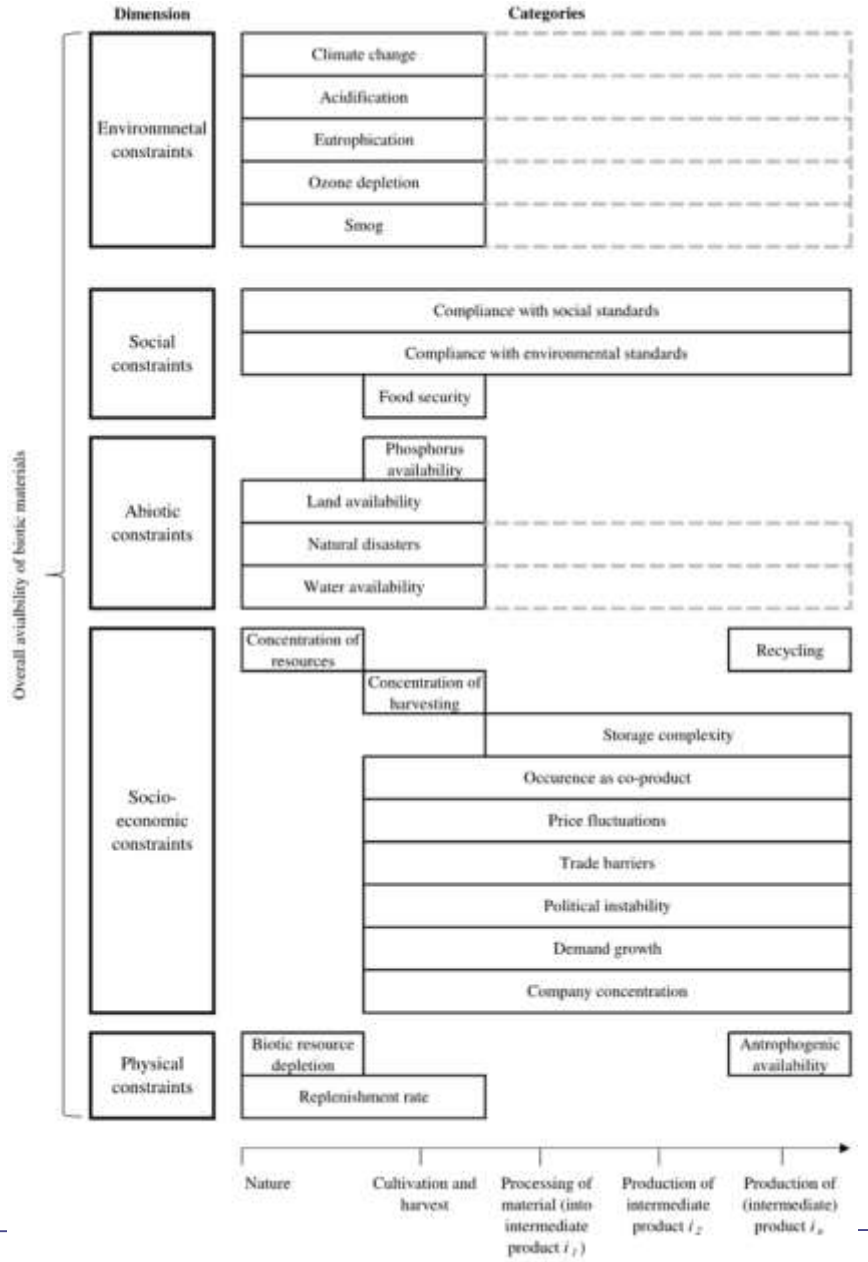
BIRD method to assess availability constraints (1)

- BIRD was developed: *"Approach to determine the availability of terrestrial biotic materials in product systems"*
  - BIRD considers various availability constraints along the supply chain



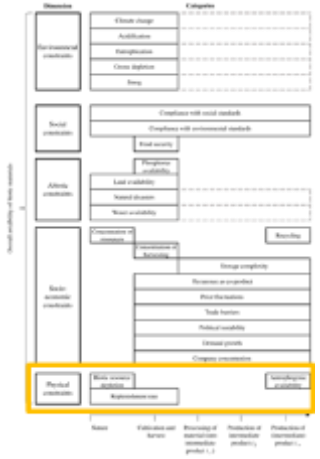
BIRD method to assess availability constraints (2)

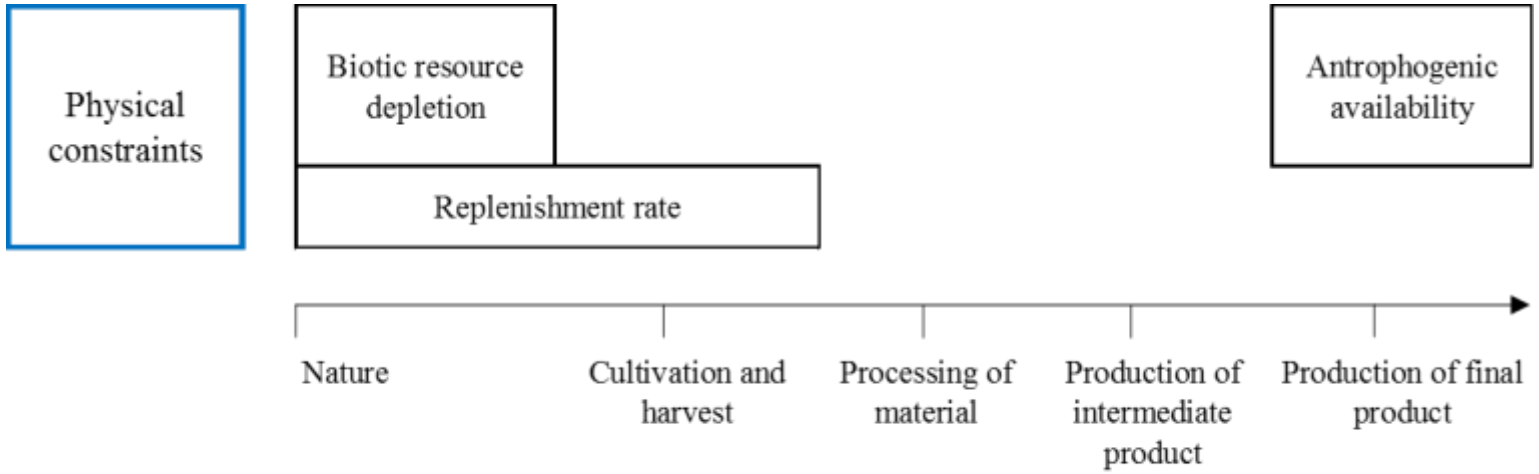
- Taking into account
  - 5 dimensions
  - With 3 – 9 categories
  - Indicators are provided



BIRD method to assess availability constraints (3)

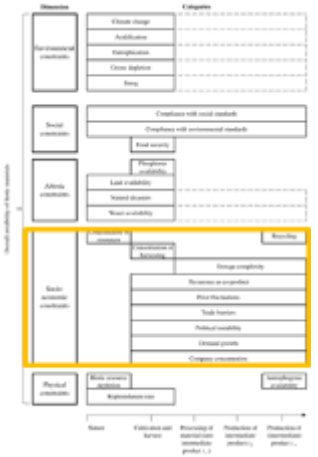
- Considering the entire supply chain
- 5 dimensions are taken into account:
  - Physical constraints: availability in nature, replenishment rate and availability in technosphere

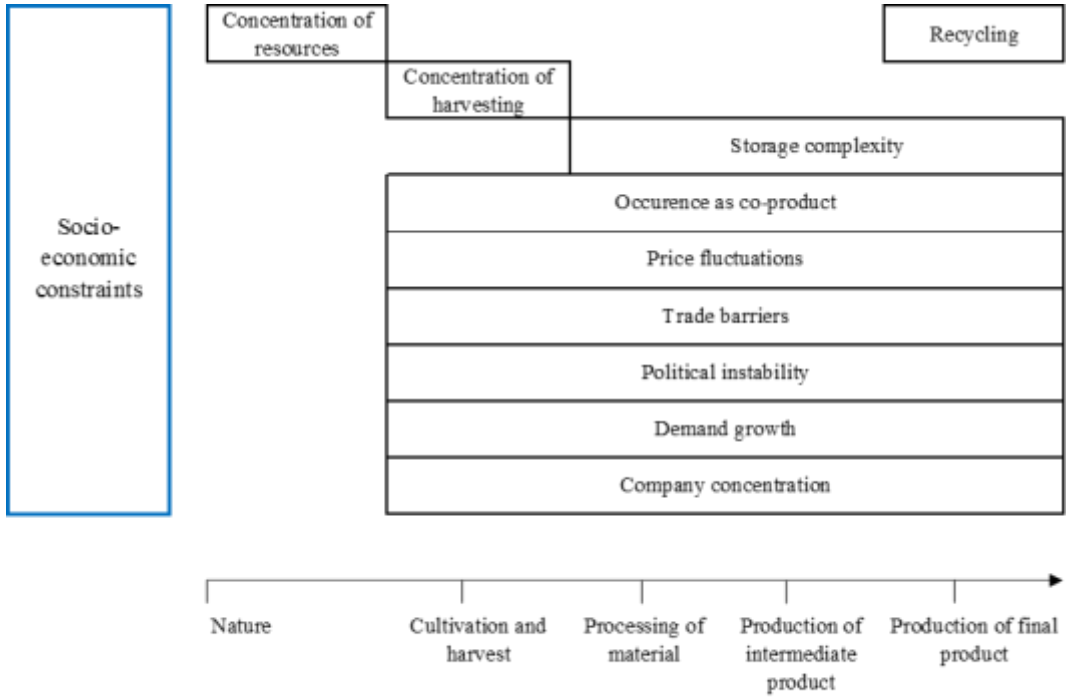




BIRD method to assess availability constraints (4)

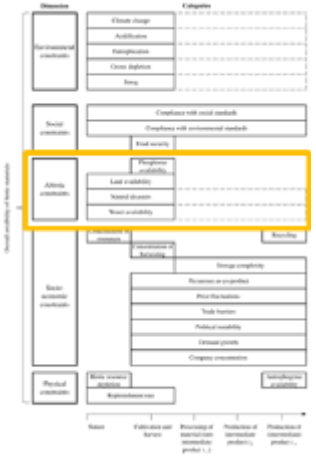
- Considering the entire supply chain
- 5 dimensions are taken into account:
  - Physical constraints
  - Socio-economic constraints: geopolitical, political and economic factors

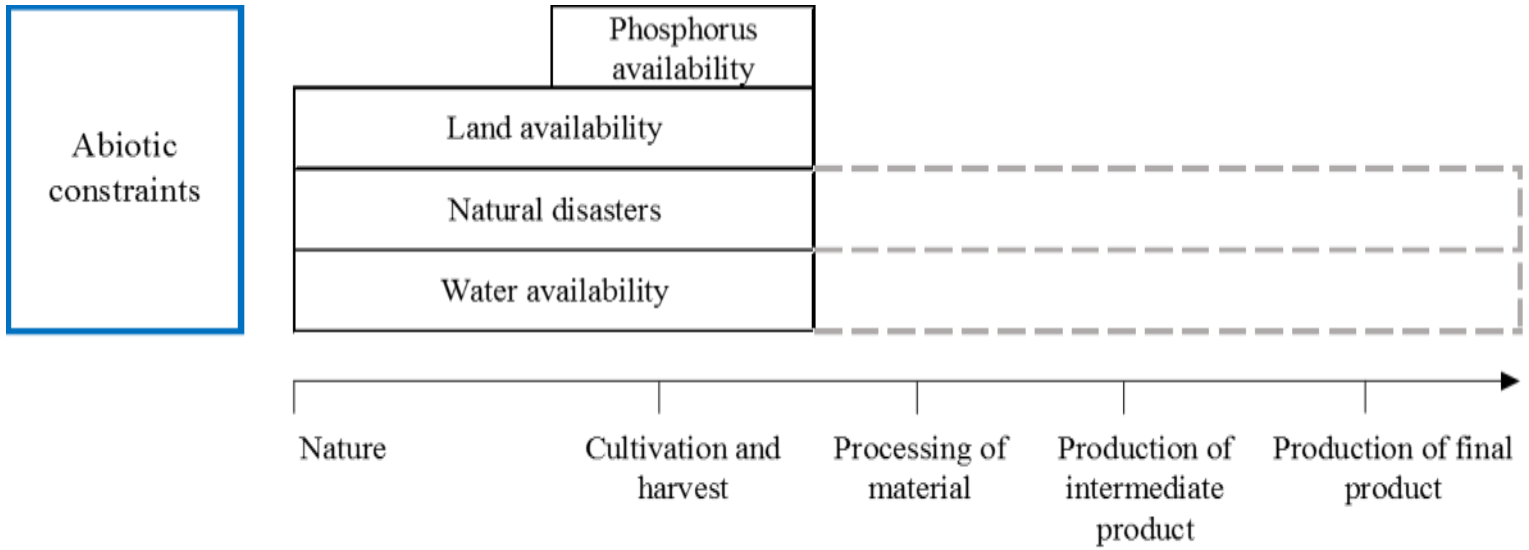




BIRD method to assess availability constraints (5)

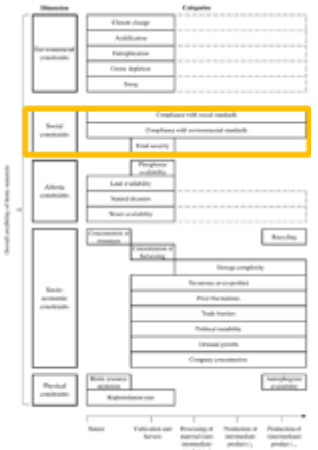
- Considering the entire supply chain
- 5 dimensions are taken into account:
  - Physical constraints
  - Socio-economic constraints
  - Abiotic constraints: abiotic factors influencing species grow

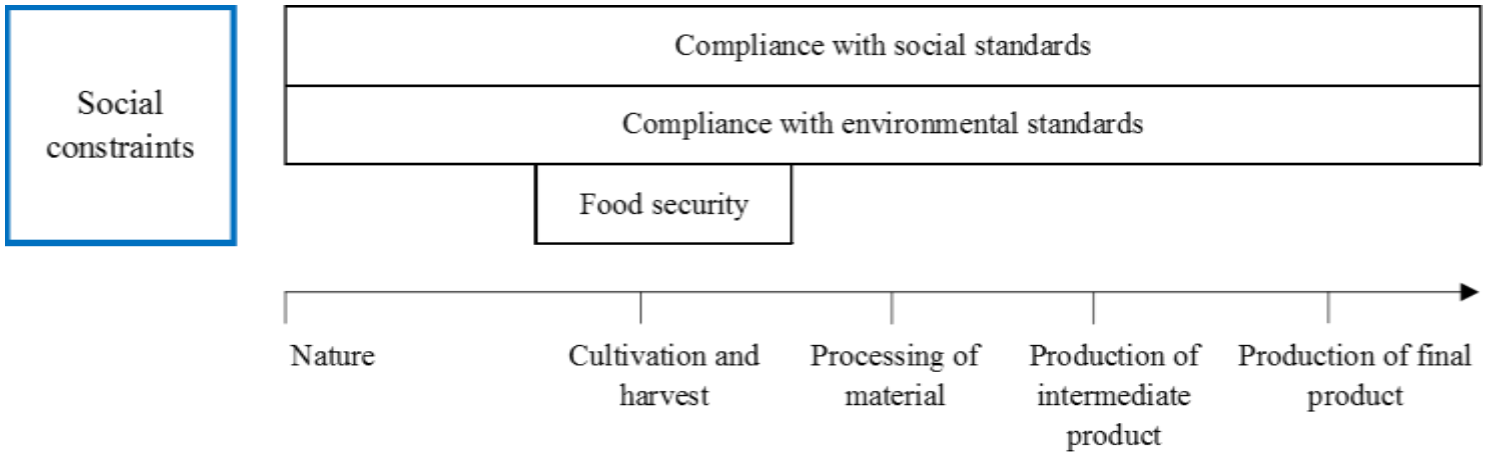




BIRD method to assess availability constraints (6)

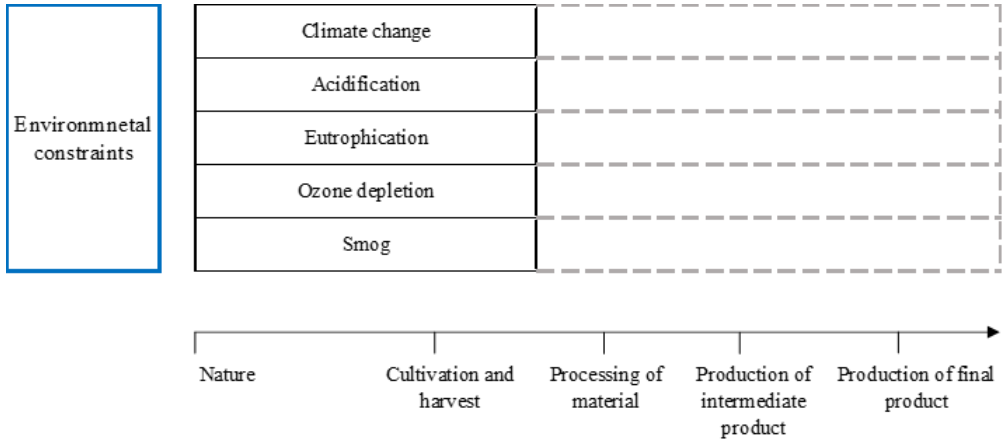
- Considering the entire supply chain
- 5 dimensions are taken into account:
  - Physical constraints
  - Socio-economic constraints
  - Abiotic constraints
  - Social constraints: societal acceptance with regard to food security and compliance with standards





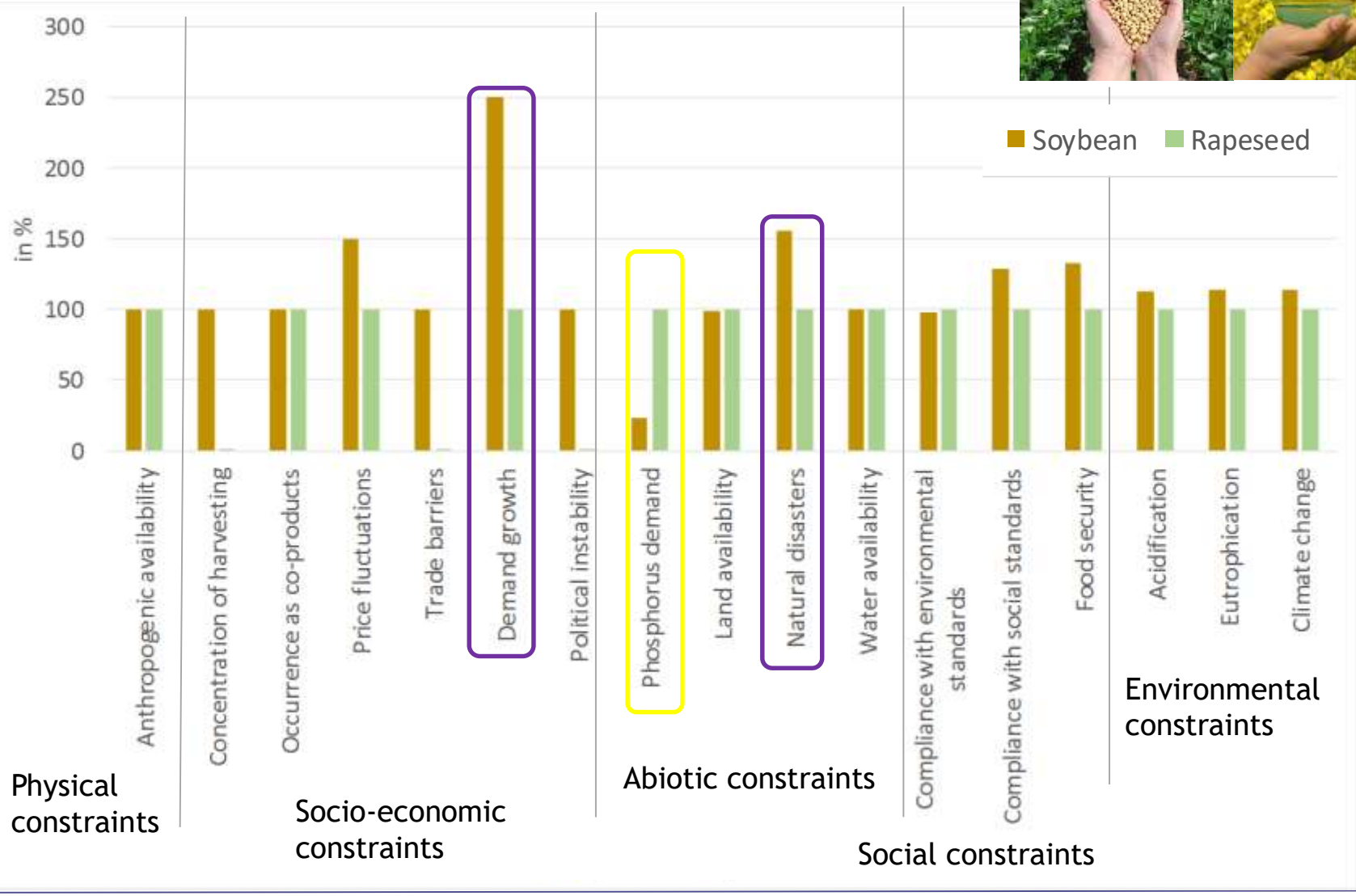
BIRD method to assess availability constraints (7)

- Considering the entire supply chain
- 5 dimensions are taken into account:
  - Physical constraints
  - Socio-economic constraints
  - Abiotic constraints
  - Social constraints
  - Environmental constraints: environmental impacts can lead to changes in ecosystem and ESS



Case study for biofuel

- Comparison of soybean and rapeseed (1 l biodiesel)



Conclusion and outlook

Research question: How can the availability of bio-based materials be assessed in product design?

- BIRD methodology can comprehensively assess availability constraints, environmental & societal impacts of bio-based materials
- BIRD can be implemented in LCA and related eco-design approaches
- By enhancing eco-design assessment of bio-based materials a contribution to the circular economy strategy is provided

- However, more case studies should be carried out to test the applicability of the method and the validity of results
- In order to increase methodological robustness, some indicators should be refined, e.g. replenishment rate by considering approach from Crenna et al. (2017)

Thank you!

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