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Rethinking circularity in bioeconomy:

What are the promising development directions for the circular use of bioresources?

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About the state-of-the-art

- Insufficient investments into green energy generation lead to hikes in the production of non-renewable energy production and energy prices.
- Retaining the value of bio-based products throughout the circular bioeconomy loop can be a challenge as bioresources – unlike metals and other minerals – degrade.
- The dominance of short-term objectives over medium- and long-term goals affects sustainability.
- Participation in the circular bioeconomy is inevitable in the long-term.

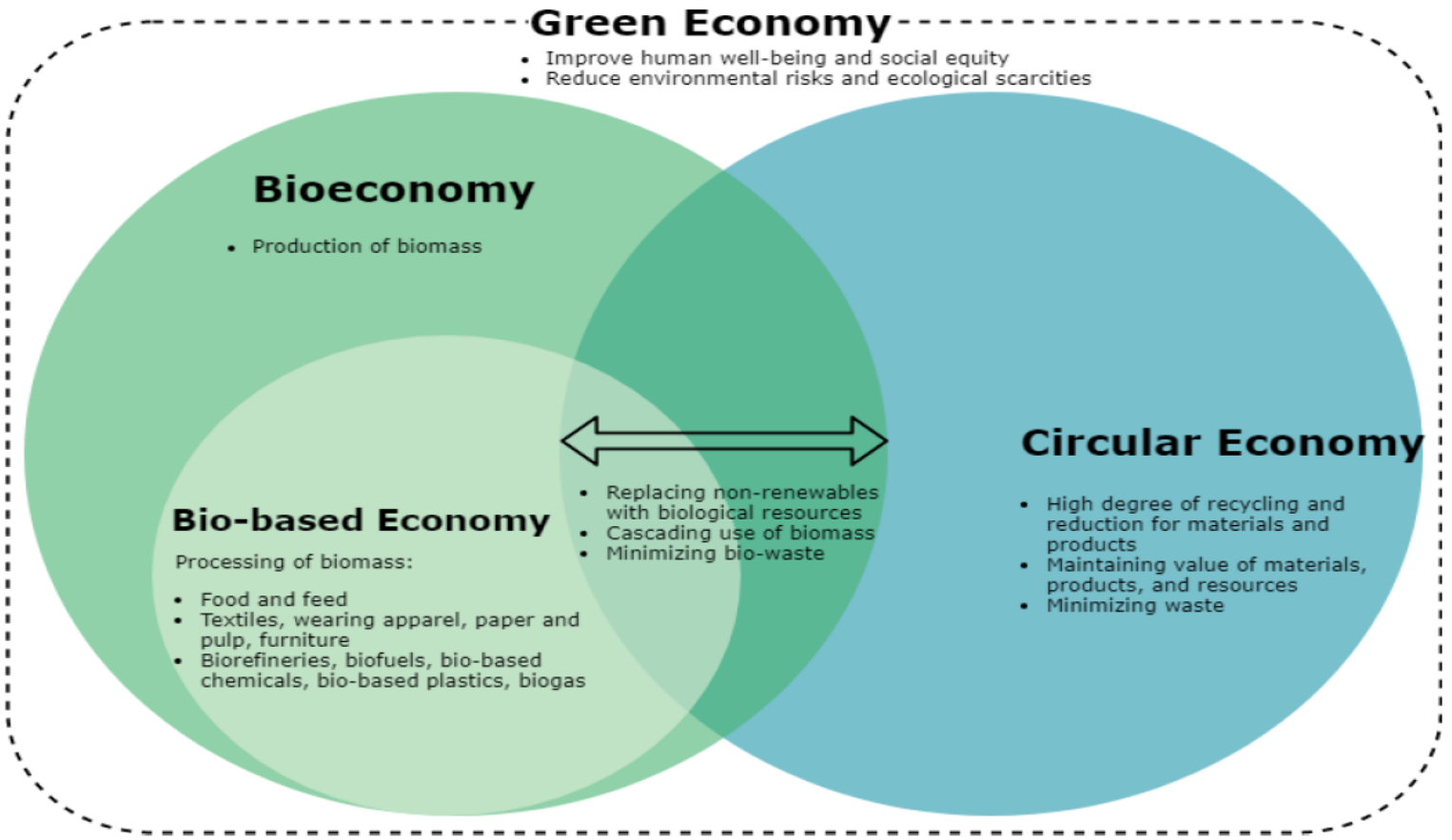
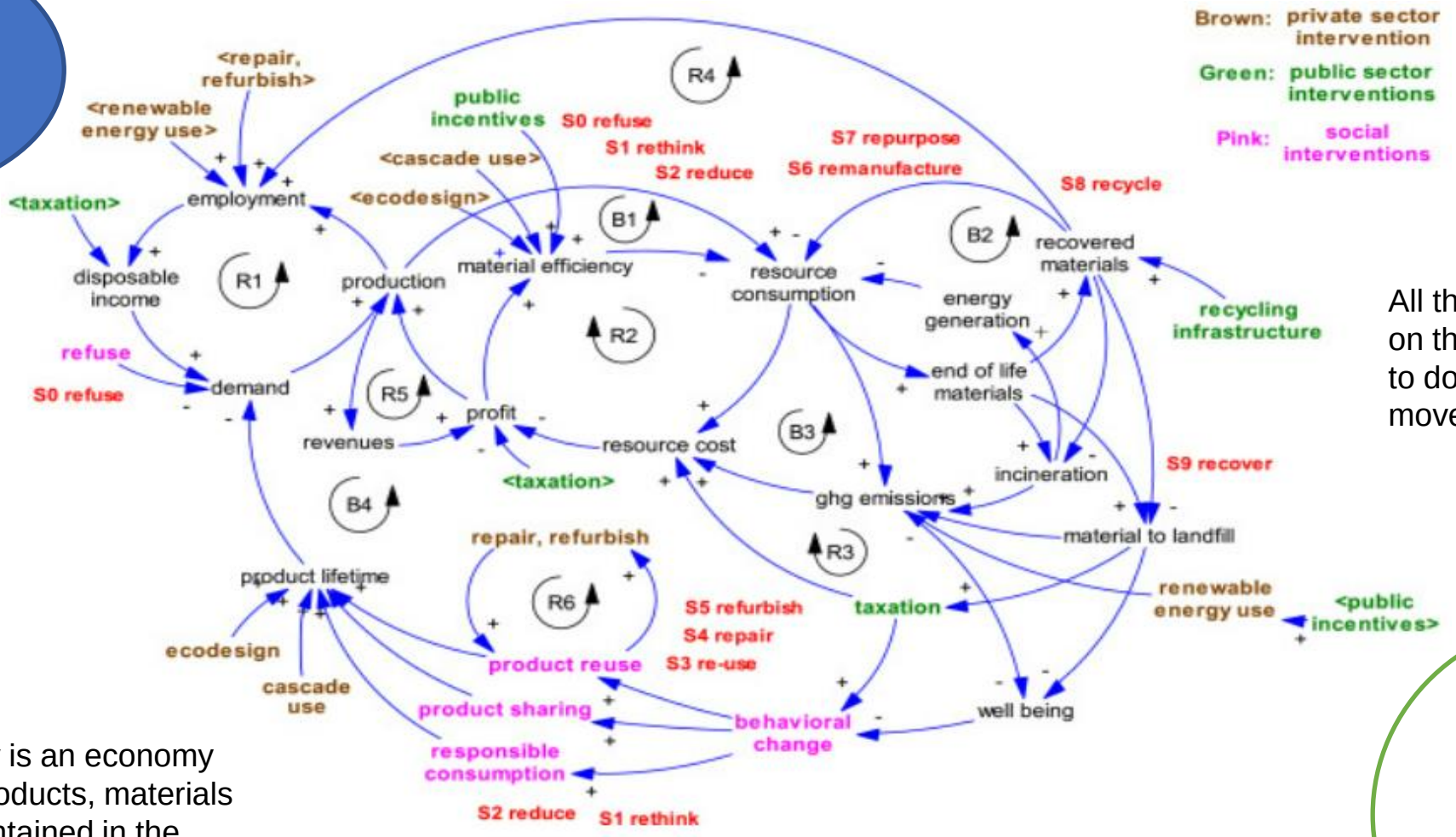


Figure 2. Relations between bioeconomy, bio-based economy, green economy, and circular economy.

Source: Kardung, M.; Cingiz, K.; Costenoble, O.; Delahaye, R.; Heijman, W.; Lovrić, M.; van Leeuwen, M.; M'Barek, R.; van Meijl, H.; Piotrowski, S.; Ronzon, T.; Sauer, J.; Verhoog, D.; Verkerk, P.J.; Vrachioli, M.; Wesseler, J.H.H.; Zhu, B.X. Development of the Circular Bioeconomy: Drivers and Indicators. Sustainability 2021, 13, 413. https://doi.org/10.3390/su13010413

How to transition towards the CBE and what are the triggers?



All the pieces are already on the table. All that is left to do is to make the right moves.

Circularity?

The circular economy is an economy where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised.

Changes in mindset, values
…
System thinking
…
Building business from waste!

Source: Bassi, A. M., Bianchi, M., Guzzetti, M., Pallaske, G., Tapia, C. (2021). Improving the understanding of circular economy potential at territorial level using systems thinking. Sustainable Production and Consumption, 27, 128–140. https://doi.org/10.1016/j.spc.2020.10.028

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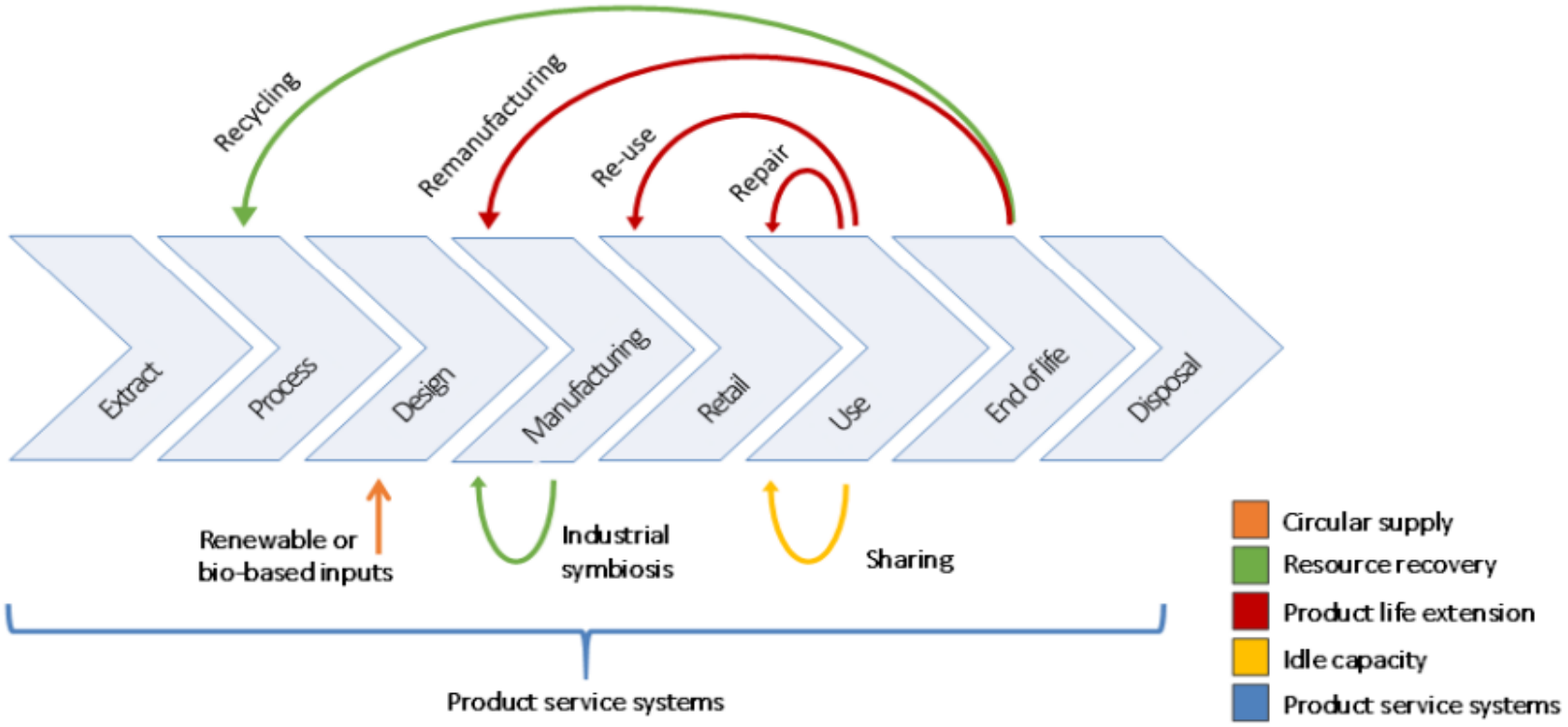
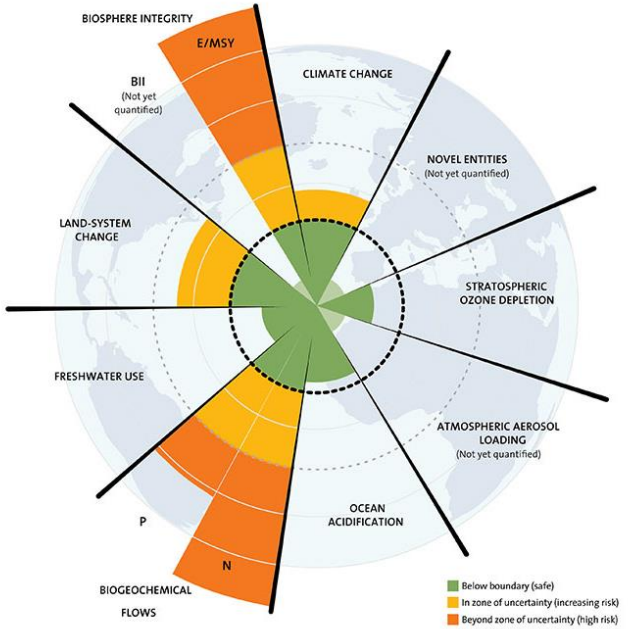
Figure 13. Circular business models help close material loops and reduce material throughput



Source: (OECD, 2019[32])

- Using renewable or bio-based inputs also leads to decarbonisation and the phase-out of fossil resources, which decreases humanity's GHG emissions.
- Waste and wastewater have untapped potential as both can be treated to cycle nutrients and carbon back into the agri-food system.
- Cascading value chains make use of leftover resources from previous links in biorefineries.

Circular business models and cascading resource use enables the humanity to remain within planetary boundaries.



Sources: https://www.oecd.org/env/waste/OECD-G20-Towards-a-more-Resource-Efficient-and-Circular-Economy.pdf, https://www.stockholmresilience.org/research/planetary-boundaries/the-nine-planetary-boundaries.html

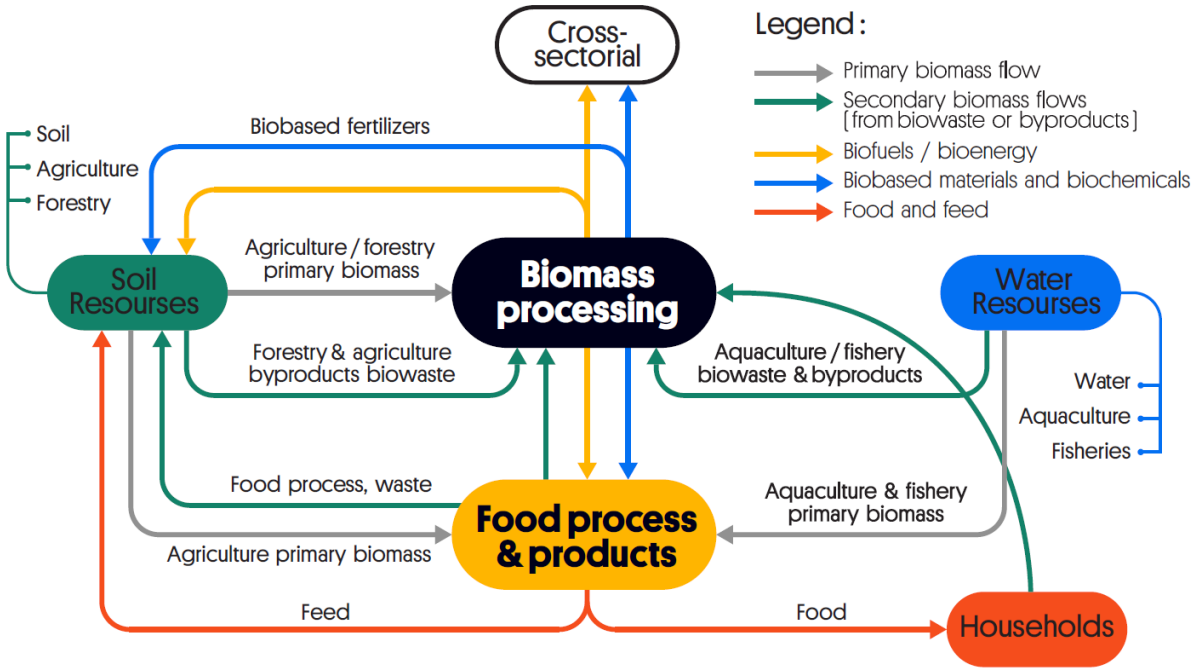
How to reach the circular bioeconomy?

- Develop and foster the local and regional governance of the circular bioeconomy.
- Use the multi-level governance approach.
- Involve stakeholders by utilising participatory methods.
- Identify and use the relevant drivers and triggers.
- Carry out knowledge-transfer programmes to improve community and consumer awareness, education and use science-based communication.
- Digital innovation brings gains in efficiency and has a transformational effect.

Figure 19. The governance of the circular economy in cities and regions: A Checklist for Action

Source: (OECD, 2020[37])

Circular bioeconomy as a system



PRINCIPLES OF THE CIRCULAR BIOECONOMY:

- Biomass that is derived from water and soil must be managed sustainably
- Closing the loops: circular flows should be established by harnessing the potential of biowaste and byproducts with high value from different industries
- Industrial symbiosis enhancing bio-circularity
- Fostering food security
- Implementing the use of the biomass cascade, reducing waste production
- Enhancing resilience in our economies
- Resource efficiency and value chain optimization

Source: https://bioeast.eu/wp-content/uploads/2021/10/BIOeast-Report-2021_FINAL_compressed-1.pdf

Challenges of the circular use of bioresources (1)

- One of the foremost challenges about the use of bioresources in the circular economy as a system is the lack of information about available biomass residues, their nature, quantity and location.
- In combination with scattered sources of biowaste, organising the logistics is difficult and expensive – on-site processing is preferable.
- Generational differences in the perspective of entrepreneurs affect the outlook of utilising novel ways to valorise biomass.
- Hurdles and hardships tend to overshadow positive examples of the circular bioeconomy practices.
- Fostering inter- and transdisciplinary cooperation is difficult due to insufficient knowledge and practice.
- We need to use the economic and social incentives to increase the storage of materials and products in the circular economy and avoid the creation of residues and thus reducing the need to extract various raw materials.
- Creating a regulatory system that promotes recycling bio-waste and certifying the products to improve the producers' confidence and assure consumers of their quality, is important.
- Viewing leftover biomass and lower value bioresources as a viable input for energy production in combination with energy-saving technologies.

Challenges of the circular use of bioresources (2)

- Acknowledging agricultural producers as possible processors of biomass in decentralised biogas production facilities – biogas can be further processed into biomethane.
- Understanding the incentive structure of biomass producers.
- Developing the technology and certification process is important. For examlpe to use fish meal and fish oil for fish and livestock feed.
- Adopting cascading resource use practices and developing biorefineries is significant. For example in the forestry sector.
- Identifying the ownership of biowaste and the factors that would promote owners to offer or sell it to the downstream processors.
- Mapping the by-products and residues flows – places of origin, quantities and current use – of bioresources to analyse the potential processing solutions, valorisation potential and profitability is crucial.
- The research development of algae use as a biomass is promising.

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Thank you for listening!

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