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3s3 Supply chain transition: managing tools and sustainability assessment of innovations

Defining circular economy principles and indicators for biobased products

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There is an urgent need to take measures to decouple economic growth from resource use, increase resource efficiency and stimulate a more sustainable production and consumption system. The increase in use of biomass as a renewable resource for bioeconomy should also go together with a more circular use of biomass. To be able to monitor this transition we need circularity indicators for biobased products. This will be crucial for providing science-based evidence to formulate business strategies and for policy decision making on the most optimal use of biomass. Circular economy metrics are yet at the initial stage of development and have a focus on abiotic resources. The considerations made so far for biotic resources are mostly limited to food loss, renewable energy use and recycling of biowaste. This study aims to capture other important aspects such as the use of biobased products in the technical cycle and the extent the quality of biomass is retained in use and subsequent cycles. For this we first define circular economy principles for biobased products which are: 1.Reduce reliance on fossil resources, 2.Use resources efficiently (including multi-output production), 3.Value wastes and residues, 4.Regenerate (maintain carbon and nutrient cycles), 5.Recirculate, 6.Extend the high-quality use of biomass (including cascading use). There are indicators required to measure the performance of the biobased product systems according to these circularity principles and also to measure the potential trade-offs such as risk of accumulation of hazardous substances, and impact on GHG emissions and sustainability (economic, environmental, social). We are working on defining these indicators and how to assess them also taking into account indicators available from literature. The physical and chemical structure of the biomass determine its quality, the production process dictate the extent the original structure is conserved. The recycling process and quality of secondary material dictate whether it is possible to use it again in the same application or its needs to be downcycled. Therefore, there is a strong need to take into account functional use of biomass and conservation of functionality in the circularity assessment.

Keywords: Biobased products, circularity indicators, cascading use, resource use efficiency, recycling