Project *brief*

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Systematic Bioeconomy Monitoring (MoBi)

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- **The presented concept provides a methodological basis for monitoring the transition from a fossil-based to a bio-based economy. We are able to monitor biomass flows and relevant economic sectors and to assess sustainability effects of bioeconomy.**
- **Currently traditional uses of biomass account for largest shares of German bioeconomy. Effects of substituting fossil resources and materials are only slowly becoming traceable.**
- **For sustainability assessment, dedicated sustainability goals must be agreed upon and prioritized.**

Background and aims

Substitution of fossil by renewable resources is an important step towards a more sustainable bioeconomy. The Federal Government of Germany wants to know how far Germany has already transitioned to a bio-based economy and how sustainable the transition is. Thus, in 2016 the Federal Government initiated a comprehensive bioeconomy monitoring[4]. As part of this initiative the project MoBi focused on resource base and sustainability of an increased use of renewable resources. Objectives of MoBi were:

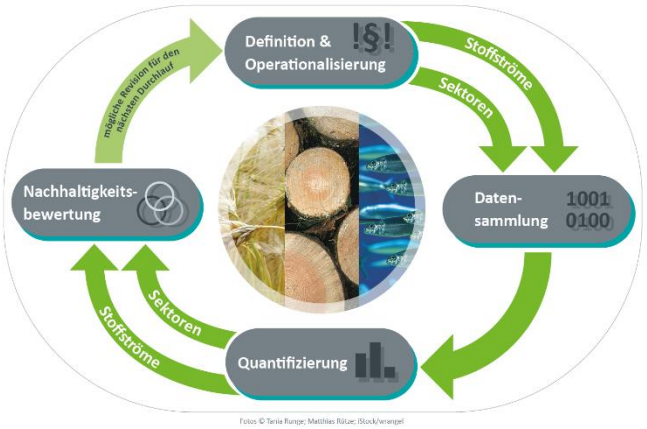
- Conceptual definition of the term 'bioeconomy' and delimitation within the economic system.
- Identification and quantification of relevant agricultural, forest-based and aquatic biomass flows.
- Development of a dedicated concept for monitoring German bioeconomy.
- Assessment of sustainability effects caused by biomass use.

The monitoring concept

The monitoring concept is set up to assess the German bioeconomy periodically, e.g. annually, following the procedure depicted in Fig. 1. Defining the term 'bioeconomy' is an indispensable requirement for starting a monitoring period as this term is subject to an inconsistent understanding that may also change. This definition then provides the basis for selecting relevant material flows and economic sectors. In the next steps, available data is collected and material flows as well as bio-based shares of sectors are quantified. Finally, sustainability effects are assessed in relation to the previously specified sustainability goals. The sustainability assessment covers two complementary approaches: material flow-based and sectoral assessment.

Material flows describe the course of biomass from production (harvest or catch) via its processing to final uses and recycling. This material flow-based monitoring provides the basis for a detailed analysis and assessment of sustainability effects of bio-based products and their value-added chains. Such analysis is suitable to assess if a new bio-based product is more sustainable than its fossil-based counterpart with the same functionality.

Figure 1: Monitoring procedure scheme



Source: Thünen Institute/own display (2019).

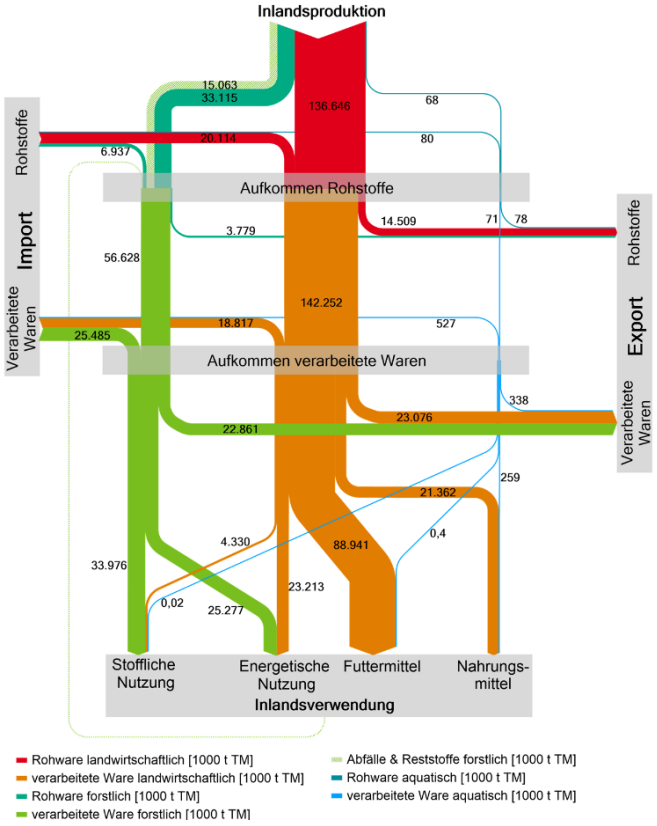
However, the approach requires detailed data that is not available for all bio-based products and related material flows. Considering the vast diversity of bio-based processes and products, a material flow-based assessment of sustainability effects fully covering bioeconomy is not feasible.

Thus, the sectoral monitoring approach does not aim at this level of detail, but assesses bioeconomy effects at a more aggregated national level. Consequently, it is possible to relate bioeconomy as a whole and its development over time to the total economy, selected sectors or even other countries. The sectoral assessment is also designed to be related to international frameworks like the United Nations Sustainable Development Goals. Last but not least, sectoral assessment of sustainability effects provides important key figures for political steering of bioeconomy.

Key findings

Figure 2 shows the first comprehensive representation of all biomass flows of the German Bioeconomy for the reference year 2015. It is obvious that agriculture produces the largest amount of biomass. Also, the diversity of different biomasses is highest in agriculture. The most important final use of agricultural biomass is the use as feed. Wood however, currently is the most important biomass for material uses.

Figure 2: Aggregated material flows of German bioeconomy (2015)



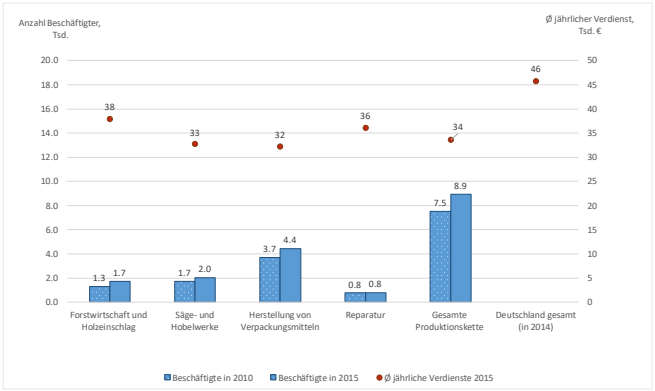
Source: own display (2020).

The sectoral assessment of bioeconomy includes the quantification of bio-based shares of economic sectors. In 2015 bio-based shares were highest in manufacturing food and feed and in traditional processing and use of wood. Currently, substitution of fossil by renewable resources in the chemical or textile industry is not traceable according to the bio-based shares of these sectors.

Gross value added is a widely acclaimed indicator of sectoral sustainability assessment. In Germany, gross value added of bioeconomy amounts to 5-6% of the total gross value added. Roughly half of bio-based gross value added is generated in manufacturing, followed by food and beverage industries (16-17 %), and agriculture, forestry and fisheries (15-17 %). About 3.0-3.6 million persons are employed in bioeconomy sectors. This represents 8-9 % of all persons employed in German economy. Of this, 39-45 % are employed in manufacturing, 27-33 % in food and beverages industries and 13-16 % in agriculture, forestry and fisheries.

Material flow-based sustainability assessment is conducted as a combination of material flow and life cycle assessment. The assessment is done in reference to so-called core products and was developed for the example of wooden flat pallets. Figure 3 shows the results for social effects. In 2015 8,900 persons were employed in production and repair of wooden flat pallets. In 2010 7,400 persons were employed. The average annual income of the complete value chain amounted to 34,000 Euro in 2015.

Figure 3: Persons employed in 2010 and 2015 and average annual earnings of full-time employees associated with the process steps of softwood lumber material flow and its core product wooden flat pallets in 2015.



Source: own calculations.

As a closing remark we would like to stress that neither bioeconomy nor sustainability are subject to a coherent understanding among the different stakeholder groups. Thus, we strongly recommend to start each monitoring cycle by finding a common understanding and definition of bioeconomy. Furthermore, bioeconomy and sustainability objectives must be selected and prioritised. The methods and tools presented here allow adjusting the monitoring to changed societal perceptions, market development and political processes and therefore provide the basis for periodically monitoring bioeconomy and its effects.

Further information

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Publications

Iost S. et al. (2020) Setting up a bioeconomy monitoring: resource base and sustainability. Thünen Working Paper 149 DOI:10.3220/WP1593762669000

[4] **Bringezu S. et al.** (2020) Pilotbericht zum Monitoring der deutschen Bioökonomie. DOI:10.17170/kobra-202005131255

Schweinle J. et al. (2020) Monitoring Sustainability Effects of the Bioeconomy: A Material Flow Based Approach Using the Example of Softwood Lumber and its Core Product EPAL 1 Pallet. Sustainability 12(6): 2444

Iost S. et al. (2019) German Bioeconomy: Economic Importance and Concept of Measurement. GJAE 68(4):275