

BIOECONOMY: RESEARCH IN SUPPORT OF SUSTAINABLE TRANSFORMATION AND DEVELOPMENT

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The future of humankind depends on a secure, and sustainable availability of food, energy, water, and industrial raw materials with safe and healthy properties. In order to achieve transformation toward such sustainability, economies must be more and more based on renewable resources including bio-based materials, i.e. whole economic systems need to become “biologized”. Productivity in such a scenario will increasingly depend on science and innovations around bio-based production and processing technologies. This puts the knowledge-based bioeconomy at the center of an economic strategy that aims to reconcile humanity with nature.

The Bioeconomy is envisioned to entail knowledge-based production and utilisation of biological resources, innovative biological processes and principles to sustainably provide goods and services across all economic sectors. Bioeconomy is not free of conflicting goals and these need to be considered in research. Moreover, bioeconomy is much more than using biomass for energy. It embraces the sustainable management of ecological systems, understands land, forests, and soils as fragile resources that provide wealth through ecosystem services. It learns from nature by employing biomimicry, and utilizes biosciences to transform established economic sectors, such as chemical

industries, pharmaceuticals, food, and construction into sustainable ones. Biologization will increasingly be connected with digitalization of society and – if well designed – the two can shape innovation for sustainability.

ZEF research and policy engagement with partners make significant contributions to bioeconomy concepts and implementation for some time already, and increasingly so over the past five years. Bonn University has recently identified bioeconomy research as a strategic area for sustainable development. The bioeconomy has been rapidly expanding during the past ten years, driven by increased prices of natural resources, such as land and water, by new technological opportunities, and by changed consumer preferences. The Paris Agreement on climate change lent further impetus to investment in a sustainable bioeconomy.

A first Global Bioeconomy Summit in Berlin in November 2015 was testimony to the accelerated worldwide initiatives in this field. A second Bioeconomy Summit is scheduled for April 2018. The advancing of bioeconomy is now actively pursued in about 50 countries worldwide, and demand for research partnerships increases rapidly.

‘Biologisation’ of the economy addresses both, the efficient

use of biological resources in the production of materials and products, and the sustainable use of renewable biological raw material instead of fossil carbon sources for industrial processes. A knowledge-based and sustainable bioeconomy contrasts with current exploitative use of biological and other natural resources, and related effects on water, soils and climate which threaten the future of humankind and earth systems. Bioeconomy is expected to play an increasing and decisive role in addressing some of the grand challenges faced by society, and at least six of the Sustainable Development Goals (SDGs) require a bioeconomy approach to be realistically achieved. Transformative impact of bioeconomy is required specifically for addressing these challenges:

- Growing population and higher living standards, leading to increased demand for food, animal feed, fiber for clothing, material for housing, water, energy, health services, etc.;
- Declining resources - e.g. degraded ecosystems and loss of ecosystem services, including land degradation and unsustainable ocean fisheries, declining biodiversity – due to unsustainable management practices –, and the effects of climate change on resources;
- Adapting to limitation in fossil resources by providing a meaningful



substitution of the consumption of such finite resources by the use of bio-based and other renewable resources;

- The move to production systems that reduce and recycle waste streams or strategies where “waste” is designed to act as a bio-resource for further biological processes.

The expansion of world biofuel production in recent years is indicative for a bioeconomy in the making, but this particular sector has initially not dealt sufficiently with its negative side effects for food security, landscapes and the environment. The biofuels aberration teaches that sound policy impact analysis has to precede hasty policy action. Biomass has to be used judiciously for food, energy and industrial products, appropriately adjusting to the local context. This includes (1) bioscience-based crop breeding technologies for a resource efficient and climate smart food system as well as (2) behavioral change to reduce excessive consumption and waste of food and biomass. Both contribute to multiple SDG dimensions, including health, and fundamentally require cross-disciplinary research. A challenge for bioeconomy policy is that it cuts across sectors, while policy is mostly designed along sectoral pillars, such as agriculture, energy, health, and environment. A nexus approach coherently cutting across sectors is needed for governance of the bioeconomy.

Bioeconomy needs development partnerships. Germany has been a front runner in bioeconomy research and policy action and is well positioned now to partner with emerging economies in this critical area of transformative innovation. Africa, for instance, is rich in biomass resources and has growing science capacities. Bioeconomy strategies need to be job creating in emerging economies. With improved value chains in Africa, a bioeconomy strategy promises job generation and poverty reduction and thereby supports pro-poor development. Yet, there are risks if poor communities' rights to land and water are not protected, which is also an area for research advising development policy. Science and technology cooperation between emerging economies and Europe can support internationally coherent bioeconomy strategies. Reconciliation of African food security goals with bioeconomy is a matter of technological and institutional innovations that accelerate sustainable growth in African agriculture.

Bioeconomy must ultimately be understood in a context of needed societal, technological, and economic change for sustainability. The essence of such change is not just technological (new science) and behavioral (adjusted consumption), but the central issue may very well be institutional, i.e. providing long-run

incentives for sustainable farming, sound bio-resource management and industrial development. The governance of this process must be just and fair, as well as stakeholder-specific, focusing for example on research system capacities, industry patterns and potentials, or federal and local policy orientations. Instead of aiming for a unified concept of bioeconomy governance, principles of justice in resources access and good bioeconomy governance must be developed. In particular, many costs and benefits of bioeconomic transformations tend to accrue as externalities, hence the need for smart public policy and standard setting, yet another area on ZEF's research agenda.

Sources

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