

BIOECONOMY: SHAPING THE WORLD TOWARD A SUSTAINABLE PLANET

Task Force 2 - S20 Brasil 2024

This is a Chair's summary of S20 Brasil 2024 discussions; the positions are not necessarily shared by all S20 members.

Preamble

In September 2015, at the United Nations Headquarters, representatives of 193 countries approved a global agenda to be achieved by 2030. The signatory countries recognized that to make our planet suitable for sustainable living, we urgently need to take action on the 17 Sustainable Development Goals (SDGs). Among the most important identified was eradicating poverty in all its forms and dimensions, including extreme poverty, which is the greatest global challenge and an indispensable requirement for sustainable development. Bold and transformative measures were outlined, with our governments committing to embrace them to steer the world towards a sustainable and resilient path. These actions are integrated and indivisible and must balance the three dimensions of sustainable development: social, economic, and environmental. Science and international scientific collaboration serve as key mechanisms to reach these goals. With this standpoint, under the motto "Science for Global Transformation", the S20 Academies of Sciences met in Rio de Janeiro in 2024, and focused the discussions on five themes related to the UN 2030 Agenda: (1) Artificial Intelligence; (2) Bioeconomy; (3) Energy Transition Process; (4) Health Challenges; and (5) Social Justice.

We present to the G20 governments and society the S20 Brasil 2024 recommendations with the expectation that these will be considered by our governments and help guide the final document of the G20. We also draw attention to the fact that G20 countries should consider their demographic trends, proactively anticipating and adapting to changes in their workforce size and age distribution, as these factors will significantly impact social security, pension systems, health and welfare programs, thereby affecting economic growth and competitiveness. It is essential for the educational system to address the diverse needs of both aging and youthful populations. Grasping social and demographic trends is essential for anticipating technological requirements and driving innovation.

Introduction

The Earth is arriving at a point of no return in the 21st century concerning:

- a) Climate changes related to the impact of greenhouse gas emissions from fossil fuel, burning and anaerobic fermentation of biomasses, uncontrolled combustion of plastic waste, municipal as well as industrial wastes, soil degradation, methane gas from the paddy soil and from livestock, and the use of nitrogen-rich soluble fertilizers.
- b) Loss of biodiversity from habitat destruction, pollution, climate change, agricultural pressure on land usage and industrial activity.
- c) Global economic dependence on depleting natural resources.
- d) Ever-increasing consumption of industrial goods and packaged consumables produces megatons of non-recyclables with negative impacts on human health, clean water, soil and aquifer health, and the environment.

Historically, biodiversity conservation has contrasted with an economic model based on the exploitation and extraction of natural resources. Responding to this, researchers from various academic fields have modeled alternative forms of development. These efforts coalesce around a still-evolving concept: bioeconomy.

According to the Food and Agricultural Organization (FAO), bioeconomy is the production, use, conservation, and regeneration of biological resources to provide sustainable solutions within and across all economic sectors. Examples include the production of vaccines, industrial enzymes, fertilizers, biofuels, medicines and cosmetics, bioproduction of cement and concrete, upcycling of organic waste and production of industrial chemicals in biological organisms, among many other examples.

Different countries have unique biomes and production challenges, leading to varied definitions of bioeconomy. However, G20 countries share common goals in this field, such as: 1) integrating bioeconomy in national plans of development; 2) improving biotrade practices through a fair and equitable sharing of benefits; 3) sharing successful methodologies and metrics nationally, regionally, and internationally; 4) financing solutions that assist countries efforts to meet the UN's sustainable development goals; and 5) ensuring inclusive and socially just bioeconomy that benefits local and indigenous communities.

Concepts of Bioeconomy

The bioeconomy programs and policies of G20 countries vary in terms of regional technological, social, and economic development. However, they share key aspects: a focus on environmental conservation and improving the well-being of global and local communities. The following cases illustrate this:

- The European Commission defines bioeconomy as “the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy”¹.
- In the United States, bioeconomy can be defined as “the portion of the economy based on products, services, and processes derived from biological resources (...)”. Executive Order 14081 prescribes a “whole-of-government approach to advance biotechnology and biomanufacturing towards innovative solutions in health, climate change, energy, food security, agriculture, supply chain resilience, and national and economic security”².
- Germany defines bioeconomy as “the production, exploitation and use of biological resources, processes and systems to provide products, processes and services across all economic sectors within the framework of a future-oriented economy”³.
- The Italian Committee for Biosafety, Biotechnology and Sciences of Life defines bioeconomy as a system for “integrating the sustainable production of renewable biological resources and converting these resources and waste streams into value added products such as food, feed, biobased products and bioenergy”⁴.
- India’s draft definition of bioeconomy is that “comprising all economic activities that depend on biological resources and their derivatives, including bio-waste/by-product(s), to provide products, processes, and services across sectors while promoting environmental sustainability, social and economic growth”.
- South Africa’s Bioeconomy Strategy defines the bioeconomy as: “activities that make use of bio innovations, based on biological sources, materials and processes to generate sustainable economic, social and environmental development”⁵.
- A survey carried out by the Center for Strategic Studies and Management (CGEE), from Brazil, led to the understanding that bioeconomy is “the economy based on generation of sustainable bio-based products, processes and services, food, feed, health, and bioenergy. Modern bioeconomy emerges as a new paradigm of development needed to ensure the sustainable development of life on Earth (...)”⁶.

¹ Publications Office of the European Union - Blue Bioeconomy Forum (<https://op.europa.eu/en/publication-detail/-/publication/c8b2f69f-4314-11ea-b81b-01aa75ed71a1/language-en>).

² Congressional Research Service - White House Initiative to Advance the Bioeconomy, E.O. 14081: In Brief (<https://crs-reports.congress.gov/product/pdf/R/R47274>).

³ The Federal Government - National Bioeconomy Strategy (https://www.bioeconomy-international.de/lw-re-source/datapool/items/item_169/summary_bioeconomy_strategy.pdf).

⁴ Bioeconomy in Italy - A unique opportunity to reconnect the Economy, Society and the Environment (https://www.agenziacoesione.gov.it/wp-content/uploads/2019/06/bioeconomia_eng.pdf).

⁵ The Bio-Economy Strategy of South Africa (https://www.gov.za/sites/default/files/gcis_document/201409/bioeconomy-strategya.pdf).

⁶ The Brazilian Center for Strategical Studies (CGEE) - Bioeconomy in the Americas 2030 (https://www.cgee.org.br/documents/10195/734063/3445_Bioeconomy+in+the+Americas+-2030.pdf).

Taking in consideration these definitions and its shared qualities, we strongly recommend that bioeconomy models must aim to meet certain criteria:

- 1) **Conserve and protect natural resources and support restoration efforts.** The natural resources present in any biome are the result of long geo-evolutionary processes (e.g., ecosystem development and soil formation). These processes form the basis for sustainable production chains and the regeneration of terrestrial and marine ecosystems.
- 2) **Adopt appropriate technologies.** Efficient use of natural resources requires tailored technologies that address key production bottlenecks without harming the environment.
- 3) **Engage indigenous and local communities and prioritize their well-being.** In order to address regional inequalities, it is fundamental to recognize the vital role of these communities in maintaining and conserving biodiversity and involve them in decision-making processes.

Based on the above, we propose the following definition that highlights the common ground of these strategies: “The bioeconomy is based on the supply of goods derived from renewable biological resources (biobased products, food, feed, bioenergy, health supplies and pharmaceuticals) comprising traditional knowledge and practices, and in line with the United Nations Sustainable Development Goals”.

Recommendations for Bioeconomy

By strengthening the converging efforts within the diversity of strategies, G20 countries can promote innovative solutions to support biodiversity, improve soil health, minimize pollution, and optimize climate change adaptation and mitigation yet fostering economic growth and prosperity. To realize this potential, we strongly advocate that the following recommendations are adopted:

1. Research and Infrastructure Investment

- a) Promote bioeconomy innovation in biogenic feedstocks is critical to the transition from fossil energy to a biological way of “harvesting the sun” to produce bioenergy.
- b) Actively promote and apply energy-saving, emission-reducing, and environmentally friendly green technologies to reduce resource consumption and environmental pollution during production.
- c) Integrate circularity as a part of a systems approach.
- d) Invest in new sources of food, energy, chemicals, medicines, and other materials derived from biomass, forest, plants and microorganisms from native biodiversity in different biomes.
- e) Stimulate innovations in the global agrifood system for new inputs, such as biofertilizers, biological control, pollination, crop protection, traceability, and post-harvest.
- f) Promote sustainable use of wood and bamboo with advanced technological and design innovations for building, construction, green energy and green chemicals.
- g) Through satellite imaging combined with the use of local technologies and methods, enable the monitoring of changing landscapes and of activities that could undermine food security and/or lead to the destruction of natural resources, such as illegal mining.
- h) Integrate biodiversity research and inputs on Earth Systems Governance to generate a better assisted use of ecosystem services providers as pollinators, seed dispersals and biological control agents.
- i) Increase support for local research institutions and enterprises to encourage them to develop technologies suitable for local environments and production needs.

2. Integration of Social Justice

- a) Promote sustainable and inclusive bioeconomic models, ensuring equitable distribution of resources and benefits and improving the well-being of local communities.
- b) Prepare human resources for the challenges of the future by developing and equipping those involved with new skills shaped by transdisciplinary approaches.

- c) Engage local communities to advance responsible research and build close cooperation to jointly develop and implement sustainable development plans, ensuring community participation in decision-making.
- d) Enable community-driven innovations that respect and integrate traditional knowledge and culture.
- e) Focus on leveraging local biological resources to promote regional economic growth and to improve carbon footprint by reducing emission and increasing carbon storage.

3. International and Multilateral Cooperation

- a) Strengthen international collaboration to share the multidisciplinary knowledge between the natural, technological, and socioeconomic sciences to understand the radical changes that the bioeconomy requires.
- b) Create a G20 policy framework that enables countries to implement bioeconomy programs that improve quality of life by investing in translational social and technological innovations.
- c) Additionally, this G20 policy framework must accelerate the involvement of startups, philanthropic and venture capital to develop innovative solutions for the bioeconomy.
- d) Strengthen natural resource protection and restoration efforts through strict legal and policy frameworks to combat illegal mining and environmental degradation.
- e) Support and invest in ecological restoration projects such as reforestation and wetland restoration.

Final Remarks

By uncovering the mechanisms of interaction between living beings in different biomes, we can develop bioproducts, bioenergy, ecotourism, and biotechnologies. This knowledge enables tailor-made strategies for each biome to maximize production and support the livelihoods of global and local communities. However, these solutions require transnational cooperation to secure natural resources, prevent ecosystem degradation, reduce the effects of non-native species, and support restoration efforts. The G20 needs a coordinated policy effort on bioeconomy as a strategy for addressing climate change, poverty, and human and animal challenges.