



G20 Initiative on Bioeconomy (GIB)

Issue Note



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Introduction

In an era characterized by intricate global challenges, such as climate change, the persistence of poverty and hunger, and a growing demand for natural resources, the importance of promoting sustainable development has gained unprecedented prominence on international agendas. By adopting the Sustainable Development Goals in 2015, the international community recognized the need to promote economic growth, environmental sustainability, and social inclusion simultaneously as the only way to build a better future for the incoming generations.

Whereas political commitment towards sustainability seems clear, there is an urgent need to incentivize concrete options to build a sustainable future already in the present. One of the most promising developments in this regard comes from a field broadly known as “bioeconomy”.

Although a concept with no internationally agreed meaning, bioeconomy could be ascribed as a new productive paradigm: an economic system that focuses on sustainably using renewable biological resources, such as plants, animals, and microorganisms, to produce goods, services, information, and energy, respecting the limits of ecosystems and maintaining the provision of ecosystems services. It emphasizes the sustainable and efficient utilization of biological resources to meet the needs of societies while minimizing negative environmental and climate impacts and creating new, decent jobs with sustained income.

At its core, the bioeconomy is a departure from the traditional linear economy, which relies heavily on finite fossil fuels and raw materials, often leading to environmental degradation and exacerbating social disparities. Instead, it is based on the sustainable harnessing of biological potential through traditional and scientific knowledge. It encompasses different economic activities such as, but not limited to, agriculture, forestry, fisheries, aquaculture, timber and non-timber forest products, food, energy, biotechnology, health care, and a long string of bio-based industries.

Bioeconomy is a knowledge-based development model, which encapsulates brand-new technologies such as bio-based nanomaterials, but also ancient ones, such as the traditional use and management of ecosystems and biodiversity species, and it constitutes a powerful tool for the promotion of sustainability in all countries, regardless of the biodiversity present in their territories.

In highly biodiverse countries, the bioeconomy can also contribute to conserving, regenerating, and sustainably using ecosystems and their functions and protecting and valuing the knowledge and culture of indigenous peoples, local and traditional communities.



Developing bioeconomy worldwide may represent a much-needed impulse to move the global economy towards sustainable development in its economic, social and environmental dimensions.

Based on this understanding, the Brazilian presidency of the G20 decided to create the G20 Initiative on Bioeconomy (GIB) to foster international dialogue and action on the subject. The GIB's activities and final products will mirror those of a G20 Working Group. There will be one virtual and three in-person meetings and a negotiated outcome that will be integrated into the Rio Declaration at the end of the Brazilian Presidency.

Priorities and Deliverables

Unlike other themes traditionally discussed in the G20 work streams, bioeconomy does not have an established international forum for debate, nor has the Group addressed the subject in the past. The GIB will therefore base its work on a conceptual discussion on what bioeconomy is in the present and what it should be in the future to effectively embed sustainability in the global economy. Such dialogue will be structured around three thematic axes:

- I) Research, development and innovation for bioeconomy
- II) Sustainable use of biodiversity for bioeconomy
- III) Bioeconomy as an enabler for Sustainable Development

All conceptual discussions will depart from the premise that a global bioeconomy must attend the moral imperative of reducing inequalities within and between countries and will seek to identify areas for cooperation amongst G20 members and beyond.

The GIB's main deliverable will be a set of agreed High-Level Principles on Bioeconomy, which will be an integral part of the Rio Declaration, to be adopted by G20 Heads of State at the end of the Brazilian presidency of the Group.



Conceptual Discussions

I) Research, Development and Innovation for Bioeconomy

In an era defined by rapid technological advancements, the relationship between technology and bioeconomy has emerged as a cornerstone for fostering sustainable development and addressing global challenges. Bioeconomy holds the promise of bringing disruptive innovations to industries, promoting decarbonization, mitigating environmental and climate concerns, and improving human well-being. At the heart of this revolution lies technology, acting as the catalyst that propels bioeconomy forward, unlocking its immense potential to drive the world towards sustainability.

One of the paramount ways in which technology is driving bioeconomy is by transforming traditional economic sectors, such as agriculture, forestry, fisheries, and aquaculture. Precision agriculture, enabled by technologies like satellite imagery, drones, and Internet of Things (IoT) sensors, empowers farmers to make informed decisions based on real-time data. This not only enhances crop yields and resource efficiency but also reduces the environmental impact of farming practices. In forestry, gene-editing techniques enable the development of trees with enhanced growth rates and wood properties, contributing to sustainable timber production.

Technology plays an instrumental role in the efficient extraction, processing, and utilization of biological resources. Biorefineries, equipped with cutting-edge biotechnological processes, enable the conversion of organic matter into a myriad of value-added products, ranging from biofuels to bioplastics – a sustainable alternative to conventional plastics, which persist in ecosystems for centuries. Microorganisms, through synthetic biology, can be engineered to produce bio-based chemicals and materials, reducing our reliance on synthetic fertilizers and pesticides, decreasing in the process environmental degradation, labor risks and the carbon footprint of various industries.

Technology acts as a powerful catalyst for innovation within the bioeconomy. Genetic engineering and synthetic biology techniques allow scientists to design organisms that can produce bioactive compounds, pharmaceuticals, and enzymes with applications in medicine and industry. The convergence of nanotechnology and biotechnology has led to the development of targeted drug delivery systems and advanced diagnostic tools, improving healthcare outcomes. Moreover, bioinformatics and computational biology are accelerating our understanding of complex biological systems, aiding drug discovery and the development of personalized medicine.

Bioeconomy aligns seamlessly with the concept of a circular economy, where resources are utilized in a closed loop to minimize waste generation. Technology breathes life into this concept by enabling the valorization of organic waste streams. Through techniques



like anaerobic digestion and composting, organic waste can be converted into biogas and nutrient-rich fertilizers, simultaneously addressing waste management issues and producing renewable energy. Furthermore, the bioeconomy leverages technology to transform waste biomass into bio-based products, reducing the demand for virgin resources.

While celebrating the profound impact of technology on the bioeconomy, it is imperative to acknowledge the ethical and biosafety considerations that arise. Genetic modifications, although offering transformative solutions, demand cautious regulation, based on scientific criteria and rigorous risk assessment to prevent unintended ecological consequences. Striking a balance between innovation and ethical responsibility is paramount to ensuring that the benefits of technology are harnessed for the greater good.

The convergence of technology and biodiversity emerges as a dynamic force in bioeconomy, holding a potential to revolutionize industries, safeguard the environment, enhance human health, and drive economic growth.

The importance of partnerships in this field cannot be overstated. G20 countries are responsible for the greater part of technological innovation in the world. Cooperation amongst its members could constitute an important driver for bioeconomy expansion globally.

By fostering a collaborative environment for international research and knowledge sharing, the G20 can facilitate responsible innovation and ensure that scientific breakthroughs align with the principles of sustainability and inclusivity.

II) Sustainable Use of Biodiversity for Bioeconomy

Biodiversity encompasses the incredible variety of species, ecosystems, and genetic diversity found across the globe. It is a source of immense value, contributing to the provision of essential ecosystem services, scientific discoveries, and economic benefits. Biodiversity forms the foundation of the bioeconomy by providing the raw materials, necessary for various sectors such as agriculture, pharmaceuticals, bioenergy, forestry, fisheries, and aquaculture. Additionally, the diverse genetic resources and biotic processes held within different species and ecosystems hold the key to developing innovative products and processes.

Conserved ecosystems provide a genetic archive for new discoveries. In agriculture, for instance, the genetic diversity enables selecting crop varieties with enhanced yields, disease resistance, and higher nutritional content. This not only promotes food security



but also drives innovation in farming practices. In this sense, the importance of in situ, ex situ and on farm conservation actions for genetic resources stands out.

Biodiverse forest ecosystems and rivers are a source of wood and non-wood forest products, of genetic materials and biological processes that can be sustainably used as raw materials or as sources of knowledge for the development of processes and products. The sustainable use of these assets has a high potential in bioeconomy to promote regional and local development, fair distribution of benefits, while maintaining the provision of key ecosystem services. Also, sustainable and biodiverse forestry systems, such as mixed-species plantations or agroforestry systems, can improve ecosystem resilience and reduce susceptibility to outbreaks of pests or diseases that affect specific tree species, whilst providing positive economic return.

Similarly, marine biodiversity provides the fisheries industry with a multitude of species that serve as food sources, while also contributing to pharmaceutical advancements through the discovery of bioactive compounds in marine organisms. Moreover, coral reefs and mangroves play a key role in providing shelter for the marine fauna as well as provide coastal protection, a key service in a world of growing extreme events.

Biodiverse ecosystems contribute to the resilience and sustainability of the global economy. They provide a more stable and adaptable environment in the face of environmental and climate changes. This stability is crucial for the continuity of bioeconomic activities. In agriculture, diverse crop varieties can mitigate the risks associated with diseases, pests, and changing climatic conditions. In forestry, mixed-species plantations can enhance ecosystem resilience and reduce the susceptibility to outbreaks of pests or diseases that target specific tree species.

Beyond its economic value, biodiversity holds deep social, ethical and cultural significance. Indigenous and traditional peoples and local communities often have profound cultural ties to specific landscapes and species. Preserving biodiversity is not only a matter of economic importance but also an ethical and social responsibility to respect the rights and traditions of these communities. Additionally, biodiversity enriches human life by providing aesthetic, recreational, and spiritual benefits. Many cultures draw inspiration from nature, and the loss of biodiversity could have profound cultural implications.

Bio-prospecting, the process of searching for and exploiting valuable biological resources, has led to remarkable discoveries. Many drugs, such as antibiotics and anti-cancer compounds, have their origins in natural sources. Biodiversity hotspots, regions with high species variety and endemism, are particularly valuable in this context as they harbor untapped potential. The intricate chemical and biological processes that have evolved over millions of years can inspire innovative solutions for pressing challenges in various industries.



The close relationship between communities and their natural environments produces relevant knowledge about local biodiversity, which on several occasions has served as

shortcuts for research, innovation, and product development. It is important in this context to observe the rights of traditional communities over this traditional knowledge, by guaranteeing free and informed consultation and the fair distribution of benefits when using their knowledge.

Biodiversity, thus, serves as a wellspring of bioeconomic potential, offering solutions to challenges ranging from food production to medical breakthroughs and sustainable energy production.

Despite its critical importance, biodiversity is under threat from various anthropogenic activities such as habitat destruction, pollution, overexploitation, and climate change. These threats jeopardize the potential contributions of biodiversity to the bioeconomy.

Conservation efforts can be integrated into the bioeconomy through sustainable practices that ensure the responsible utilization of biological resources. Sustainable agriculture, fisheries and aquaculture management, and sustainable forest management and forest recovery and regeneration initiatives are examples of how bioeconomic activities can support biodiversity conservation.

Biodiversity provide several benefits for society, regulating and maintaining water flows, regulating the climate, mitigating climate change, maintaining a genetic pool for discoveries. Moreover, it has cultural, spiritual and aesthetic values. It is thus necessary to recognize and incorporate the economic value of ecosystem services provided by biodiversity, incentivizing conservation efforts. Payment for ecosystem services (PES) programs, where communities or regions receive financial incentives for preserving their local ecosystems, are a essential tool to implement this approach.

By recognizing the inherent interdependence between biodiversity and bioeconomy, the G20 can lay the groundwork for sustainable practices that conserve and promote the sustainable use of ecosystems while harnessing their potential. This priority emphasizes the need for policies that promote responsible, innovative and sustainable resource management, the protection of vulnerable ecosystems, and the equitable sharing of benefits derived from biological resources, including the full implementation of international agreements in the area.

III) Bioeconomy as an Enabler for Sustainable Development

Bioeconomy offers an alternative framework that integrates economic prosperity with ecological stewardship and social equity. By prioritizing investments in bio-based



activities, nations can transition towards regenerative economic systems that are socially sensible and sensitive.

Traditional economic activities have often perpetuated inequalities, with marginalized communities bearing the brunt of environmental pollution and limited access to resources.

The bioeconomy, on the other hand, offers pathways to address these disparities and constitute a powerful tool for the promotion of sustainable development in its social, economic and environmental dimensions.

In terms of social development, bioeconomy has the power, for example, to rejuvenate rural areas by creating jobs in agriculture, forestry, and related industries, invigorating rural economies. Many vulnerable populations reside in rural areas, often lacking access to essential services and facing economic hardships. Technology-driven agricultural practices, sustainable forestry and non-timber forest products can generate increase in productivity and enhance the livelihoods of rural communities.

Small-scale farmers, family farmers, indigenous peoples and traditional communities can play a pivotal role in the sustainable management of biodiversity and in supplying biomass for bio-based products, generating income, and reducing urban-rural migration. Additionally, bioeconomy-driven advancements in agriculture can bolster food security and improve nutrition, ensuring that marginalized communities have reliable access to nutritious food sources.

The bioeconomy encourages knowledge sharing and capacity building, fostering a more inclusive and informed society. The bioeconomy relies on a deep understanding of biological systems and sustainable practices. This presents an opportunity for knowledge transfer and capacity-building in developing regions. Collaboration between different stakeholders can empower local communities to harness their resources while safeguarding their environment.

Indigenous and traditional knowledge, often held by marginalized groups, aligns with bioeconomy principles of sustainable resource management and holistic approaches to ecosystems. Integrating this knowledge into bioeconomy practices, provided that their benefits are shared with their original holders, not only respects diverse cultural perspectives but also enriches the overall pool of expertise.

In the realm of healthcare, the bioeconomy plays a crucial role in ensuring equitable access to essential medical products. Plant-based pharmaceuticals and vaccines can be produced at lower costs, making them more accessible to underserved populations. By prioritizing affordable and accessible healthcare solutions, the bioeconomy can ensure that medical innovations reach all corners of the globe, leveling the playing field for health outcomes.



Education is a cornerstone of social equality, and the bioeconomy can play a pivotal role in promoting access to quality education for all. Training programs focused on sustainable agricultural practices, biotechnology applications, and resource management can equip marginalized individuals with the skills needed to participate in the bioeconomy. This not only enhances their employability but also empowers them to contribute to their communities' development.

Promoting gender equality is a crucial component of social inclusion, and the bioeconomy can foster opportunities for women's empowerment. Many bioeconomy sectors, such as agriculture and biotechnology, offer avenues for women to play active roles as entrepreneurs, scientists, and leaders. By challenging gender norms and providing equal access to resources, the bioeconomy can contribute to breaking down barriers and transforming societal norms.

One of the most remarkable aspects of the bioeconomy is its potential to empower vulnerable communities. Traditionally excluded from decision-making processes and resource allocation, these communities can find a voice and an opportunity when taking part in the bioeconomy. By focusing on locally available biological resources and community-led initiatives, the bioeconomy provides a platform for these communities to assert their rights and contribute to sustainable development.

In terms of economic growth, bioeconomy is already an engine of prosperity in many areas. There are thriving sectors that have been making use of the binomial biodiversity-technology to produce wealth for a long time. Some examples are tech-intensive agriculture, bioenergy, pharmacology and the cosmetics industry, all of which have successfully been increasing the bio-based approaches in their activities in recent years.

The biotechnology sector within the bioeconomy holds immense promise for economic expansion. From bio-based materials to bioenzymes, advancements in biotechnology offer new revenue streams and business opportunities. Investment in research and development in this sector can lead to breakthroughs with far-reaching economic impacts, paving the way for a more sustainable future.

The bioeconomy encompasses the use of biofuels, which emit fewer greenhouse gases compared to fossil fuels. Crucially, biofuels, currently used mainly to power cars, also have the potential to be a sustainable solution for both aerial and maritime transportation. This transition can significantly contribute to global efforts to curb climate change. Bio-based materials, derived from renewable sources such as plant fibers and agricultural waste, are gaining traction as eco-friendly alternatives to traditional materials like plastics and metals. These materials are not only biodegradable but also possess the potential to sequester carbon, contributing to climate change mitigation. The proliferation of bio-



based materials in industries ranging from packaging to construction exemplifies the bioeconomy's potential to reshape economic landscapes sustainably.

Other bio-based industries, such as bioengineering and bio-based agricultural inputs, are poised to flourish in the bioeconomy. These industries offer diverse employment opportunities ranging from research and development to manufacturing and marketing. This diversity can reduce income inequality by providing jobs across educational and skill spectrums.

Despite its clear positive effects on social inclusion and economic growth, **the environmental area** is perhaps where bioeconomy's game-changing potential is most well-known.

Resource efficiency is a linchpin of the bioeconomy. By tapping into biological resources and optimizing their use, the bioeconomy minimizes waste and reduces the strain on non-renewable resources. It also embraces circular economic models, where products are designed to be reused, recycled, or biodegraded, minimizing waste and conserving resources.

Instead of discarding organic waste, the bioeconomy sees it as a valuable resource. Through processes like composting and anaerobic digestion, waste can be transformed into bioenergy and fertilizers. This shift is crucial for mitigating ecological damage and securing a livable planet for future generations.

Moreover, the bioeconomy can contribute to carbon sequestration through sustainable land management practices. Afforestation, reforestation, and agroforestry initiatives enhance carbon capture while fostering biodiversity and ecosystem resilience. These efforts align with global goals such as the Sustainable Development Goals and the Paris Agreement under the UNFCCC.

In summary, the bioeconomy encourages the protection of biodiversity and the maintaining of ecosystem services, which are vital for human well-being and to sustainable development in its three dimensions.

Challenges and Considerations

While the bioeconomy holds immense potential, it is not without challenges. Striking a balance between resource use and conservation requires careful planning. Ensuring that the transition to a bioeconomy does not inadvertently harm vulnerable ecosystems or communities is crucial.

It is therefore essential to approach the bioeconomy with sensitivity and ethical considerations. Engaging with vulnerable communities requires respect for their rights,

cultural practices, and knowledge systems. Inclusive policies and social safeguards should be established to prevent the exploitation or exclusion of vulnerable groups.

It is also essential to ensure that the benefits of the bioeconomy are equitably distributed, and that no communities are disproportionately burdened or excluded. To this end, improving the effectiveness, transparency and quality of the patent system in relation to the use of genetic resources and traditional knowledge is essential. The inclusion of an origin disclosure requirement can prevent misappropriation, whenever an invention claimed in a patent application originates from the use of genetic resources or traditional knowledge.

As biomass is diverted for industrial use, concerns arise about potential conflicts with food production. Responsible land use planning and sustainable agricultural practices are essential to prevent competition between food and non-food crops.

Furthermore, the bioeconomy heavily relies on technological innovation, including in paradigm-breaking sectors, such as genetic engineering. While these advancements can drive progress, ethical considerations regarding their potential long-term impacts must be addressed.

Realizing the full potential of the bioeconomy requires robust policy frameworks and international collaboration. Governments, industries, academia, and civil society must work in tandem to create an enabling environment that incentivizes sustainable bio-based practices. This includes investment in research, development of supportive regulations, and the establishment of platforms for sharing best practices. G20 can play an important role in bringing this discussion to the forefront of the international agenda.

Conclusion

The bioeconomy represents a productive paradigm shift in how we perceive and pursue economic growth, environmental protection, and social equality. By harnessing the regenerative power of biological resources, the bioeconomy offers a pathway to reconcile the three dimensions of sustainable development. As we stand at a critical juncture in human history, facing interconnected challenges of climate change, resource scarcity, and social inequality, fostering the bioeconomy could be the catalyst for building a more prosperous, equitable, and sustainable world for current and future generations. G20 countries, given their economic and scientific capacity, are in a privileged position to stimulate the debate on the approaches and challenges towards a global bioeconomy that is able to contribute to a sustainable future for all.



Calendar

13-14 March: 1st Experts Meeting (virtual): initial discussions.

5 April: Distribution of the Zero Draft of the “G20 High Level Principles on Bioeconomy”.

7-9 May: 2nd Experts Meeting, in the city of Brasília. Thematic discussions on the role of technology for bioeconomy. 1st round of negotiations of the “G20 High Level Principles on Bioeconomy”.

17-19 June: 3rd Experts Meeting, in the city of Manaus. Thematic discussions on the sustainable use of biodiversity for bioeconomy. 2nd round of negotiations of the “G20 High Level Principles on Bioeconomy”. Field trip to the facilities of the Amazon Bio-business Center in Manaus.

August (if needed): Intersessional Meeting (virtual): Negotiations of the “G20 High Level Principles on Bioeconomy”.

9-10 September: 4th Experts Meeting, in Rio de Janeiro. Thematic discussions on the role of bioeconomy for the three dimensions of sustainable development. “Final Negotiations of the “G20 High Level Principles on Bioeconomy”.

11 September: Ministerial Meeting (TBC)