Task Force 6
Accelerating SDGs: Exploring New Pathways to the 2030 Agenda

CIRCULAR BIOECONOMY AND SDGs: PROPOSALS FOR THE G20

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Abstract

India is focused on recommitting the G20's efforts to achieving the targets of the 2030 Agenda for Sustainable Development. With less than a decade left to attain the Sustainable Development Goals (SDGs), an informed push, supported by an enabling policy environment, innovations, and implementation, is an urgent requirement. A circular bioeconomy can contribute to attaining 53 targets in 12 of the 17 SDGs. The G20 discussions so far have focused more on the circular economy in general or the circular carbon economy. Given the significance of the bioeconomy in realising the SDGs, it is a good time for India to take the lead in accelerating the development of a circular bioeconomy. This Policy Brief frames the potentials and challenges of doing so for the G20. It will further examine various policy options for a circular bioeconomy and offer specific recommendations on aspects such as circular bioeconomy partnership and biocircularity metrics.

The Challenge

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The strategy of 9Rs (refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, and recover), the Paris Agreement, and committing to net-zero goals are some of the adaptation and mitigation measures being adopted as the global community grapples with resource scarcity and climate change. Though a relatively new area of exploration, the circular bioeconomy has the potential to alleviate this crisis. A circular bioeconomy can be described as a step beyond the circular economic principles of waste to wealth. India's G20 presidency comes at a crossroad of major decision-making. Plagued with extreme climate events and ever-rising demand for energy and mineral resources owing to its huge population, the country must lead the initiative to promote circular bioeconomy across the world.

The increased material consumption of G20 countries over the years has been a stress inducer. According to the International Resource Panel, over the last 50 years, global consumption of resources has increased from 30 billion tonnes to almost 95 billion tonnes (UNEP 2023). Since 1970, consumption of various bio-resources in G20 countries has increased by 2.5 times, although its share in total consumption has decreased largely because of unprecedented growth in demand for other resources, especially non-metallic ones. The G20's share in the total consumption of biological resources has fallen from 38 percent to 23 percent, with an estimated decline of 0.28 percent per annum. From the bioeconomic perspective, biomass resources hold huge potential for promoting circularity across various sectors in an economy.

Developing circular bioeconomy offers a significant opportunity for achieving the Sustainable Development Goals (SDGs) at the global level. India's G20 presidency comes at a crucial juncture, i.e., the midpoint of the 2030 Agenda and the SDGs. With less than eight years remaining to attain the SDGs (by 2030), India is clearly focused on recommitting to the G20's efforts. According to the World Economic Forum, it is estimated that transition to circular bioeconomy could reduce global waste generation by up to 98 percent by 2050 and create around 18 million net new jobs globally by 2030 (Palahi 2020). Moreover, the Bio-based

Industries Consortium has pointed out that, by 2030, bioeconomy – such as agriculture, forestry, bio energy, and bio plastics – has the potential to reduce greenhouse gas (GHG) emissions by up to 2.5 billion tons of CO_2 equivalent per annum (Palahi 2020). Overall, circular bioeconomy can contribute to the attainment of 53 targets in 12 of the 17 SDGs (see Table 1). An analysis of synergies and trade-offs between SDGs and circular bioeconomy finds that circular bioeconomy will lead to more synergies than trade-offs with the SDGs (Ronzon and Sanjuán 2020) with many synergies being found with goals 7 (sustainable energy), 11 (cities and waste management), 12 (sustainable consumption and production), and 15 (life on land) (See Annexure 1 for details of SDG targets fulfilled by circular bioeconomy).

Table 1: SDG targets linked to circular bioeconomy

SDG 2 (End hunger)
Target 2.3: "double the agricultural productivity and incomes of small-scale food producers (…), including through access to (…) financial services"
Target 2.4: "ensure sustainable food production systems, (…) that help maintain ecosystems"
Target 2.5: "maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species"
Target 2.a: "Increase investment (…) in rural infrastructure, agricultural research and extension services, technology development"
SDG 4 (Quality education)
Target 4.4: "increase the number of youth and adults who have relevant skills"
Target 4.7: "ensure that all learners acquire the knowledge and skills needed to promote sustainable development"
SDG 6 (Clean water)
Target 6.3: "improve water quality by reducing pollution"
Target 6.4: "increase water-use efficiency across all sectors"
Target 6.5: "implement integrated water resources management"
Target 6.6: "protect and restore water-related ecosystems"
Target 6.a: "including (…) water efficiency, wastewater treatment, recycling and reuse technologies"

SDG 7 (Clean energy)
Target 7.2: “increase substantially the share of renewable energy in the global energy mix”
Target 7.3: “improvement in energy efficiency”
Target 7.a: “access to clean energy research and technology” and “promote investment in (…) clean energy technology”
Target 7.b: “upgrade technology for supplying modern and sustainable energy services”
SDG 8 (Decent work and economic growth) and SDG 9 (Industry, innovation and infrastructure)
Target 8.2: “higher levels of economic productivity through diversification, technological upgrading and innovation (…)”
Target 8.3: “support productive activities (…), creativity and innovation, and encourage the formalisation and growth of micro-, small- and medium-sized enterprises”
Target 8.4: “Improve (…) resource efficiency in consumption and production”
Target 8.5: “achieve full and productive employment”
Target 9.2: “Promote inclusive and sustainable industrialisation (…), significantly raise industry’s share of employment and gross domestic product”
Target 9.3: “Increase the access of small-scale industrial (…)to financial services (…) and their integration into value chains and markets”
Target 9.4: “retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes”
Target 9.5: “Enhance scientific research, upgrade the technological capabilities of industrial sectors”
Target 9.b: “Support domestic technology development, research and innovation (…) for, inter alia, industrial diversification”
SDG 11 (Sustainable cities and communities)
Target 11.6: “by paying special attention to (…) municipal and other waste management”
Target 11.a: “by strengthening national and regional development planning”
Target 11.b: “implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change”
SDG 12 (Responsible consumption and production)
Target 12.2: “sustainable management and efficient use of natural resources”
Target 12.3: “reduce food losses along production and supply chains”
Target 12.5: “reduce waste generation through prevention, reduction, recycling and reuse”
Target 12.6: “Encourage companies (…) to adopt sustainable practices”
Target 12.7: “Promote public procurement practices that are sustainable”
Target 12.8: “ensure that people everywhere have the relevant information and awareness for sustainable development”

SDG 13 (Climate action)
Target 13.2: “Integrate climate change measures”
Target 13.3: “institutional capacity on climate change mitigation, adaptation, impact reduction”
SDG 14 (Life below water)
Target 14.1: “reduce marine pollution”
Target 14.2: “sustainably manage and protect marine and coastal ecosystems” and “take action for their restoration”
Target 14.3: “Minimise and address the impacts of ocean acidification”
Target 14.4: “science-based management plans, to restore fish stocks”
Target 14.7 - “sustainable management of fisheries, aquaculture'
Target 14.a: “Increase scientific knowledge, develop research capacity and transfer marine technology”
Target 14.b: “access for small-scale artisanal fishers to marine resources and markets”
SDG 15 (Life on land)
Target 15.1: “ensure the (…) sustainable use of terrestrial and inland freshwater ecosystems and their services”
Target 15.2: “sustainable management of all types of forests, (…) restore degraded forests and substantially increase afforestation and reforestation”
Target 15.3: “restore degraded land and soil”
Target 15.4: “conservation of mountain ecosystems, including their biodiversity”
Target 15.5: “protect and prevent the extinction of threatened species”
Target 15.9: “integrate ecosystem and biodiversity values into national and local planning”
Target 15.a: “increase financial resources (…) to conserve and sustainably use biodiversity and ecosystems”
Target 15.b: “finance sustainable forest management (…), including for conservation and reforestation”
SDG 17 (Partnerships for the goals – Policy and institutional coherence)
Target 17.14: “policy coherence for sustainable development”
Target 17.17: “effective public, public-private and civil society partnerships”
Target 17.19: “develop measurements of progress on sustainable development”, “support statistical capacity-building”

Source: Based on Ronzon and Sanjuán (2020)

Figure 1: G20 discussions with links to circular bioeconomy

2013	Saint Petersburg Summit	Bioenergy
2017	G20 Leaders´ Declaration from the Hamburg Summit	G20 Resource Efficiency Dialogue
2019	The G20 Osaka Leaders' Declaration	Circular economy, sustainable materials management, the 3Rs
2020	The Leaders' Declaration of the G20 Riyadh Summit	Circular Carbon Economy (CCE) Platform and 4Rs framework
2021	The G20 Rome Leaders' Declaration	Circular economy approaches for climate mitigation and adaptation
2022	G20 Bali Leaders' Declaration	Lifestyles, resource efficiency and circular economy

Source: TERI

The G20 discussions on circular bioeconomy have linked circular economy measures to SDGs as well as climate stewardship. Furthermore, they have focused more on circular economy in general or circular carbon economy. Given the significance of bioeconomy in realising the SDGs, now is a good time for India to take lead in accelerating the development of a circular bioeconomy. The objective is not only to displace fossil energy with renewable energy, but also to replace materials like polymers originating from fossils to lower carbon or even zero carbon alternatives. The management of fossil energy is a global issue since its vast majority is currently burned or buried in soil, causing air and water pollution and global warming. Globally, biomass remains the major source of bio-based products. In a recent assessment by the World Business Council for Sustainable Development (WBCSD), of the 23 billion tonnes of biomass used in manufacturing various products, agriculture-based biomass has the largest share at 82 percent, followed by forestry and aquaculture at 17 percent and 1 percent, respectively. The importance of incorporating the principles of circular economy, such as recycling and repairing, to bio-based materials in these sectors for the establishment of circular bioeconomy as well as furthering the concept of Lifestyle for Environment as envisioned by the Prime Minister of India cannot be overstated. The areas which require considerable effort to achieve success in this front are:

Economic

Economic factors such as scattered availability of bio-resources, the inability to compete with traditional and fossil-based products, miscellaneous supply chain costs, and low scales of production affect overall delivered costs of production.

Technical

It might not be enough to simply implement technology or have access to working technology.

Social

Commercial scale demand of biogenic materials may adversely impact subsistence living of communities who depend upon forest and land-based produce for food and fodder.

Regulatory framework

The challenges are especially acute for developing an ecosystem at the global scale due to a lack of metrics or standards acceptable to all countries.

Mindset and values

The general public's perception of bio-based products continues to be ambiguous, and consumers are rarely prepared to pay a higher price. The ways in which circular bioeconomy can serve as a new economic model replacing the current GDP-focused model that has proved to be insufficient for measuring human development has been outlined below:

- It gives the opportunity to transform our land, food, health, and industries to self-sustaining systems;
- New income opportunities of circular bioeconomy will improve the standard of living and eventually decrease the socioeconomic distress of people;
- Industrial innovations around bioeconomy in fields of aquaculture and hydroponics, waste to energy, processing industries, and fisheries can give the much-needed push for industrial decentralisation of big economies.

The G20's Role

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Given the current opportunities and challenges to circular bioeconomy, the G20 can play a major role in certain aspects:

Cleaner energy through circular bioeconomy-based solutions

The G20 countries consume over 70 percent of the global energy. Therefore, its contribution to usher the world to a cleaner energy transition is essential to create a ripple effect and thus reflect change globally. The major sources of biomass for energy production are crop residue and organic parts of solid and animal waste. Utilising waste as feedstock for bio-energy is a two-pronged approach to tackle waste generation and its associated problems, as well as emerging cleaner energy requirements. Further, assimilation of waste into bioprocesses to produce useful products and metabolites leads to a sustainable circular bioeconomy and many countries including that of the G20 have started implementing the same.

Bio-economy and bio-based materials

Bio-based materials refer to products that mainly consist of substances derived from living matter (biomass) and either occur naturally or are synthesised. The term usually refers to modern materials that are seen as sustainable successors of fossil fuel derivatives or other synthetic materials in terms of their sourcing and those that have undergone extensive processing to reach their final stage. For instance, Orange Fibre, a leading Italian luxury brand, makes clothing out of bio-based materials such as orange peel, thereby avoiding significant landfill dump. Italy also leads in production of grape leather. The UK is another leading example for sustainable textile production. The UK's Waste and Resources Action Plan (WRAP) has launched a new initiative called Textiles 2030, which is an ambitious voluntary national plan that seeks to encompass all clothing and textile companies of the country. It aims to change the country's make-use-dispose clothing culture into a circular one. Bio-active ingredients derived from natural sources have a well-known

positive effect on cosmetic usage, which serve as an incentive for consumers despite higher prices. People then are willing to pay for products which they believe will give them immediate and observable benefits. Therefore, this needs to be channelised to upscale the production of bio-based materials and adopt the business models that facilitate the same.

Business models and innovations around circular bioeconomy

Designing a comprehensive and viable business model for an innovative bio-based technology is crucial for successful commercialisation and its integration into the circular bioeconomy framework. The current understanding of business models within the context of the circular bioeconomy is lacking comprehensive exploration. The intricate nature of the circular bioeconomy, characterised by its intricate knowledge domain, diverse policy landscape, and a range of innovative approaches, presents considerable obstacles in formulating effective business models. A sustainability-oriented business model should ideally point to sustainable value to customers and all other stakeholders, create and deliver this value, and "capture economic value while maintaining or regenerating natural, social and economic capital beyond its organisational boundaries" (Schaltegger et al. 2016). Giving equivalent importance, it is vital to enhance the inventor's understanding and foster a trust-oriented connection with potential financial investors or business angels. Obstacles in surmounting the divide between innovative research investigations and lucrative commercial utilisation, market entry, and the effective enticement of private investors arise from the restricted fiscal reservoirs of fledgling startups, deficiency in organisational proficiencies, and the hazards tied to both early-stage (unproven and proven) as well as middle-stage (pre-commercial) technologies, notably those employed by micro, small, and medium enterprises (MSMEs). Careful analysis of eco-industry circular business models that have successfully reached the market will give us some answers. An instance of this can be found in the Integrated Cascading Catalytic Pyrolysis (ICCP) innovation, crafted by BioBTX B.V., an SME headquartered in the Netherlands. This technology is aimed at generating aromatic compounds like benzene, toluene, and xylene (BTX) from biomass. BioBTX B.V. operates as a tech provider, with their business

strategy revolving around licensing the technology and offering related services to firms interested in producing bio-based BTX. Central factors behind their achievements encompass initial patents covering core and downstream technologies, an incremental tech advancement methodology, along with proficiency in catalysts and engineering. Moreover, they have dedicated efforts to harnessing varied funding avenues and initiating revenue inflow during the early phases through research advisory services.

Circular bioeconomy catalysing MSME competitiveness

MSMEs are important players in the global economy, especially in developing nations. They account for between 60 and 70 percent of all employment and roughly 50 percent of the global GDP. Despite playing a vital role, the bulk of MSMEs are typically less productive and profitable than large businesses. The difference in productivity between small and large businesses is 41 percent in Germany and 60 percent in Turkey.

This is caused by obstacles unique to MSMEs that prevent them from growing and gaining access to strategic assets. While MSMEs account for 48 percent of Indian exports, the average contribution of countries within the Organisation for Economic Co-operation and Development (OECD) to global exports is 36 percent. This is despite the massive role of MSMEs in employment generation and economic activity. In OECD countries, most foreign exchange happens through large companies which already have a well-established capital base. MSMEs are not equipped to compete with such companies due to their lack of access to global value chains (GVCs) and finance mechanisms.

Nevertheless, it is essential for MSMEs to participate in global trade if they are to continue playing a sustained role in global economies. Along with their economic relevance, participation in GVCs is also important as they are a well-established vehicle for productivity spill over to local levels. Therefore, a revamp of strategy is required for improved contribution of MSMEs.

Recommendations to the G20

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The G20 plays a strategic role in fostering the transition to circular bioeconomy both among its member-states and the global development community. For practical measures to extend to the local municipality, international collaboration holds utmost significance. To assess the potential gains from small-scale initiatives and gauge the timeline required to progress toward sustainability in economically disadvantaged nations, worldwide contemplation becomes essential. International collaboration on the political and economic fronts should focus on fostering a shared understanding of the goals and strategies of circular bioeconomy to provide a number of tangible public goods on a global scale and to ease the transfer of technology. Two specific recommendations are proposed below:

Launch the Global Circular Bioeconomy Partnership (GCBP)

This should serve as a platform sharing best practices across domains of policy, science-technology-innovation, industries (including MSMEs), institutions, and citizen engagement. The platform should be able to engage with the G20 as well as other countries to forge multistakeholder partnerships involving governments, world-class research institutions, and the private sector. The platform should also be able to facilitate a dialogue on innovative financing and business models. This platform would involve and encourage MSMEs, farming communities, municipalities, communities, and citizens to adopt practices for utilising waste streams and by-products into bio-based products and bio-energy.

Establish the BIOMET (biocircularity metrics) initiative

While many G20 countries are drawing up action plans on circular economy, it is also important to focus on circular bioeconomy. A first step towards the same would be establishing an initiative that defines the metrics and an indicator framework for biocircularity metrics. This initiative should convene empirical studies to help estimate the potential of circular bioeconomy as well as impacts of circular bioeconomy measures. A comprehensive experiential database must be created. Given the unprecedented benefits of data and knowledge sharing in the accelerated transition of circular bioeconomy,

enhanced formal collaboration among key stakeholders for sharing experiential data emerging from related research and development activities is necessary. However, policies related to regulation on data governance, regulation on the free flow of nonpersonal data, and the open data will deepen confidence and support collaboration and partnerships.

The Environment, Climate and Sustainability Working Group under the Sherpa Track has a thematic focus on circular bioeconomy. The proposed initiative could be institutionalised by a G20 country with a secretariat based on a governmental or non-governmental organisation. Reflecting the theme of the current G20, "One Earth One Family One Future", through international cooperation on circular bioeconomy can ensure that the actions proposed are translated into concrete institutions and partnerships.

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