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IMPACT OF BIOECONOMICS ON SUSUTAINABLE DEVELOPMENT GOALS

AUTHORED BY - HITHA S

ABSTRACT

The paper deals with how bio economics, an emerging concept can impact the fulfilment of sustainable development goals and how to define the bioeconomy-SDG relation. The author has attempted a doctrinal research approach and reviewed the concerned literature to find out the main issues involved that constrains the implementation. It is realised that renewable energy is regarded as the natural solution for SDGs but lacks proper policies and regulations worldwide. This research concludes that bioeconomy not only upholds the sustainability goals but also initiates the growth and societal well- being. Bio economic policies should be inculcated as soon as possible to protect the world from the uncertainties caused by the conventional fuel and energy resources. The measures should be balanced and consider all the dimensions and shall have the aim to ensure the maintenance of ecosystems, the productivity of resources and controlling the pollution. The development of bio-based economy should be in accordance with the notion of strong sustainability, and should acknowledge and address the trade-offs.

1. INTRODUCTION

1.1 Relevance Of ‘Bio economics’ In Modern Economy and Its Relation with Sustainable Development

We are facing the biggest threat of global warming, thanks to the interactions of human beings on a global scale through the socio-economic systems we ourselves are digging the grave not only for us, but also for the future generations. With the advent of technology, many new concepts emerge in the modern era for minimising the impact of such activities which hampers the environment. Bio economics is one such term. This scientific term establishes the socio-economic activity threshold, allowing the community to make use of the biological system without destroying it and achieving sustainability goals in the process¹. Bio economy is the

¹ Mohammadian M, ‘What Is Bio economics: Biological Economics?’ (2003) 14 Journal of Interdisciplinary Economics 319

product of innovations derived from research² and has a cross sectoral relation³. The main objective is to create a holistic equilibrium between economic growth and sustainable utilisation of the biological capital⁴. A fundamental approach for achieving the goals of the bioeconomic model is the substitution of renewable resources for fossil fuels⁵. It is recognised as a 'key driver of green transformation' and has the capacity to address the global environmental challenges⁶. As industrialisation took hold, society saw an evolution from a structure reliant on renewable resources to one reliant on raw materials derived from fossil fuels.⁷ And now its high time to bring back the public confidence on renewable energy in the modern economy.

The scholars regard bioeconomy as 'the productivistic urgency'⁸ requiring a swift action to shift to the alternative energy resources. The implementation of bioeconomic policies in low- and middle-income nations was made possible by the Paris Climate Agreement, opening up new avenues for resource conservation and economic growth⁹. Thereby, Bio economics can be classified into three elements: -

- a) Using renewable biomass and efficient bioprocessed to achieve a sustainable development
- b) Introduction of biotechnology
- c) Integrating the applications across sectors of agriculture, health, and industry¹⁰.

Sustainable Development is defined by the United Nations as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"¹¹. There are a total of 17 interrelated goals and 169 targets that address social, economic, and environmental issues under the UN Sustainable Development Goals 2030 (SDG) adopted

² Johan Swinnen & Olivia Riera, "The global bio-economy," (2013) 44 *Agricultural Economics*, International Association of Agricultural Economists, pages 1-5

³ Wesseler J, 'Financial, Real, and Quasi Options: Similarities and Differences' [2014] Springer Proceedings in Mathematics & Statistics 673

⁴ Mohammadian, (n-1)

⁵ Heimann T, 'Bioeconomy and SDGs: Does the Bioeconomy Support the Achievement of the Sdgs?' (2019) 7 *Earth's Future* 43

⁶ Ibid.

⁷ Hubbert, M.K, 'Exponential Growth as a Transient Phenomenon in Human History' (1976) In Margaret A. Storm, ed., *Societal Issues: Scientific Viewpoints*. New York: American Institute of Physics.

⁸ Giuseppe celli, 'The EU Bioeconomy Strategy: Opportunity or global risk for local economies?' (2021) 63, 189

⁹ Bracco, S.; Calicioglu, O.; Gomez San Juan, M.; Flammini, A, 'Assessing the Contribution of Bioeconomy to the Total Economy: A Review of National Frameworks' (2018) *10 Sustainability* 698, <https://doi.org/10.3390/su10061698>, last accessed on 4th October 2024

¹⁰ Ibid.

¹¹ World Commission on Environment and Development (WCED), 'Report of the World Commission on Environment and Development: Our Common Future' (1987) Oxford University Press: Oxford, UK,

by the United Nations General Assembly in September 2015¹². Sustainable development contains two basic needs, the need for socio-economic development and secondly the need for implementing limitations imposed on the environment's capability to fulfil the inter-generational equity¹³. The idea is that economic growth and sustainable development should go hand in hand, yet few national and international policy designs seem to recognise this¹⁴. One can find them being rarely incorporated in the existing legal framework of domestic legislations.

There exist two concepts of sustainability which are weak and strong sustainability¹⁵. The neoclassical economists argue in favour of weak sustainability where they assume that 'human welfare will continue if economic production sustains regardless of whether the natural resources are depleted, to the contrary, ecological economists argues that maintaining human welfare is beyond economic output and it is mandatory to include non-market attributes such as ecosystem and biodiversity¹⁶. Since bio economics has special characteristics and considers both ecological health and societal considerations, it can be viewed as the virtue of the perfect compromise between strong and weak sustainability. It also depends on market-driven progress and technical advancement.

2. LITERATURE REVIEW

The bio-based economy strives to be sustainable by utilising cleaner manufacturing techniques, reducing greenhouse gas emissions, establishing circular value chains, and efficiently utilising biobased resources¹⁷. Because of how quickly research agendas are set and networks are formed, it is referred to as emergent or swiftly evolving¹⁸. Although there are many benefits of having a bio-based economy, many academics who oppose the idea contend that it causes

¹² Kempton Y, Salvati L and Vardopoulos I, 'Long-Term Planning and Development for Urban and Regional Inclusion, Safety, Resilience, and Sustainability. Insights from Singapore' (2023) 14, <https://doi.org/10.12681/rp.32607>, Accessed on 3rd October 2024.

¹³ Kailas Pratapsing Vasave, 'Sustainable Development and its Legal Framework in India: An Analysis' (2023) 6 (4) IJLMH 138 – 149, <https://doi.org/10.1000/IJLMH.115363>, last accessed on 4th October 2024

¹⁴ Heimann, (n-5)

¹⁵ Gowdy JM and Walton M, 'Sustainability Concepts in Ecological Economics', *Economics interactions with other disciplines*, vol 1 (Encyclopedia of Life Support Systems 2009)

¹⁶ Ibid.

¹⁷ Bennich T and Belyazid S, 'The Route to Sustainability—Prospects and Challenges of the Bio-Based Economy' (2017) 9 Sustainability 887

¹⁸ Vanholme B and others, 'Towards a Carbon-Negative Sustainable Bio-Based Economy' (2013) 4 Frontiers in Plant Science.

overuse of resources¹⁹. In the process of attaining sustainable economic growth, it might potentially contribute to sustainability by tackling interrelated societal issues like food security, the depletion of natural resources, reliance on fossil fuels, and climate change²⁰. The main criticism arises that it focuses more on economic growth and used for greenwashing people and therefore considered an arbitrary phase²¹. However, if certain requirements are met, countries could have an advantageous effect and lessen the trade-offs²². Achieving the sustainable development objectives through bio economics is a difficult challenge because some of the goals may be incompatible with one another and/or related to one another. Therefore, appropriate policies and regulatory frameworks must consider all relevant risk factors to properly reconcile the goals²³.

Bio economy has enormous prospects of innovation and job creation especially focussing on the rural areas and can strengthen the agricultural sector²⁴. Additional research to examine the wide range of potential in the bioenergy sector has been advocated for by several authors²⁵. A shift from mere measuring the size to assessment of outcomes like the environmental benefits or improvement in public health can provide an extensive understanding of the bioeconomy's value to the society²⁶. It is difficult to identify the various sectors and subsectors that compose the bioeconomy thus unable to accurately determine the value-added contributions²⁷. The presence of externalities, arbitrary regulatory costs and uncertain opportunities has made the measurement of bio economy a tedious task²⁸. Various approaches include calculating GDP or a renewable bio-based content but have its own limitations. Due to the lack of readily available

¹⁹ Pfau, S. F., Hagens, J. E., Dankbaar, B., & Smits, A, 'Visions of Sustainability in Bioeconomy Research' (2014) 6(3), Sustainability, 1222–1249, <https://doi.org/10.3390/su6031222>, last accessed on 4th October 2024

²⁰ Schmidt, O.; Padel, S.; Levidow, L, 'The bio-economy concept and knowledge base in a public goods and farmer perspective' (2012) 1(1) Bio-Based Appl. Econ., 47-63

²¹ Thrän, D. & Moesenfechtel, U, 'The bioeconomy system' ((2022), Springer, <https://doi.org/10.1007/978-3-662-64415-7>, last accessed on 4th October 2024

²² Liobikiene, G., Balezentis, T., Streimikiene, D., & Chen, X, 'Evaluation of bioeconomy in the context of strong sustainability' (2019) 27(5), Sustainable Development, 955–964, <https://doi.org/10.1002/sd.1984>, last accessed on 3rd October 2024.

²³ Maksymiv, Y., Yakubiv, V., Pylypiv, N., Hryhoruk, I., Piatnychuk, I., & Popadynets, N, 'Strategic Challenges for Sustainable Governance of the Bioeconomy: Preventing Conflict between SDGs', (2021) 13(15), Sustainability, 8308, <https://doi.org/10.3390/su13158308>, last accessed on 3rd October 2024.

²⁴ Justus Wesseler and Joachim von Braun, 'Measuring the Bioeconomy: Economics and Policies' (2017) 9 Annual Review of Resource Economics, 275-298, <https://doi.org/10.1146/annurev-resource-100516-053701>, last accessed on 4th October 2024

²⁵ Ibid

²⁶ Wesseler J, Smart R, 'Environmental impacts. In Socio-Economic Considerations in Biotechnology Regulation' (2014), New York: Springer, 81–95.

²⁷ Carlson R, 'Estimating the biotech sector's contribution to the US economy' (2016) 34(3), Nat. Biotechnol, 247–55

²⁸ Heijman W, 'How big is the bio-business? Notes on measuring the size of the Dutch bio-economy' (2016) 77 NJAS, 5–8

data on bioeconomy resources, product flows, and their contributions to employment and consumption complicates the measuring process. Thereby, it is the responsibility of the authorities to prepare assessment devoid of barriers and brings accurate measurement having both aspects of economic opportunities and sustainability²⁹.

Only by implementing essential changes to industrial processes, market and technology growth, and production-consumption patterns will we be able to construct the perfect future economy³⁰. Though the companies and private entities might pose in front of the public as carriers of biobased economy, their ultimate intention being profit making would act as a hinderance³¹. 'Adaptive regulations' is a means of dealing with the scientific uncertainty, the socio-economic and political risks of the current dynamic system³². Therefore, the need arises to develop a framework which incorporates the adaptive system. The national legal framework wholly depends on the global economic developments, trade patterns and regulations, sustainable and climate protection issues³³. The economic growth is based on the increased demand and supply of bio-based products³⁴.

Bioeconomy is indeed a mixture of beneficial linkages and conflicts thus highlights the existing fragmented regulation. What we need is the reviewal of the present policies which would lead the way to construct additional policies³⁵. Also, such legislations which impose minimum efficiency standards along with multiple uses of biomass resources turns out to be beneficial market barriers. There exists an unavoidable conflict between land and biomass use typically referred as land v. fuel debate, as competitions arises among the bio economic activities and the different land uses such as nature conservation or recreation, thus a non-rivalrous way of

²⁹ Sugden R, 'Opportunity as a space for individuality: its value and the impossibility of measuring it'(2003) 113, *Ethics* 783–809

³⁰ Dr Suvi Borgström & Dr Volker Mauerhofer, 'Developing law for the bioeconomy' (2016) 34(4), *Journal of Energy & Natural Resources Law*, 373–406, <https://doi.org/10.1080/02646811.2016.1200349>, last accessed on 4th October 2024

³¹ Michael Porter, Claas van der Linne, 'Green and Competitive' (1995) 73 *Harvard Business Review* 120.

³² JB Ruhl, 'General Design Principles for Resilience and Adaptive Capacity in Legal Systems with Applications to Climate Change Adaptation' (2011) 89 *North Carolina Law Review* 1373

³³ José G. Vargas-Hernández, Karina Pallagst, Patricia Hammer, 'Bio economy's institutional and policy framework for the sustainable development of nature's ecosystems' (2017) 2, *Atlantic Review of Economics*.

³⁴ de Jong, S. A., Hoefnagels, E. T. A., Faaij, A., Slade, R., Mawhood, R., & Junginger, H. M., 'The feasibility of short-term production strategies for renewable jet fuels – a comprehensive techno-economic comparison' (2015) 9, *Biofuels, Bioproducts and Biorefining*, 778–800. <https://doi.org/10.1002/bbb.1613>, last accessed on 3rd October 2024

³⁵ Patrick Dieckhoff, Beate El-Cichakli and Christian Patermann, 'Bioeconomy Policy: Synopsis and Analysis of Strategies in the G7' (German Bioeconomy Council 2015).

balancing the competing rights should be brought forth³⁶. A systematic approach should be taken while evaluating and developing regulatory systems, with special attention to the coherence and coordination among various levels, sectors, and governance tools³⁷. The key components—integration, adaptation, and proactivity—reflect the biobased economy's flexibility and are often referred to as "responsive regulation" or "polycentric governance"³⁸.

3. Research Gap

Bioeconomy is still considered to be favouring the economic growth rather than on the environmental, ecological, and social aspects, thus it depicts the need to create a framework to measure and monitor the bioeconomy is a panoramic approach. There shall be an assessment on the broader outcome including its impact on health, well-being and environmental sustainability. Furthermore, bio economy is recognised as a cross- sectoral regime therefore it should focus on sector-based governance to integrate the inter-disciplinary aspects.

4. Research objectives

1. How relevant it is to push the society towards the bio-based economy specially in cases of developing and emerging economies.
2. Analyse both the positive and negative impact of bio economy and suggesting the structural changes to be included in the existing legislations.
3. How the term 'bio economics' can be defined more clearly the importance of laying down more concrete and measurable objectives rather than from the current abstract ones leading into inconsistencies in comparing the contribution.

5. Comparative Approach by analysing the policy frameworks

Sweden, who aims to be the forerunner in the bioeconomy world has set the emission targets to reach net-zero GHG by 2045 through their new policies³⁹ and the most notable action of providing grants and incentives for installing energy efficiency measures in residential houses

³⁶ Brett Frischmann, 'Infrastructure: The Social Value of Shared Resources'(2012),Oxford University Press 2012, 227

³⁷ Borgström, (n-30)

³⁸ Elinor Ostrom, 'A Polycentric Approach for Coping with Climate Change' (2009),World Bank Research Working Paper No 5095, <https://openknowledge.worldbank.org/entities/publication/afe3b3e9-96e5-580e-a71e-882dfc4e9421> , last accessed on 5th October 2024

³⁹ Katarina Axelsson, Jindan Gong, César Dugast, Fiona Lambe, Pierre Maquet and Timothy Suljada , 'Consumption-based emissions: a new frontier for EU climate policy'(2024),Stockholm Environment Institute, <https://www.jstor.org/stable/resrep60954>, last accessed on 4th October 2024

and professional working spaces is to be appreciated⁴⁰. Denmark, has introduced the Climate Act and has set the reduction target for 2035 particularly targeting the SDG 12 and 13⁴¹. France has adopted the carbon neutrality (Stratégie Nationale Bas-Carbone) which acts as a roadmap for achieving the goals.

The biodiversity laws which have provisions for dealing with waste management and the decarbonisation plan derived from the Paris Agreement was applied by Costa Rica in furtherance of the Bioeconomy agenda⁴². In Malaysia, the country developed a comprehensive bioeconomy programme which emphasised a biomass driven approach⁴³. Looking at the largest oil producer Saudi Arabia, has directed ARAMCO to invest in sustainable energy sources like hydrogen fuel⁴⁴. India is working on creating a knowledge – and innovation- driven bioeconomy as part of the National Biotechnology Development Strategy 2025⁴⁵. India, being a part of the newly launched G20 Global Biofuels Alliance, are trying to manufacture biofuels locally.

It is seen that South Australia has released a bioeconomic strategy and generated an action plan (BIOFUTURE'S 10-year roadmap)⁴⁶. In Germany, The National Policy Strategy on Bioeconomy (BMEL, 2013) prioritises a knowledge-based economy highlighting the areas which needs action⁴⁷. The Malaysian government has also introduced the National Biotechnology Policy (NBP) which is a 15-year plan and their Bio Nexus status recognise and awards those companies who undertakes value added biotechnology⁴⁸. This shows that bio-based economy has now become globally relevant.

⁴⁰ Sara Holmgren, Alexandru Giurca, Johanna Johansson, Christoffer Söderlund Kanarp, Tove Stenius, Klara Fischer,

'Whose transformation is this? Unpacking the 'apparatus of capture' in Sweden's bioeconomy'(2022) 42, Environmental Innovation and Societal Transitions, 44-57, <https://doi.org/10.1016/j.eist.2021.11.005>, last accessed on 5th October 2024.

⁴¹ Emma Charlton, 'Who's promised net zero carbon emissions, and who looks likely to get there?', (world economic forum, Dec 13, 2019) < <https://www.weforum.org/agenda/2019/12/countries-companies-net-zero-carbon-emissions/>> last accessed on 5th October 2024.

⁴² Ibid

⁴³ Faisal khan, 'How countries are redefining their bioeconomy for the future', (world economic forum May 28, 2024) <https://www.weforum.org/agenda/2024/05/countries-redefining-bioeconomy-for-the-future/>, last accessed on 5th October 2024.

⁴⁴ Alok Medikepura Anil, 'Saudi Arabia and India: A bioeconomy match made in heaven?(World Economic Forum, April 26 2024) <https://www.weforum.org/agenda/2024/04/saudi-arabia-and-india-a-bioeconomy-match-made-in-heaven/> last accessed on 4th October 2024.

⁴⁵ Ibid

⁴⁶ Bracco, (n-9)

⁴⁷ Bracco, (n-9)

⁴⁸ Mahaletchmy Arjunan, 'The Biotechnology and Bioeconomy Landscape in Malaysia'(2017) New biotechnology 40 , 52, [10.1016/j.nbt.2017.06.004](https://doi.org/10.1016/j.nbt.2017.06.004), last accessed on 4th October 2024.

6. Positive and Negative impacts of bioeconomy on sustainable development goals

Regarding how well it contributes to achieving the sustainable development goals, the bioeconomy offers both advantages and disadvantages. The result is a mixed outcome of socio-environmental targets and there is a slight inclination to the industrial targets⁴⁹. It shows how important it is to give special attention to bioeconomic policy to maintain the equilibrium. It demonstrates the significance of paying close attention to bioeconomic policies to preserve equilibrium⁵⁰. Time is a crucial component; it takes a long time to replenish renewable resources like biomass, which may function as a barrier⁵¹. Likewise, rather than emphasising sustainability components, the bioeconomy places more emphasis on reducing greenhouse gas emissions and the usage of fossil fuels⁵².

An incentive to acquire more agricultural land is created by the growing demand for biomass, which in turn raises the price and demand for land and degrades biodiversity and ecosystem services⁵³. The SDGs 1,2 and 8 dealing with 'No poverty, zero hunger and Economic Growth' can have detrimental impact as halts the job market, the agricultural commodity market leading to unemployment, food security issues and poverty⁵⁴. The SDG goals 6, 13, 14 and 15 dealing with clean water and sanitation, climate action etc are severely affected by the ecological dimensions of bioeconomy⁵⁵.

The SDGs 7, 9, and 12, which address industry, innovation, infrastructure, affordable and clean energy, and responsible usage and production of non-renewable resources, all clearly demonstrate the good effects of sustainability⁵⁶. Economic development is prioritised by developed countries and introducing biotechnology and value-added production, the countries create skilled labour opportunities. But farming and allied agricultural sector suffers in this transformation. The technological integration results in extremely unclear scenario putting

⁴⁹ Heimann, (n-5)

⁵⁰ Heimann, (n-5)

⁵¹ Zilberman, D., Kim, E., Kirschner, S., Kaplan, S., & Reeves, J, "Technology and the future bioeconomy. *Agricultural Economics*", (2013) 44, 95–102, <https://doi.org/10.1111/agec.12054>, accessed on 4th October 2024

⁵² Pfau, S. F., Hagens, J. E., Dankbaar, B., & Smits, A. J, "Visions of sustainability in bioeconomy research. *Sustainability*", (2014) 6, 1222–1249, <https://doi.org/10.3390/su6031222>, accessed on 4th October 2024

⁵³ Deininger, K, 'Global land investments in the bio-economy: Evidence and policy implications' (2013) 44, *Agricultural Economics*, 115–127, <https://doi.org/10.1111/agec.12056>, accessed on 4th October 2024

⁵⁴ Heimann, (n-5)

⁵⁵ Heimann, (n-5)

⁵⁶ Heimann, (n-5)

farmers in danger of losing the job and leaving them with no options of other off-farm employment opportunities, which pushes them to further poverty and migration into urban areas⁵⁷.

How can bioeconomic activities reduce poverty? one of the ways is considering the demand of agricultural goods, higher demand leads to higher prices which provides higher income to the farmers⁵⁸. The EU projects that global food demand would rise by more than 70% by 2050, which will also result in a rise in the need for biomass⁵⁹. The misuse of renewable energy resources occurs when there is no regulatory framework or governmental support, even if it may open up new potential for value-added enterprises in both developed and developing nations⁶⁰. Despite having large potential and an enabling environment, most of the Asian countries fails to adopt the production of renewable energy⁶¹. The governments continue to preserve fossil fuels for future generations, despite facing both technological and, more crucially, financial barriers to commercial production of bio-based products⁶².

The ratio of negatives to the positives must be balanced and the existence of negative consequences indicates substitution⁶³. The benefits of the bioeconomy on land, seas, water, and resources are evident, but there are also some drawbacks that can be attributed to the inherent trade-offs of the Sustainable Development Goals (SDGs), which indicate that achieving one SDG may inevitably have an impact on another⁶⁴. Principle 15 of the Rio Declaration on Environment and Development mentions the employment of precautionary measures, particularly when using biotechnologies, due to the potential irreversible impacts that the bioeconomy may have on the environment and human health⁶⁵.

⁵⁷ Cotula, L., Dyer, N., & Vermeulen, S, "Fuelling exclusion? The biofuels boom and poor people's access to land." (2008), IIED, <http://pubs.iied.org/pdfs/12551IIED.pdf>, accessed on 3rd October 2024

⁵⁸ Ibid

⁵⁹ European Commission, "Innovating for sustainable growth: A bioeconomy for Europe. Brussels: European Commission" (2012), <https://publications.europa.eu/de/publication-detail/-/publication/1f0d8515-8dc0-4435-ba53-9570e47dbd51>, accessed on 4th October 2024

⁶⁰ Anindya Bhattacharya, "Renewable Energy:: A Strategic Policy for Sustainable Development", (2010), Global Environmental Strategies, <http://www.jstor.com/stable/resrep00734>, accessed on 5th October 2024

⁶¹ Ibid

⁶² Ibid

⁶³ Heilmann, (n-5)

⁶⁴ Pradhan, P., Costa, L., Rybski, D., Lucht, W., & Kropp, J. P., "A systematic study of Sustainable Development Goal (SDG) interactions. Earth's Future," (2017), 5, 1169–1179, <https://doi.org/10.1002/2017EF000632>, accessed on 5th October 2024

⁶⁵ United Nations, 'Report of the United Nations Conference on Environment and Development' (1992) 1, United Nations Gen. Assem., Rio de Janeiro, Braz, A/CONF.151/26

The SDG goals of zero-hunger agenda can be fulfilled by enhancing the productivity of agriculture and the development of sustainable and resilient food production practices with the help of infrastructure, research, and biotechnology and this also helps in the generation of biomass from local and small farmers⁶⁶. The goal 7 deals with affordable and clean energy which ensures access to reliable energy resources by improvising their efficiency. The biomass extracted from rural areas can be converted into bio fuels for the creation of bioeconomic system⁶⁷. The SDG 12 requires sustainable management of natural resources and the private corporations shall implement sustainable production methods⁶⁸. The bioeconomic strategy should consider the conditions required to provide sufficient biomass and the governance instruments for the enforcement⁶⁹.

An extensive cost-benefit analysis would facilitate rational and consistent policy making⁷⁰. Investment in a bio-based economy is considered as beneficial, however in current situation, the investments are specific in nature and uncertain, necessitating the introduction of regulations to nullify the negative effects⁷¹. The transboundary externalities and the risks of bioeconomy pathways associated with the increased international trade of bio energy gives rise to the need for International Agreements⁷².

7. POLICY FRAMEWORKS

The Green New Deal is a renewable energy-based green economy strategy; however, it has a propensity to fail because it depends on the progress and expansion of the nation⁷³. Budgets for green energy are only implemented in developed and emerging nations in response to increases

⁶⁶Gruner, A, 'The Bioeconomy and the Achievement of the Sustainable Development Goals (SDGs): To what extent can the Bioeconomy Strategies of Germany and Queensland help to achieve the SDGs, particularly considering SDGs 2, 7, and 12?' (2023)

⁶⁷ Sillanpää, M., & Ncibi, C, 'A Sustainable Bioeconomy: The Green Industrial Revolution' (2017), Springer, <https://doi.org/10.1007/978-3-319-55637-6>, accessed on 4th October 2024

⁶⁸ Möller, M., López, V., Prieß, R., Schleicher, T., Wolff, F., Kiresiewa, Z., Hasenheit, M., & Schröder, P, 'Sustainable use of resources – requirements for a sustainable bioeconomy from the Agenda 2030/SDG implementation' (2020)Federal Environment Agency , 257

⁶⁹ Birner, R, 'Bioeconomy Concepts'(2018) Bioeconomy,17–38), https://doi.org/10.1007/978-3-319-68152-8_3, accessed on 4th October 2024

⁷⁰ Wessler J, Scatista S, Nillesen E, 'The maximum incremental social tolerable irreversible costs (MISTICs) and other benefits and costs of introducing transgenic maize in the EU-15'(2007) 51(3) Pedobiologia 261–69

⁷¹ AmbecS, Coheny MA, ElgiezS, LanoieP, 'The Porter Hypothesisat 20: Can environmental regulation enhance innovation and competitiveness?' (2014) 7(1) REEP, 2–22

⁷² Von Braun, J.; Birner, R, 'Designing Global Governance for Agricultural Development and Food Nutrition Security' (2017) 21 Rev. Dev. Econ, 265–284

⁷³ Sam Betts-Davies, Jonathan Norman, 'Is all inequality reduction equal? Understanding motivations and mechanisms for socio-economic inequality reduction in economic narratives of climate change mitigation' (science direct,2024) <https://doi.org/10.1016/j.erss.2023.103349> , accessed on 5th October 2024.

in the price of fuel and oil, which is known to be an unstable and volatile factor. The private sector loses out on investment possibilities due to price fluctuations, and the established sectors are left with unrecoverable costs and poor investments. Mature policies calling for greater energy investment should be enacted by the government.

The government has the unfavourable opinion that producing renewable energy sources will be expensive and need a significant amount of time. But on the contrary, the pay back periods of such an investment yields long term benefits. Even with the enhanced Feed-in-Tariff program, solar energy in Japan has a payback period of about ten years. It may take more than 5 to 10 years to observe the net benefits of the green energy supply in the economy⁷⁴. Additionally, pressure is being applied on the government to defend the local merchants. By promoting the sole use of renewable energy resources, the prices of the non-conventional sources reduce thus affecting the retailers. Renewable energy may prove to be the best option overall, mitigating the trade-offs, if the authorities choose to disregard the cost-competitive impacts in favour of fostering an enabling environment. Creation of green collar jobs aims to increase employment and improving the overall domestic employment rate. The skilled labour requirements also facilitate in the eradication of unemployment. It is estimated that around 1 million jobs can be created out of Asia's potential production⁷⁵. It also employs women in income generating activities, thereby empowering the rural women community⁷⁶.

The USDA model sets standards, provides certification and labels by identifying the 'quality' of bio-based products, serving as indicators for monitoring and social sustainability. Inclusion of taxes, subsidies are also a part of monitoring measures⁷⁷. The governments at the national level can coordinate communication between various domestic agencies and entities and lay down protocols and norms for measurement to ensure that countries' commitments to the Sustainable Development Goals (SDGs) are met⁷⁸. Developing thorough pertinent guidelines at the international level is another form of creating the adequate bio economy. The Food and

⁷⁴ Nakano, S., Arai, S. & Washizu, A, 'Economic impacts of Japan's renewable energy sector and the feed-in tariff system: using an input-output table to analyze a next-generation energy system'(2017)19, *Environ Econ Policy Stud*, 555–580, <https://doi.org/10.1007/s10018-016-0158-1>, accessed on 5th October 2024.

⁷⁵ Mehta, Aasha K., Mohapatra, G., Ali, A., Mukherjee, Suparna D, 'Renewable Energy for Rural Livelihoods in MNRE-UNDP-FRG Project Villages in Rajasthan and Uttarakhand: A Report' (2009) New Delhi. Indian Institute of Public Administration.

⁷⁶ Ibid

⁷⁷ Jan Coen van Elburg and Derk Loorbach, 'Transition Perspective on Regulation and Renewable Energy' (2012) *The European Business Review* 67.

⁷⁸ Bracco, (n-9)

Agricultural Organisation is already working on the task of establishing sustainability guidelines⁷⁹.

Law accelerates and boosts the bioeconomic development by removing inflexible standards and administrative barriers⁸⁰. Using the legal tools, the demand for the bioeconomic products and services can be increased. Additionally, it can govern the supply of biomass and the competitiveness of products on the market, thereby creating favourable conditions for its flourishing⁸¹. Moreover, it may raise the regulatory expenses associated with releasing a novel bioeconomic product onto the market⁸². The amount of regulation should be balanced by the government; it should not be either excessively high or low. Regional integration can at times be beneficial as it driven by economic considerations to facilitate the exchange of goods and services as well as strengthen the mutual security⁸³. The local level strategies can be connected to the international level.

8. Notable institutions working on establishing bioeconomy

Nearly all the G7 nations have established bioeconomy strategies⁸⁴ and in the same manner the G20 does acknowledge the bioeconomy concepts in some documents⁸⁵. Academics think that these bodies would play a tangible part in managing environmental concerns. They are 'clubs' that advances climate change outside official UNFCCC processes⁸⁶. The lack of authority to enforce binding regulations and the limited membership are the existing barriers. World Trade Organisation promotes fairness and growth of bioeconomy⁸⁷. The EU is moving its domestic funding for GHG reductions into the "green box," which is thought to encourage competition for safer and more environmentally friendly products, hence fostering innovation in the

⁷⁹ FAO (Food Agric. Org.), 'How Sustainability Is Addressed in Official Bioeconomy Strategies at International, National and Regional Levels' (2016) Rome: FAO

⁸⁰ Paul Twomey and Idil Gaziulusoy, 'Review of System Innovation and Transitions Theories' (2014) Working Paper for the Visions & Pathways Project

⁸¹ Borgström, (n-30)

⁸² Geert van Calster and Thomas de Romph, 'Regulating Opportunity and Innovation in the EU. The Case of Sustainable Materials (Plastics) Management' (2015), <http://dx.doi.org/10.2139/ssm.2588562>, accessed on 4th October 2024

⁸³ Slocum-Bradley, N.; Felício, T, 'The Role of Regional Integration in the Promotion of Peace and Security' (2006), <http://cris.unu.edu/sites/cris.unu.edu/files/O-2006-2.pdf>, accessed on 4th October 2024

⁸⁴ Bioökonomierat, 'Bioeconomy Policy Synopsis and Analysis of Strategies in the G7. A Report from the German Bioeconomy Council' (2015)

⁸⁵ G20 Meeting of Agriculture Ministers Declaration (2018)

⁸⁶ Widerberg, O.; Stenson, D.E, 'Climate Clubs and the UNFCCC FORES' (2013), <https://fores.se/wpcontent/uploads/2013/11/ClimateClubsAndTheUNFCCC-FORES-Study-2013-3.pdf>, accessed on 5th October 2024

⁸⁷ Johnson, F.X, 'Regional-Global Linkages in the Energy-Climate-Development Policy Nexus: The Case of Biofuels in the EU Renewable Energy Directive' (2011) 2 Renew. Energy Law Policy Rev, 91–106

bioeconomy⁸⁸.

Similarly, UNCTAD (United Nations Conference on Trade and Development) launched initiatives under the programme ‘Sustainable energy for all programme’⁸⁹. They oversee ‘bio trade’ project to support the Convention of Biological Diversity that manages the ‘Linking trade, biodiversity, and sustainable development’⁹⁰. OECD has developed its own comprehensive bioeconomy strategy ‘The Bioeconomy to 2030: designing a policy agenda’, emphasising on the roles of biotech to economic activity⁹¹. The Global Bioeconomy Summit, or GBS for short, is a high-level gathering for practitioners, policy officials, and others to engage in informal conversations about bioeconomy-related topics⁹². FAO being the most active party is one of the UN’s most ‘cross-cutting’ agencies in developing bioeconomic strategies⁹³.

9. Suggestions and recommendations

The traditional model has a significant influence on the principles of the bioeconomy. By evaluating the ecological conditions and local considerations, afforestation and reforestation can help achieve the SDG targets⁹⁴. However, although land is utilised to generate biomass, excessive use of that area should be limited as it can result in desertification, indicating an unintentional shift against bioeconomy.⁹⁵ The bioeconomy principles must be capable of creating incentives which attracts the participation of countries for the fulfilment of goals of

⁸⁸ Herwig, A; Pang, Y, ‘WTO Rules on Domestic Support for Agriculture and Food Safety: Institutional Adaptation and Institutional Transformation in the Governance of the Bioeconomy’ (2019) In EU Bioeconomy Economics and Policies; 69–88

⁸⁹ Biofuels and Renewable Energy. UCTAD. 2019. Available online: https://unctad.org/en/Pages/DITC/ClimateChange/UNCTAD-Biofuels-Initiative.aspx?Me=,ows_Title,ascending (accessed on 19 August 2020)

⁹⁰ UNCTAD BioTrade Initiative submission to CBD Notification 2016-078 - Decision XII/5: Biodiversity for poverty eradication and sustainable development.

⁹¹ OECD. The Bioeconomy to 2030: Designing a Policy Agenda—OECD. 2009. Available online: <https://www.oecd.org/futures/long-termtechnologicalsocietalchallenges/thebioeconomyto2030designingapolicyagenda.htm> (accessed on 23 August 2020)

⁹² Global Bioeconomy Summit. Communiqué Global Bioeconomy Summit 2015. Making Bioeconomy Work for Sustainable Development. International Advisory Committee. 2015. Available online: https://gbs2020.net/fileadmin/gbs2015/Downloads/Communique_final_neu.pdf (accessed on 3 July 2020)

⁹³ FAO. Bioeconomy|Energy|Sustainable Bioeconomy Guidelines. 2019. Available online: <http://www.fao.org/energy/bioeconomy/en/> (accessed on 25 July 2020)

⁹⁴ UN (2015). Transforming our world: The 2030 agenda for sustainable development. New York: United Nations. <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>

⁹⁵ Smolker, R. (2008). The new bioeconomy and the future of agriculture. Development, 51(4), 519–526. <https://doi.org/10.1057/dev.2008.67>

sustainability.

There is a need to curate proper regulations and policies for ensuring the sustainability goal which otherwise would not help in minimising the negative effects. A wise implementation the bioeconomic policies can have a strong potential and it would fulfil the benchmarks set by the SDGS.

The risk explicit cost benefit analysis of the renewable energy sources should be undertaken⁹⁶. Such an analysis shall have the ability to influence the investors to adopt the renewable energy modes. In the Japan electricity portfolio, the estimates shows that a 1% increase in renewable energy supply can reduce the portfolio risk by 1% which has the effect of significant reduction in the expenditure on risk-covering premiums⁹⁷

Another intervention required would be that of the regional sectors which can introduce cost competitive renewable energy supply domestically which would cover the problems of underutilisation and increased marginal cost. There can also be a multi-country regional corporation which would enhance the use of renewable energy in the domestic market.

Green collar jobs is an emerging term which belongs to an employment category having the capability to improve the national employment rate. Appropriate land planning to avoid the fuel v. land conflict and establishing procedural instruments having enhanced public participation and environmental assessments can be regarded as important tools to help the conflict management. The current scenario shows that the existing policies aren't enough, it is rather diverse and incoherent. The government should be extremely vigilant and maintain public confidence in emerging technologies. A state-based regulation would make compliance a mandatory criterion and are considered highly credible and legitimate to the public's viewpoint⁹⁸.

Non-state actors and private entities can take initiatives to create a platform for the access to

⁹⁶ Renewable Energy:: A Strategic Policy for Sustainable Development Author(s): Anindya Bhattacharya Institute for Global Environmental Strategies (2010) Stable URL: <http://www.jstor.com/stable/resrep00734>

⁹⁷ Bhattacharya, Anindya and Kojima, Satoshi 2010. Power Sector Investment Risk & Renewable Energy: A Japanese case study using portfolio risk optimization method. Working Paper, Economic Analysis Team, IGES, Hayama. (Under review of Energy Policy Journal special issue on Renewable Energy Investment)

⁹⁸ Sarah Light and Eric Orts, 'Parallels in Public and Private Governance' (2015) 5 Michigan Journal of Environmental & Administrative Law 1

bio-based products and there can be partnerships between various stakeholders. Certifying and labelling bioproducts would indicate better quality, and the augment in the sustainable exports into global markets. The government should review the current laws to identify the potential barriers and develop new tools to facilitate the transition into bioeconomy.

The global economy has a plethora of uncertainties within itself therefore cannot be predicted. Arguments for a more coherent and harmonized approach highlight a need for transparency, comparability between countries, and coordination to avoid market distortion [Knudsen, M.T.; Hermansen, J.E.; Thostrup, L.B. Mapping Sustainability Criteria for the Bioeconomy; Aarhus University, Department of Agroecology: Aarhus, Denmark, 2015.]. Opponents of a more consistent and standardized approach argue that sustainability can be ensured by already-existing sustainability criteria, and that it would be difficult to implement overarching frameworks due to the different characteristics of countries as well as of the sectors of the bio-based economy.

Conclusion

This is well indicated by the concept of a bioeconomy: while its core idea is to produce marketable goods and products and therefore support economic growth, in the end development of a bioeconomy is dependent on healthy, functioning ecosystems for the raw material. Therefore, regulatory systems for a bioeconomy cannot focus merely on advancing functioning of markets by providing security and stability for the market actors, but must at the same time enhance the resilience of ecosystems on which markets ultimately depend.

Issues related to the development of a bioeconomy form one kind of a 'policy jungle', due to the vast uncertainties related to the linkages between increased use of biomass, mitigation of climate change and ecosystem degradation.

Development of a bioeconomy offers significant possibilities to address the challenges faced by the world with a growing population, resource scarcity, environmental degradation and climate change. The urgency of the problems that a bioeconomy may provide solutions to and the new sustainability challenges emerging in a growing bioeconomy indicate the need to develop regulatory regimes that enable and make the transition to a bioeconomy more rapid, controlled and sustainable.

Sustainable bio-economy development addresses societal and economic challenges related to sustainable economic development on issues such as climate warming and fossil resources, natural resource scarcity, biomass competition, biodiversity, waste streams, governance, social well-being, etc. (Vargas-Hernández, José G.; Pallagst, Karina; Hammer, Patricia (2017) : Bio economy's institutional and policy framework for the sustainable development of nature's ecosystems, Atlantic Review of Economics, ISSN 2174-3835, Colegio de Economistas de A Coruña, A Coruña, Vol. 2)

To assess public policy issues encouraging research and innovation, removing barriers and forming strategic cooperation relationships and alliances between the different stakeholders and economic agents. As reported previously by OECD (2009a) inform some political events may influence the development of bio-economy such as the quality of governance or the system of regulations and policies and the economic competitiveness of biotechnological innovations. A policy agenda on bioeconomics requires a framework for cooperation relationships between different institutions, technological and economic sectors, including society, business and government. Policy formulation Policy formulation and development and investments are required for an effective bioeconomy innovation system based on circular economy. Bio-economy needs more flexible coordination and integration of efforts among academics, stakeholders, policymakers, etc., conducive on a bio-economy web to become more sustainable from the raw materials to the residues.