

Cluster initiatives in bioeconomy: experience of support in Russian regions

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Abstract. The development of the bioeconomy is driven by various forms of integration. Natural integration involves business combinations and various organizational interactions, such as concerns, transnational companies, and cartels. Disintegration and quasi-integration occur when businesses unbundle, and formal associations are formed with the aim of acquiring control rather than assets of other business entities. Enterprise clusters are a typical example of quasi-integration. These clusters consist of geographically localized and interconnected companies with shared goals and strategies. While the benefits of participating in clusters were evident at the end of the 20th century, it has become clear by the early 21st century that the integration of companies is taking on new hybrid forms, and clusters themselves can undergo significant transformations over a short period. The bioeconomy is widely recognized as a promising approach to conserve Earth's energy resources. Its main objectives include the development of alternative energy sources, improved energy efficiency, efficient waste utilization, the promotion of renewable energy derived from biomass, greening the industrial sector, enhancing the sustainability of agriculture, producing new food products, advancing medical technologies, and utilizing biotechnologies based on renewable biological raw materials.

1 Introduction

The present socio-economic landscape is undergoing a significant transformative shift due to various megatrends that span the global stage. These megatrends encompass a range of factors, some linked to the proliferation of new technologies, while others foretell demographic, socio-political, environmental, and economic shifts within society. The concept of megatrends originated from the pioneering work of John Naisbitt in the 1980s, where he initially defined megatrends as "major social, economic, political, environmental, or technological changes that emerge gradually but persistently over multiple economic cycles."

In contemporary times, the megatrends that are anticipated to exert the most substantial influence on various developing industries encompass the following [1]:

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Mass Customization and Servitization: These trends are reshaping the organization of businesses and giving rise to new market segments.

Intellectual Mobility: This trend has repercussions across various economic sectors. The heightened emphasis on energy efficiency, alternative fuels, shared mobility, automated vehicles, and transportation systems necessitates alterations in business models, skill requirements, and the structure of value chains in emerging industries. These changes can present both challenges and opportunities for companies, contingent on their adaptability and willingness to embrace change.

Circular Economy (Bio-Economy) [2]: This trend emphasizes sustainability and savings through the utilization of renewable carbon resources. It encompasses the entire lifecycle, from production and processing to the repurposing of by-products and bio-waste, all while striving to derive added value and ensure food security. This business model poses significant challenges for industries as it calls for the reformation of business models and the transformation of global value chains, which are likely to become more streamlined and circular.

2 Research Methodology

Studying international practices leads us to the conclusion that cluster formation aligns well with the establishment of the foundations of the bioeconomy, which is regarded as the economy of the future. The global shift toward the bioeconomy has been actively underway since 2012, notably initiated by European nations that first adopted proactive cluster policies [5].

The organizational and economic framework for shaping the bioeconomy in the Krasnodar region can be delineated across two key stages. Initially, the primary focus is on establishing a biomass value chain. Subsequently, in the second phase, it becomes pertinent to implement measures aimed at configuring a value chain profile within the region. This entails positioning biomass as a financially viable product in the future.

In essence, the transformation priorities module encompasses the following components [3]:

- Orchestrating and coordinating support for the bioeconomy, involving the management and local governance of processes.
- Monitoring energy consumption and fostering renewable alternatives.
- Cultivating the bioindustry by structuring and advancing territorial biorefinery platforms.
- Promoting sustainable agricultural growth, a pivotal sector within the bioeconomy.
- Advancing the food industry and the production of animal feed devoid of artificial ingredients.
- Leveraging artificial intelligence in business operations.
- Ensuring social acceptability.

These principles are best implemented through cross-sectoral collaboration within flagship clusters, utilizing both private and public investments, along with active involvement from the scientific community. The Southern agro-industrial cluster outlined in the Strategy holds promise for playing a leading role, and the "Smart Industry of the South of Russia" cluster is equally significant in this context.

3 Results and Discussions

The bioeconomy is considered an important aspect of the green transition in the European Union. The circular economy is expected to bring huge benefits to the European economy

in 2030, with a 7% increase in GDP and annual economic benefits of €0.6 trillion. Russia, like other countries, is trying to adapt its approaches to these trends, seeking to find a balance between regional orientation and global partnerships [4].

The goal is to integrate Russian society into the global initiative to create an economy based on renewable resources, which involves the rational use of these resources in production and consumption. More than 60 countries, including Russia, have committed to achieving carbon neutrality, which will require radical changes in government policies and market structures [6]. Russia is making progress in diversifying its economy and reducing its dependence on fossils, but working to reduce dependence on fossils in production requires further efforts.

Biotechnology is recognized as a key area of innovative economic development in Russia [11]. The new Strategy for the socio-economic development of Russia until 2050 with low greenhouse gas emissions emphasizes the importance of a green economy. This provides an opportunity for Russia to actively implement bioeconomic principles.

The circular production characteristic of the bioeconomy requires the integration of different industries. This provides opportunities for regional initiatives and cluster development to promote cross-sector collaboration. The development of the bioeconomy requires coordinated action at the national and regional levels. Recently, Russian regions have been actively developing clustering policies [7].

The analysis of bioeconomic clusters has revealed a range of challenges in their development. These include the emergence of hybrid cluster forms like project alliances due to factors such as shortened technology life cycles. Additionally, as of the end of 2022, there were only 117 registered clusters across all industries, with just 11 of them considered highly efficient (super-clusters).

There is also a limited regulatory framework in place for creating, regulating, and overseeing cluster activities, which hinders their development. Furthermore, cluster initiatives need stimulation to encourage successful business activities.

A comprehensive socio-economic and investment analysis is lacking to assess the feasibility of creating and funding new clusters from both state and regional budgets.

Monitoring tools for evaluating the efficiency of budget spending in cluster strategy implementation are currently absent [8].

Moreover, there is no clear methodology for assessing cluster development stages or criteria for determining the effectiveness of a cluster's operation, making it challenging to establish funding mechanisms for successful clusters [9].

Inconsistencies in cluster goals arise due to a lack of clear definitions regarding concepts like "bio-economy" or an "economy based on bio-resources [10]." Defining specific objectives is necessary for cluster communities.

For the bioeconomy to thrive, efficient local infrastructure is crucial for the low-cost and swift transportation of biomass over short distances. This infrastructure, based on clusters, would connect local factories and enterprises to ensure effective use and recycling of waste and biological materials.

4 Conclusions

Bioeconomic clusters have the potential to serve as catalysts for economic growth and prosperity in regions, driving the development of innovative technologies, products, and services essential for addressing both current and emerging socio-economic challenges identified in state, regional programs, and national projects. To harness this potential, it is crucial for the scientific community to prioritize the education and training of highly skilled professionals capable of effectively and efficiently addressing the complex issues associated with ensuring the sustainable development of society.

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