BIOECONOMY: A NEW PERSPECTIVE FOR A SUSTAINABLE AND SMART FUTURE

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Abstract

Bioeconomy is a tool for achieving the goals of sustainable development.

About 22 percent of the total market size of the bioeconomy has been estimated to come from food and feed loss and waste.

Food loss and waste is equivalent to about 1.6 billion tonnes of food yearly, and it is expected to grow to 2.1 billion tonnes by 2030. However, biomass coming from food loss and waste can still be used in a productive and regenerative way.

For example composting, which supports soil health, helps optimize the value of discarded food and other forms of biomass over time, leading to the notion of a “circular bioeconomy”, where biological materials are repurposed, reused, recycled and renewed.

The bioeconomy is not only about biomass, it also promotes bio-based processes and tools carried out by and with the help of micro-organisms, animal and plant cells and their components. These processes and tools include breeding, bioinformatics, technologies and methods for data analysis and production processes for industrial biotechnology. Biotechnology includes traditional, low-tech approaches, such as microbial fermentation, to more advanced technology-driven approaches such as bionics, artificial intelligence, and carbon capture.

Examples include: fermentation, where micro-organisms convert sugars from plants, animals or residues into alcohol or acid for the production of food additives, bioethanol, biopharma, or bioproducts, such as biofertilizer. For instance, today, 100 percent of vitamin B2 on the global market is produced by fermentation using industrial biotechnology; carbon capture, where micro-organisms such as microalgae capture carbon emissions from farms, landfills or heavy industry, and convert atmospheric carbon into valuable materials; digital sciences and data analysis tools, which can optimize and upscale all these applications – e.g. biotechnology is used for plant and animal disease diagnosis, cell culture, bio-based sensors and for the characterization and conservation of genetic resources for food and agriculture.

Keywords*:* European Integration, Digital Economy, Smart Economics, Bioeconomy Strategy, Biomass

1. INTRODUCTION

The current pace of implementation of smart technologies: digitization, smartization, smart specialization, the transition from a linear to a circular economy gives rise to a wide range of issues that affect the bioeconomy, for example, the intellectualization of socio-economic development [1], integration into the European space [2], the use biomass and waste processing [3], energy saving, overcoming the food crisis [4], social inequalities [5], the need to transition to a cyclical economy [6], loss of biodiversity [6], land use difficulties [4], soil and atmospheric pollution, wear and tear infrastructure and buildings, security and cyber security, smart specialization [7], sustainable economic development [8-12], etc.

According to the Summit [13], the term sustainable bioeconomy is the center of "the production, use, preservation and transformation of biological resources, which with the help of digital technologies aim to provide data and information that contribute to improving the circularity and efficiency of waste, water, energy, agriculture, health care, education, mobility, telecommunications and management".

Bioeconomy strategies and practices are at the heart of several international frameworks, such as:

- Report on "challenges, visions and ways of development of the city of the future" [14];

- the study "New views on the urbanization of the cities of the world" [15];

- The UN Agenda for Sustainable Development until 2030 [16].

In [17, 28], the authors identified a wide range of bioeconomic strategies and practices that meet the various goals and objectives of the UN Sustainable Development Agenda for the period up to 2030, such as:

- food security (Goals 1 and 2);

- water quality (Goal 6);

- energy efficiency (Goal 7);

- economic development (goal 8);

- prevention of waste generation and its reuse (goal 12);

- prevention of life under water and on land (Goals 14 and 15).

Likewise, the Report [19] recommends politicians, urban planners and managers to strengthen "sustainable resource management, promoting ecosystem conservation, regeneration, restoration and resilience in the face of new emerging challenges".

Therefore, politicians, entrepreneurs and citizens need to rethink the bio-economic paradigm through the implementation of smart technologies and sustainable initiatives in order to optimize social, economic and environmental processes and operations.

To this end, it is important to improve understanding and awareness of bioeconomic flows and reorient their circulation in order to support a perspective and dynamic vision of bioeconomy as an engine of smart solutions and a driver of the development of Ukraine's smart economy [1].

2. MATERIAL AND METHOD

Research methods: general scientific methods: analysis, synthesis, induction, deduction, system approach and modeling – for studying theoretical issues of forming a strategically oriented model of sustainable development; method of generalization - for the formation of a strategically oriented model of sustainable development.

The research methodology involves the use of general scientific and specific methods used in economics, ecology and biotechnology, and is based on an interdisciplinary approach.

The scientific novelty of the obtained results lies in the determination of directions for the development of the bioeconomy within the framework of the national economy in the conditions of the latest global challenges.

3. RESULTS

The transition to a smart economy, a circular economy and a sustainable bioeconomy aims to solve the problem of an approach based on an ever-increasing number of renewable biological resources, such as: plant resources, agro-food production, forests, marine and livestock resources, microorganisms, algae, as well as waste, by-products and wastewater of agro-industrial origin, and consequent congestion, to reduce anthropogenic built-up and natural settlements.

A new form of smart technologies, thanks to the use of digital platforms and dashboards, holistically combines a wide range of information and communication technologies (ICT), such as: sensors, real-time monitoring stations, cameras, GPS system tracking, big data analysis methods, artificial intelligence, augmented reality, blockchain, Internet of Things (IoT), cloud computing, smart grids, satellites, nanotechnology, advanced biotechnology and drones.

The information and communication technologies (ICT) listed above provide real-time, fully transparent authentication, tracking, analysis and evaluation of data and information on bio-economic ecosystem resources from source to customer and contribute to the safety and efficiency of production processes.

Therefore, the widespread and intensive distribution of stationary and mobile digital devices revolutionizes the circularity of raw materials and secondary materials, by-products, chemicals, biofuels, bioplastics, urban and industrial waste and wastewater, generates a wide and diverse range of data and information useful for politicians, managers enterprises, agricultural entrepreneurs, scientists, manufacturers, logistics companies, workers of biorefineries, chemical-technological enterprises, enterprises of the construction industry and enterprises of the provision of services, etc., capable of optimizing the use of natural and non-natural resources and improving the quality of their interaction.

In this context, information and communication technologies (ICT) allow to act proactively and on the basis of a systemic holistic approach, able to improve the interdisciplinary integration of smart economic knowledge in the global transformation space, commercialization in the bioeconomy sector through innovations such as precision agriculture, animal husbandry, ecological packaging and industry 4.0. Conversely, the lack of scientific research, detailed data and real-time information determines a wide range of uncertainties related to, for example, the timing of procurement, production, distribution and reproduction, quality, location and consumption, which leads to insufficient optimization of bioeconomic flows.

Therefore, systematicity, variety, proactivity, flexibility, coordination ability, variety, prediction, interdependence, cooperation, adaptability, creativity, efficiency, agility, self-organization, robustness and resourcefulness of bioeconomic data and information provided by stationary and mobile digital equipment allow not only to minimize economic, social and environmental costs, and act as tools to upgrade other dimensions such as: mobility, telecommunications, health, education and security.

4. DISCUSSION AND CONCLUSIONS

According to the Bioeconomy's Future Transitions to Sustainable Development-ment and a Climate-Neutral Economy report developed by the European Commission's Bioeconomy Knowledge Center, the bioeconomy employs about 17.5 million people (almost 9% of the workforce), generating €614 billion added value (about 5% of its GDP). In addition, if we include the tertiary bioeconomy sector based on digital services, which amounts to 872 billion euros, we get a pan-European scale of the bioeconomy of 1.5 trillion euros (almost 10% of its GDP) [20].

Thus, the growing importance of the bioeconomy has provided a wide range of strategies and practices at the global level [13]. In this sense, the development of bioeconomic policy is becoming increasingly complex and diverse. In general, bioeconomy strategies and practices tend to differ based on factors related to, for example, technical and logical advances, availability of natural resources, cultural and institutional progress and development of the economic system [21].

5. CONCLUSIONS

Thus, the current theoretical and managerial issues of the interdisciplinary integration of smart economic knowledge in the global transformational space are focused on the role of biotechnology, nanotechnology, and information and communication technologies (ICT) in the bioeconomy [84]. In this regard, Costa Rica [79] introduced the term "advanced bioeconomy" to emphasize the importance of digitalization to improve the cycle of natural and non-natural resources.

At the same time, the intensive widespread use of digital technologies in the bioeconomy highlights a wide range of challenges and problems in the social, economic and environmental spheres [85]. Based on reports, master plans and documents developed by governments, ministries, departments, research centers, the interdisciplinary integration of smart economy knowledge in the global transformation space involves a detailed review of bioeconomy strategies and practices implemented worldwide to develop a multidimensional platform capable of holistically integrating aspects , which characterize the decision-making process regarding the bioeconomy.

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