Biotechnology: socio-economic, political and ethical aspects

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Abstract. The experiences of the past century have led to the realization that technological innovations often proceed without adequate testing for their readiness and potential consequences for humanity. The prevailing mindset often revolves around the stereotypes of continuous scientific and technological progress, where new developments are rapidly integrated into consumer society, including military applications, without comprehensive oversight. These waves typically encompass several decades and are associated with the evolution of technologies and industries. They provide a framework for understanding how technological innovations and economic structures interact and evolve over time. The concern raised is that during these waves of technological and economic development, there may not always be sufficient consideration of the potential consequences, both positive and negative, of the innovations introduced. This lack of foresight can result in unforeseen challenges and risks for society. In today's rapidly changing technological landscape, it is crucial to consider the ethical, environmental, and societal implications of emerging technologies. A more cautious and responsible approach to technological progress, taking into account the broader implications for humanity, is increasingly important to ensure the well-being and sustainability of our global society.

1 Introduction

The current biotechnology market is estimated to range from one and a half to two and a half billion dollars (fig.1). The largest segment within this market is biopharmaceuticals, accounting for 80% of the sector's activity, largely due to imports [1-2]. However, the modern bioindustry in Russia is still in its nascent stages and is practically non-existent. The development of the bioindustry requires several key factors, which theoretically exist in our country but are underutilized in practice.

One of these crucial factors is the country's rich bioresource base. Russia boasts the largest arable land areas globally, possesses a quarter of the world's forest resources, abundant freshwater reserves, a wealth of energy resources, and a pool of qualified

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personnel [3]. These resources create a strong foundation for the development of biotechnology.

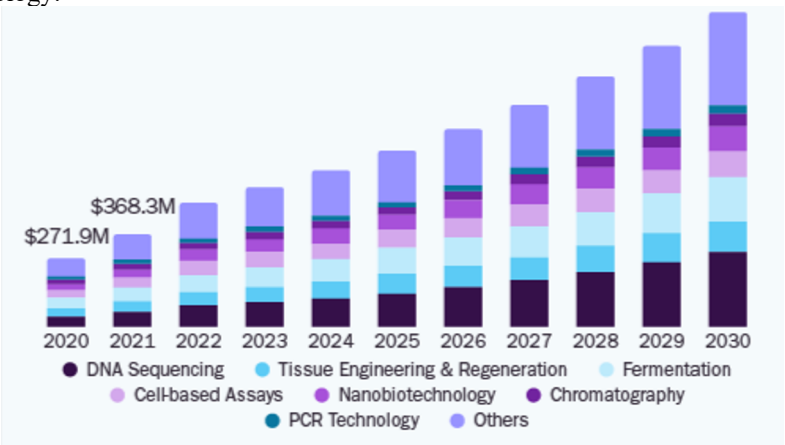

Fig. 1. Biotechnology Market Size

At the turn of the 21st century, Russia saw positive government initiatives and became a driving force in organizing project activities aimed at advancing the country's development. This marked a shift away from a purely neoliberal approach and signaled a willingness to explore new strategic directions for Russia's progress [4]. However, when it comes to biotechnologies, which are one of the four essential NBIC (Nanotechnology, Biotechnology, Information technology, and Cognitive science) technologies in the sixth technological order, the state seems to be largely neglecting their potential [5].

In light of the substantial resources and human capital available in Russia, there is untapped potential for the country to become a significant player in the global biotechnology industry. Realizing this potential would require a more proactive approach from the government and a greater emphasis on the development of biotechnologies as a critical component of the nation's future growth and innovation.

2 Research Methodology

In various fields, including biotechnology, cellbiology and human genetics, they find applications in different areas of genetic engineering [6]. The use of gene engineering methods is found in a number of fields: biotechnology, cell biology, Because of the use of such technology, our knowledge of life processes at the molecular level has significantly deepened compared to centuries ago. Thanks to this genetic technology, our understanding of life processes at the molecular level has significantly deepened compared to centuries ago. In biotechnology, they promise to address and even defeat some hereditary diseases in the future [7]. This progress in biotechnology holds the hope of addressing and even defeating some hereditary diseases in the future.

At the intersection of biological, chemical and scientific sciences in modern world, biotechnology occupies a prominent position in the modern world [9]. It has been closely linked to the development of its product, in particular, with addressing different global problems [8]. Energy shortages and depletion of mineral resources are important for improving health quality through food scarcity, as well as energy shortages from the depletion of mineral resources, food scarcity, and the enhancement of healthcare and environmental quality.

For centuries, humanity has involved in biotechnological activities such as baking winemaking and fermented milk products. In the past, humans have engaged in

biotechnological processes, such as baking, winemaking or the preparation of fermented milk products. Traditional biotechnology gained scientific foundation in the mid-19th century, thanks to the pioneering work of Louis Pasteur, who was one of the first French microbiologists to develop microorganisms. In his work, he discovered and demonstrated the connection between fermentation process and the activity of microorganisms, who play an important role in fermentation processes.

Today, biotechnological methods are instrumental in creating new varieties of agricultural crops and plants. These include transgenic varieties of soybeans, potatoes, tomatoes, wheat, and more. These varieties are developed with the aim of addressing global food security challenges and nourishing the world's growing population.

3 Results and Discussions

We are far from thinking that biotechnology is a panacea for all ills, but we consider it necessary to widely explain the ideas of biotechnology, including in the humanitarian community, and not just among representatives of the natural sciences and technical intelligentsia [9]. This approach will help avoid unwanted alternative confrontation in views and develop balanced, optimized approaches to resolving pressing issues. We see this as one of the main goals of the “Biotechnology and Society” forum, which can and should become a platform for permanent discussion of the socio-humanitarian aspects of biotechnology. What are the opportunities for biotechnology in providing food and feed? This is, first of all: increasing agricultural yields with minimal impact on the environment; genetic modifications of plants and other organisms to increase their value as a source of food, feed, fiber and raw materials for various industries; improving technologies for processing agricultural products, including aquaculture, seafood, etc. When applied to medicine, biotechnology is becoming a truly revolutionary tool. It makes medicine an information industry with multi-billion-dollar databases on the health status of hundreds of millions of people, obtained using the latest achievements of genomic and post-genomic technologies. We are talking about the healthcare of the future - the so-called P4 medicine, based on four basic principles: predictiveness, prevention, personalization, and broad patient participation in treatment. There is a prejudice about the high cost of future medicine, its elitism and inaccessibility to the poor. However, according to experts, the cost of high-tech diagnostic and treatment procedures will be reduced in the next 10–20 years and will become quite comparable with the current cost of a highly specialized examination [10]. The contribution of biotechnology to solving environmental problems and the depletion of mineral resources is extremely important. Historically, there has always been a direct link between economic growth, energy consumption and environmental destruction. This occurred as a result of the use of traditional “polluting” technologies with emissions of CO2 and toxic chemicals. A new generation of “green biotechnologies” allows for economic growth without environmental destruction. The use of renewable plant raw materials (biomass) creates great opportunities for the production of vital products: chemicals, biopolymers, biofuels, etc. The widespread use of technologies for complete processing of biomass (“biorefineries”) is especially promising. According to forecasts by the Organization for Economic Co-operation and Development (OECD), by 2030 biotechnology will account for 2.7% of the GDP of developed countries. All of the above regarding the contribution of biotechnology to the economic activities of modern society creates a completely new concept - bioeconomy, that is, an economy based on the large-scale application of biotechnology, including the use of renewable bioresources to produce valuable products and energy (fig.2).

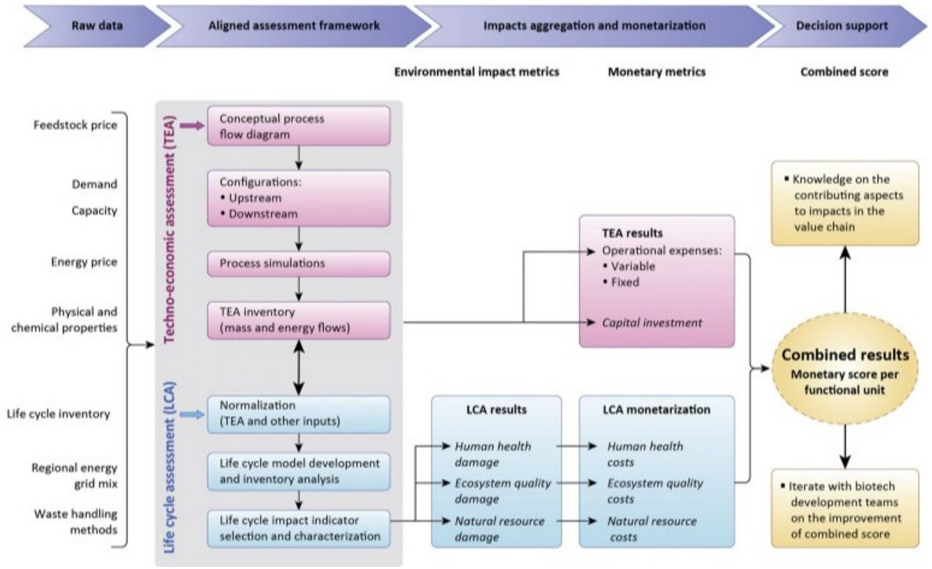

Fig. 2. Combining Environmental and Economic Performance for Bioprocess Optimization

In this context, it's crucial to consider the distinctive aspects of biotechnology, which result from the amalgamation of life sciences, engineering, and production. A significant outcome of this fusion is the creation of genetically modified organisms (GMOs) and GMO-derived products, which offer numerous advantages [11]. However, a comprehensive evaluation of their impact remains ambiguous due to existing disadvantages. The ethics surrounding GMOs comprises two levels, the first of which is the ethics of scientific research within intricate domains, often yielding unpredictable results. This unpredictability has parallels with other major scientific discoveries, as noted by Moscow ecophilosopher Professor Alexander Nikanorovich Tetior: "Scientific knowledge is not inclined to foresee the possible negative consequences of major scientific discoveries... after a number of years, it becomes clear that there is a negative and dangerous side to the discovery for humanity, such as nuclear winter getting out of control, long-term environmental pollution and waste from nuclear weapons, and more." This list can similarly include the production of modified products and organisms, as ethical control over science on a global scale has not been developed or implemented.

4 Conclusions

The potential of nano-bio-medical technologies to extend human life and enhance our capabilities is both promising and concerning. While these technologies hold the promise of improving the human condition, they also create the conditions for a significant increase in societal stratification. This stratification is influenced by the financial means available to individuals who can access and benefit from these advancements. In the current state of society, this trend could lead to new forms of colonialism and the subtle enslavement of a vast portion of the global population by a small elite group.

This elite group could be those who are quickest to harness network technologies for organizing specialists in the field of nano-biomedicine, leveraging these technologies for their own corporate interests. This concept aligns with the idea of a ruling group of "supermen" who exercise control on a global scale.

In this context, the stance of transhumanists, who focus on creating enhanced superhumans with the intention of ultimately forming a "better society," raises concerns. It is important to recognize that this challenge necessitates the development of meta-technologies aimed at mitigating or neutralizing these potential risks and imbalances in the application of advanced technologies.

Addressing these complex ethical, societal, and technological challenges is essential to ensure that the benefits of emerging technologies are distributed equitably and used for the betterment of all of humanity rather than concentrating power and influence in the hands of a few.

References

1. A. A. Daukaev, R. Kh. Dadashev, L. S. Gatsaeva, R. A. Gakaev, IOP Conf. Series: Earth and Environmental Science, 378 (2019)
2. A. Yu. Apokin, D. R. Belousov, Scenarios for the development of the world and Russian economy as a basis for scientific and technological forecasting, **3(3)**, 12–29 (2009)
3. Bio-Economy Technology Platforms. The European Bioeconomy in 2030: Delivering Sustainable Growth by addressing the Grand Societal Challenges (2021)
4. C. Cagnin, E. Amanatidou, M. Keenan, Orienting European Innovation Systems towards Grand Challenges and the Roles that FTA Can Play, **39(2)**, 140–152 (2020)
5. E. Reynard, M. Panizza, Geomorphosites: definition, assessment, and mapping. Geomorphol Relief , 177–180 (2018)
6. EU-Russia Energy Dialogue, Energy Forecasts and Scenarios 2009–2010 Research. Final Report (2021)
7. K. Haegeman, F. Scapolo, A. Ricci, E. Marinelli, A. Sokolov, Quantitative and qualitative approaches in FTA: from combination to integration?, **80**, 386–397 (2021)
8. R. Kh. Ilyasov, Spline modeling and analysis of relationships in the economy with the possible presence of regression switching points, **11(4)**, 165-175 (2018)
9. K. M.-S. Murtazova, Ecological and economic assessment of sectoral agricultural technologies, **3(15)**, 68-71 (2021)
10. A. S. Salamova, Socio-economic factors in the fight poverty and hunger in the modern world: the scientific approach of Amartia Kumar Sen, **17(1)**, 237-245 (2023)
11. A. S. Salamova, Global networked economy as a factor for sustainable development, 03053 (2020)
12. Ç. Sabahattin, K. Ayhan, The Manager, **12(3)**, 44-55 (2021)