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BIOECONOMICS OF HEALTH AS A NEW MODEL OF SUSTAINABLE ENDOGENOUS INCLUSIVE DEVELOPMENT MODEL FOR THE LOCAL COMMUNITY AND INNOVATION MAINSTREAM OF THE POST-PANDEMIC TRANSFORMATION OF THE WORLD ECONOMY

The inventive of the steam engine, which became a symbol of the First Industrial Revolution (1IR) and its rapid spread in the 18-19 centuries, opened the way for the formation of a new model for the development of human communities on an industrial basis through a consistent change in technological patterns. The economy created on this foundation had as its main goal the production of not only resources to maintain the life and health of people, but also technical tools and technologies for industries (physical or produced capital). At the same time, economic growth was ensured by the accumulation of the concentration of skilled labor and such capital as its basic factors, both at the micro level of an enterprise and at the macro level of a country or industry. The discovery of electricity and invention of electrical machines in the late 19th and early 20th centuries became the spokesman for 2IR and predetermined the leading role of physical capital in increasing the economic wealth of corporations and nations. In turn, 3IR and the automation of production processes in the 60-70s gradually brought innovative technologies to the forefront, giving rise in the 80s of the last century to a technocratic-oriented linear concept of Scientific and Technological Progress (STP) as the economic mainstream. However, since the generation of technological innovations (as innovative objects) is critically depended on the quality and motivation of the human potential (innovative actors). The emergence of information and communication technologies (ICT) and Internet at the end of the 20th century, as well as the rapid expansion of digital technologies, generated by 4IR, brought the humanitarian capital, intangible assets and social innovations on the main place of leading factor of endogenous economic growth by the beginning of the 21st century. Meanwhile, the conditional construction of humanitarian capital resembles a multi-story building, the foundation of which forms public life and health of the corporate personnel or local community, as their human capital, the first floor is the intellectual capital created by them, interactively integrated through appropriate interfaces into the multi-layered and interdependent global economy using the upper floors of such building.

From this point of view, the pandemic shocks were aimed at innovative destruction of the very foundation of the world economy; an adequate response to them requires a radical

institutional transformation of existing systems of economic and social activity. In essence, we are talking about a commodity-centric and industry-oriented market economy to a human-centric and health-oriented social bioeconomy. And this is quite consistent with the fact, that people's life and health are the value foundation of any nation and key among 17 UN global sustainable development goals (SDGs). The COVID-19 pandemic has convincingly shown that these values form the sense of the state existence, as well as a criterial base for the effectiveness of public power. Having provoked the deepest economic crisis in the past century and a half and caused an unprecedented world lockdown, this pandemic has demonstrated both the inefficiency of existing national healthcare systems and the lack of sustainability of the global economy. In combination with the sharply increased phenomenon of Volatility (V), Uncertainty (U) and Complexity (C) of the observed and interpreted within the framework of traditional (neo) classical theories of modern economic processes and the Ambiquity (A) of the predictive results obtained on their basis [1], all this indicated an equally unprecedented nature of the global innovation challenges behind them. In turn, VUCA-trends and the uncertainty of the prospects for restructuring the post-pandemic economic reality give rise to the need to rethink the original theoretical concepts laid in the classical scientific foundation of ideas about health and the system of its maintenance, as well as about the economy and its target function in the context of future inclusive sustainable development.

As for health, it's basic concept as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" was formed by the UN back in 1946 and laid down in the Constitution of the World Health Organization (WHO). Moreover, this Constitution treats the health as a key principle for "the happiness, harmonious relations and security of all peoples [2]. Such a broad definition implies a strong role of the state in vertical integration of national public health system (PHS), based on the primary healthcare as its institutional foundation at the level of the local community. The key role in such a system belongs to the hospital as a main institution for the treatment of acute diseases and pathologies with passive role of the patient ordering or needing medical services.

30 years later, after the entry into force in 1948 the WHO Constitution, in the Declaration of Alma-Ata Conference on Primary Health Care (PHC) in 1978 states that PHC "is based on the application of the relevant results of social, biomedical and health services research and public health experience, addresses the main health problems in the community, providing promotive, preventive, curative and rehabilitative services" and includes at least "education prevailing health problems and the methods of preventing and controlling them; promotion of food supply and proper nutrition; adequate supply of safe water and basic sanitation; maternal and child health care, including family planning; immunization against the major infectious diseases, prevention and control of local endemic diseases; appropriate treatment of common diseases and injuries; and provision of essential drugs" [3]. In general, within such framework, PHS realized a sectoral and "medical-centric" approach, although it

came of the understanding, that “the attainment of the highest possible level of health is a most important world-wide social goal whose realization requires the actions of many other social and economic sectors in addition to the health sector”, as well as all “aspects of national and community development, in particular agriculture, animal husbandry, food, industry, education, housing, public workers, communications and other” and “demands the coordinated efforts of all these sectors”.

By virtue of this, there was declared “the need for urgent action by all governments, and health and development workers, and the world community to protect and promote the health of all the people of the world”, and stated the “main social target of the governments, international organizations and the whole world community in the coming decades should be attainment by all peoples of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life”. Simultaneously, there was emphasized that “primary health care is the key to attorney this target as part of development in spirit of social justice” [ibid].

The adoption of this declaration made it possible to integrate the efforts of the world community in both struggle with a specific disease, such as malaria or tuberculosis, and increasing the life expectancy of people in different countries and regions based on innovation technologies and healthy lifestyles. However, due to the deepening global economic and social stratification, primarily between developed and dveloping countries, by the 2000 the world was farther from the declared goal of “health for all” in “spirit of social justice” in the framework of “medical-oriented” approach than in 1978 [4].

This meant that that the problem of building effective PHS requires a broader intersectoral approach and needs a wider spectrum of socio-economical determinants and political and institutional drivers. Moreover, the Public Health System itself should be harmoniously integrated into the global development in context of the Millennium Development Goals (MDGs), defined by the UN for the 2000-2015 period.

Meanwhile, the global crisis of 2007-2009 has exacerbated the problem of social inequity even more and demanded better joint governance for better life and health. To develop such a policy, based on comprehensive intersectoral interaction, the World Conference on Social Determinants of Health there was held in Rio de Janeiro, Brazil, in October 2011, which noted, that “current global economic and financial crisis urgently requires the adoption of actions to reduce increasing health inequities and prevent worsening of living conditions and the deterioration of the universal health care and social protection systems” in spirit of policy “all for equity” and “health for all” [5]. In framework of this Rio Declaration there were worked out five domain of the monitoring system mirroring the five action areas and determined eight key sectors for determinant’s designing, including , in addition to health, seven more related sectors: housing and environment; agriculture and food; economy and trade; as well as employment, education, transport and justice. The adoption by the UN in 2015 of 17 SDGs on 2016-2030 period, among which the key role belongs to goal

3 (quality life and health), not only further strengthened the request for an integrated intersectoral approach to the building up the PHS, but also intensified attempts to work out a holistic system of health indicators [6].

To this end, forty years after Alma-Ata, in order to give adequate answers how to ensure the health in a spirit of intersectoral partnership and international cooperation in the face of innovation challenges of sustainable development, the new Global Conference on Primary Health Care was held in Astana, Kazakhstan, 25 and 26 October 2018. Within the framework of the Astana Declaration adopted there, a big shift is planned from previous focus on PHC towards Universal Health Coverage (UHC) with particular emphasis on new knowledge, capacity-building based on innovation-oriented human resources, technologies and financing. To achieve this goal, there was significantly expanded the range of active participants and partners, including individuals and local communities [7, sect. VI]:

"We support the involvement of individuals, families, communities and civil society.

We will increase community ownership and contribute of the accountability of the public and private sectors for more people to live healthier ... in enabling and health-conductive environments". And further [7, sect.VII]:

"We call on all stakeholders- health professionals, academia, patients, civil society, local and international partners, agencies and funds, the private sector, faith-based organizations and others - to align with national policies, strategies and plans across all sectors, including through people-centered, gender sensitive approaches, to take joint actions to build stronger and sustainable PHC towards achieving UHC ... in a spirit of partnership and effective development cooperation, sharing knowledge and good practices while fully respecting national sovereignty and human rights.

As we can see, over the past four decades, there has been a significant transformation in visions how to ensure high quality of public health. This transformation is manifested not only in the shift from PHC into UHC, which requires going beyond prevailing medical sciences and integration into broad interdisciplinary cooperation, but also a fundamental change in focus from hospital-oriented approach to people-centered one. Of course, such evolution took place also under the influence of that mainstream of the current decade, which affected the widespread transition from exclusive to inclusive models and proactive strategies of sustainable development. At the same time, quite naturally, not only the traditional question about the level of costs required for this arose, but also more broad problem of economic basis for such models. Moreover, the path and the cost of maintaining high quality of health and existing level of life expectancy demonstrated by OECD countries, as can be seen from Fig.1, turned to be economically unacceptable not only for the emerging economies, but also for most of the less developed states [8].

Indeed, from the data presented in Fig.1 it follows that if other countries build their PHS like the United States did, it would be necessary to spend almost the entire globally produced GDP. Meanwhile, the total expenditures that the entire planet can afford to spend

security. Improving global health requires a holistic approach that includes cities, food, and education. It also implies a shift from reactive medicine to predictive and preventive approaches.

To achieve this multi scale purpose, we must connect people, ideas, data and solutions. Healthcare today calls for a fresh and collaborative approach to innovation, which cuts across scientific disciplines and breaks down silos to allow education, research, big firms, retailers, and patients to collaborate in real time. Collaborative experience platforms are the infrastructure of this change. They provide a continuum of transformational disciplines to imagine, create, produce, and operate experiences from end to end."

Such innovative visions and trends largely predetermined the situation when, next year after the Conference in Astana, a High-Level Meeting on Universal Health Coverage was held on the 23d of September 2019 in New York within the framework of the UN General Assembly. The Political Declaration, adopted during this Meeting, is oriented on scaling up the global efforts to build a healthier world for all and to achieve UHC by 2030 in coherence with 2030 Agenda.

And in this regard there are specifically stated [10]:

"5. Recognize, that universal health coverage is fundamental for achieving the sustainable development goals;

8. Recognize, that health an investment in the human capital and social and economic development;

10. Recognize the need for health systems that are strong, resilient, functional, well governed, responsive, accountable, integrated, community-based, people-centered and capable of quality service delivery, supported by a complement health workforce, adequate health infrastructure, enabling legislative and regulatory frameworks as well as sufficient and sustainable funding;

52. Explore, encourage and promote a range of innovative incentives and finance mechanisms for health research and development, including a stronger and transparent partnership between the public and private sectors as well as the academia;

54. Engage all relevant stakeholders, including civil society, private sector and academia ... through the establishment of participatory and transparent multi-stakeholder platforms and partnerships, ...

56. Build effective, accountable, transparent and inclusive institutions at all levels to end corruption and ensure social justice …

61. Develop, improve, and make available evidence-based training that is essential to different cultures..., as well as promote a continued education and life-long learning agenda and expand community-based health education and training in order to provide quality care for people through the life-course;

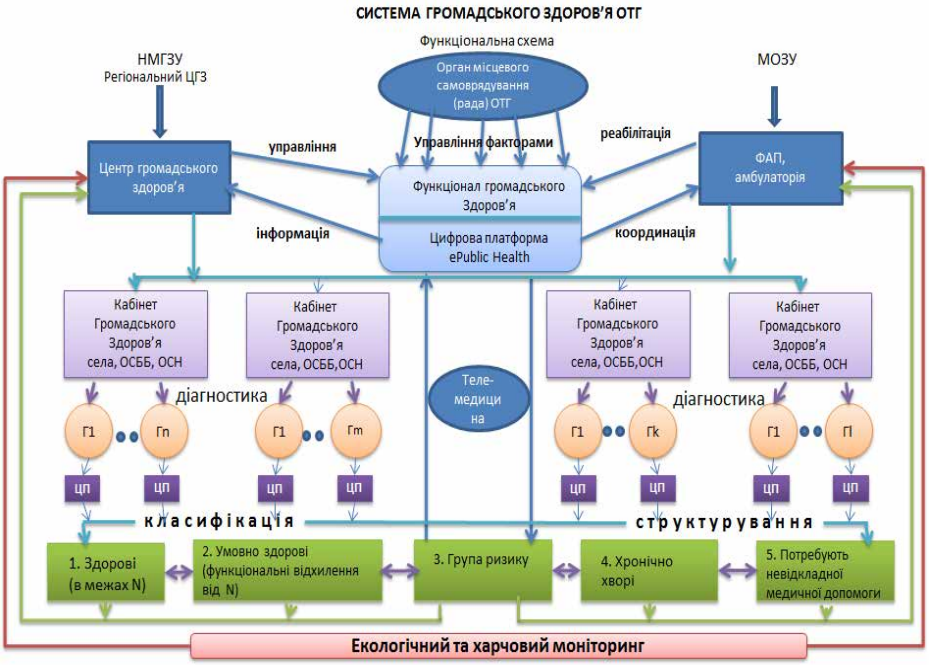
65. Strengthen capacity on health intervention and public-health-driven use of relevant evidence-based and user-friendly technologies, including digital technologies, and innovation

to increase access to quality health and related social services and relevant information, improve the cost-effectiveness of health systems... to build and strengthen interoperable and integrated health information systems and public health surveillance, as well as the need to protect data and privacy and narrow the digital divide;

77. Realize and promote strong global partnership with all relevant stakeholders to achieve coverage and other health-related targets of the SDGs ...”

Taking into consideration the community-based (above-mentioned p.10) nature of such decentralized UHC ecosystems, their modeling is of fundamental importance (p.5). This leads to a well-grounded formulation of the problem of designing such local public health system as an innovation foundation for holistic multilayered national PHS, built in “bottom-up” direction and integrated with traditional vertically-subordinated PHC in spirit of p.65. At the same time, such a system is based on a nonclassical quantum mechanical concept of individual human health and the spatially distributed picture and factorized functional of public health of the local community [11].

In development of such approach and its expertise and implementation in a pilot version based on Polyana resort local community in Transcarpathia region in Ukraine there was arranged the first International scientific and practical round table “E-Public health management system for local community” in February 2018, and at the end of the same year (November,30 - December, 1) was held the First International scientific and practical conference “Public Health System: theory, methodology, technologies, social practice and management”. A schematic diagram of such system for the local community is shown in Fig.2 [12].

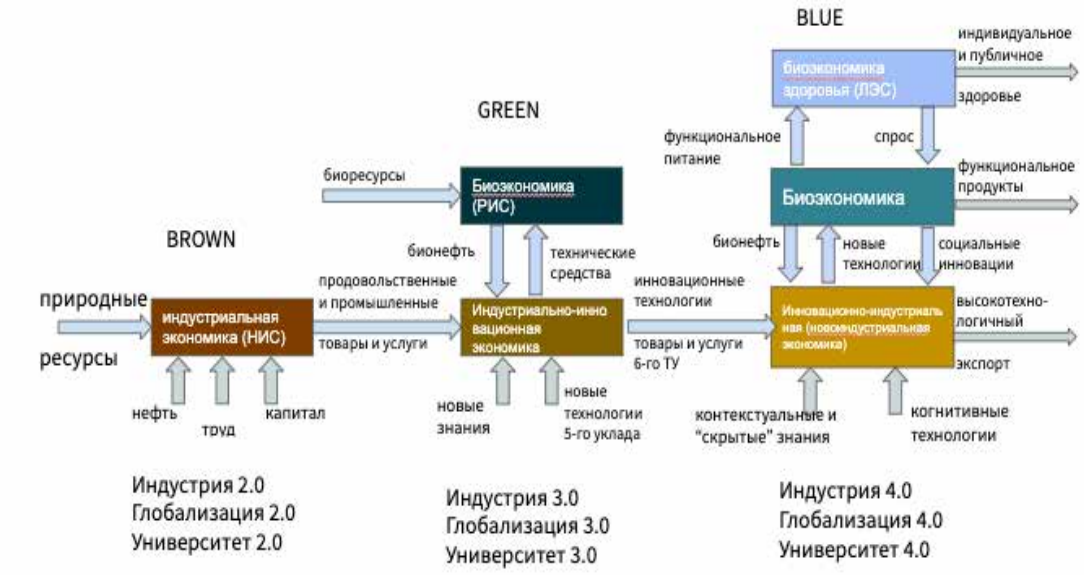


As can be seen from this figure, the key institutions of such local PHS are the Public Health (PH) Center and PH offices, connected via a digital platform into a common network. At the same time, these centers and offices are responsible for diagnosing and adjusting individual health indicators using technological systems based on artificial intelligence, while the central server and e-platform provide monitoring and affordable regulation of the PH factors for the entire community.

The approach implemented within the framework of this decentralized PHS is close in spirit to the energy-informational paradigm of health proposed by prof. Apanasenko G.L. [13], which is alternative to the existing traditional medical version of it. Such a paradigm, combined with a quantum-mechanical picture of health, opens up the prospect of creating a broad scientific platform for interdisciplinary synthesis that integrates the possibilities of natural and medical sciences.

Another aspect of such PHS is associated with its key role among 17 SDGs as well as the basis for the formation of human capital as a leading one in inclusive sustainable development systems on an innovative basis. This means that health and PHC, which are often viewed outside economic categories as budget expenditures, within the UHC approaches and SDGs become a capital-forming direction. In this sense, we can talk about the synthesis of economics and health as a qualitatively new, post-nonclassical form of scientific rationality and a new stage in global economic evolution as an innovative BIOECONOMICS OF HEALTH [14].

A schematic diagram of such evolution, as well as the essential differences that distinguish each of its stages, is shown in Fig.3.



НИС - национальная инновационная система; РИС -региональная инновационная система; ЛЭС - локальная (местная) экосистема

As one can see, two of the three steps of this “evolutionary ladder”, the Industrial (Brown) and Bioeconomy (Green), have become a reality in a third of the mainly developed

countries on the planet, involving all the rest with help of the mechanisms of Globalization 2.0 (Trade without borders based on WTO rules) and Globalization 3.0 (Production without borders) [15]. The third, (Blue) BIOECONOMICS OF HEALTH is the predicted future new post-pandemic economic reality, the target function of which is not the production of goods and services, even if they are ecological and organic, but expanded reproduction of health.

In this sense, the institutional transformation of national economies towards decentralized formation of such bioeconomics is objectively the leading trend in the post-pandemic transformation of the global industry, integrating not only the opportunities of Industrialization 4.0 and the corresponding Globalization 4.0 (Service without borders), but also the modernized possibilities of the previous two types of economy (Brown and Green) as mega-means of world production.

At the same time, at a faster pace under the double impact of both the innovative challenges of IR4 and the global challenges of the COVID-19 pandemic, on the one hand, digital sectors are developing within the framework of UHC and Bioeconomy, and on the other hand, new business models in the field of public health and medicine. In particular, the use of digital technologies in healthcare systems will allow generating from $1.5 trillion to $3.0T of added value by 2030 and reducing the total global health expenditures from the projected $14.5 to $11.5T compared to $8.4T in 2020, due to more efficient organization of UHC service and reducing relative need for qualified medical personnel [16].

At the same time, against the backdrop of rapidly growing telemedicine, at a record high pace, spurred on by the lockdown, demonstrated a relatively new sector telehealth, in April 2020 alone it grew 78 (!) times, slightly slowing down to 38 times over the course of 12 months, reaching $250 billion [12]. Along with this, due to lockdown and forced isolation, in 2020, 3 times compared to 2017, the previously almost imperceptible global digital food-delivery market grew to $150 billion, especially in Canada (7times), in Australia (5.5 times), and almost 5 times in the US and UK [17].

The rapid and deep penetration of 4IR technologies into the field of public health and medical service really leads to the creation of new business models, including next-gen management care, the simultaneous fragmentation of sites of care, integration of different forms of UHC around the patient, consolidation of public care and public health institution, new kinds of technology-enabled UHC-integrated services and businesses [19].

The rapid diversification and interdisciplinary integration of modern digital and biotechnological tools in order to preserve and enhance individual and public health n local communities, predetermines that the local bioeconics of health should become the new leader of post pandemic recovery and economic growth, however, focused on the advancing build-up of human capital and new knowledge. In turn, this also presupposes a corresponding evolution of educational institutions with the key role of network “University 4.0”[20] capable not only of training the necessary personnel for the future, but also serving as a “capitalizer” of humanitarian potential as well as a designer and globalizer of regional

inclusive development. As a result, this creates both unprecedented innovative challenges and new great opportunities for regional mechanical and bioengineering and instrument making.

References

1. Buckley P.J. The theory and empirics of the structural reshaping of globalization. Journal of International Business Studies, 2020, Vol.51, №9, pp.1580-1592

2. Constitution of the World Health Organization. Geneva, UN, 1946. URL: https://www.who.int/governance/be/who_constitution_en.pdf

3. Declaration of Alma-Ata Conference on Primary Health Care, Alma-Ata, USSR, 6-12 September 1978. The International C-World Health Organization, 1978. URL: http://www.euro.who.int/_data/assets/pdf_file/0009/113877/E93944.pdf?us

4. "Achieving Health Equity: from root causes to fair outcomes", Interim Statement, Commission on Social Determinants of Health. Geneva, World Health Organization. 2007. URL: http://www.who.int/social_determinants/en

5. Rio Political Declaration on Social Determinants of Health, Rio de Janeiro, Brazil, 21 October 2011. URL: https://www.who.int/sdhconference/declaration/Rio political_declaration.pdf

6. "Global monitoring of action on the social determinants of health: a proposed framework and basket of core indicators" [Consultation Paper]. Geneva, WHO, 2016. URL: //www.who.int/social_determinants/consultation-paper-SDH-Action-Monitoring.pdf

7. Declaration of Astana Global Conference on Primary Health Care "From Alma-Ata Towards universal health coverage and the sustainable development goals". Astana, 25-26 October, 2018. URL: https://www.who.int/docs/default-source/primary-health/declaration/gcphc-declaration.pdf

8. "Health Systems Leapfrogging in Emerging Economies. Ecosystem of Partnership for Leapfrogging". WEF Report, May 2016. URL: http://www3.weforum.org/docs/WEF_Health_Systems_Leapfrogging_Emerging_Economies_report.pdf

9. "Creating Healthy Lives- The Future of Medical Innovation". Global Innovation Index 2019. 12-th edition. Geneva, WIPO, 2019. URL: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2019.pdf

10. "Universal Health Coverage: moving together to build a healthier world". Political Declaration of the UN High-Level Meeting on Universal Health Coverage. New York, UN, 23 September 2019. URL: https://www.un.org/pga/73/WP-content/uploads/sites/53/2019/05/UHC-Political-Declaration-zero-draft.pdf.

11. Сенюк Ю.В., Морозов О.Ф. Система громадського здоров'я як інноваційна проблема та фундамент сталого інклюзивного розвитку України. - Проблеми інноваційно-інвестиційного розвитку, 2018, Вип.16, С.109-136.

12. Seniuk Y., Dyachenko K. “Bioeconomic priorities for innovation transformation of industry and education” - Збірник тез доповідей 2-ї Міжнародної науково-технічної конференції «Перспективи розвитку машинобудування та транспорту - 2021», м. Вінниця, 13-15 травня 2021 р., С.184-186.

13. Apanasenko G.L. “Introduction to a new paradigm of healthcare” (in Russian). Kyiv, 2020.

14. Seniuk Y. «Bioeconomics of health as a global innovation challenge and the main trend of institutional transformation of the post-pandemic economy” - Збірник тез доповідей 2-ї Міжнародної науково-технічної конференції «Перспективи розвитку машинобудування та транспорту - 2021», м. Вінниця, 13-15 травня 2021 р., С.10-16.

15. Baldwin R. “If this is Globalization 4.0, what we’re the other three?” WEF 22.12.2018. URL: https://www.weforum.org/agenda/2018/if-this-is-globalization-4-0-what-were-the-other-three/

16. McKinsey Global Institute, May, 7, 2021 - “How the medtech industry can capture value from digital health”.

17. McKinsey Global Institute, July, 9, 2021 - “Telehealth: A quarter-trillion-dollar post COVID-19 reality?”

18. McKinsey Global Institute, September, 22, 2021 - “Ordering In: The rapid evolution of food delivery”.

19. McKinsey Global Institute, April, 9, 2021 - “Leap to the future of healthcare: Reinvent through business building”.

20. Seniuk Y. Entrepreneurial University as Innovation Hub In Transnational Economy: New Digital Platform for SME Globalization. - Proceedings of the 16th International Conference on Emerging eLearning Technologies and Applications ICETA 2018. Stary Smokovec, The High Tatras: IEEE, November 15-16, 2018, pp.489-498.

**НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ БІОРЕСУРСІВ
І ПРИРОДОКОРИСТУВАННЯ УКРАЇНИ
КАФЕДРА ЕКОНОМІЧНОЇ ТЕОРІЇ**

**МАТЕРІАЛИ ДОПОВІДЕЙ
МІЖНАРОДНОЇ НАУКОВО-ПРАКТИЧНОЇ КОНФЕРЕНЦІЇ**

РОЗВИТОК БІОЕНЕРГЕТИЧНОГО ПОТЕНЦІАЛУ В СІЛЬСЬКОМУ ГОСПОДАРСТВІ

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