

INSTITUTIONALIZATION OF THE METAVERSE BASED ON THE DEVELOPMENT OF THE EXABYTE ECONOMY AND GIG ECONOMY

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Abstract. The development of the Metaverse will depend on the rapid development of the exabyte economy and a new technical and technological impetus to improve the tools for the functioning of the gig economy. The article substantiates the existing products, services and national projects of the Metaverse in the context of the accelerated formation of the exabyte economy. It is noted that the exabyte economy, by improving its throughput, lays an innovative and digital basis for the development of the Metaverse ecosystem and the optimization of business processes through the digitalization of business models of entrepreneurship. The connection of the Metaverse with the exabyte economy and the gig economy is analyzed through the prism of digitalization and breakthrough innovations. The article reveals that the technologies that are actively developing the exabyte economy are AI, IoT, Big Data, and blockchain technology. The structural components of the Metaverse engineering in the context of the digital transformation of the global world-system are presented. It's indicated that the institutional, technical and technological components and the crypto ecosystem are key drivers of the progressive development of the Metaverse using virtual, augmented and augmented reality, the application of smart contracts, and patentability for virtual goods. It's noted that a global, institutionalized, interacting network of 3D virtual worlds is demonstrated in real time. An attempt has been made to reveal the characteristic features, types, and models of the Metaverse in the conditions of the development of the gig economy, including the currently existing ones: 2 types of Metaverses; 3 models of ownership of the Metaverse. The goods produced by digitized businesses in physical space have every chance of becoming tools for the progressive development of the virtual environment of the Metaverse. Scientists are of the opinion that it was the technological wave of the last 5 years that gave rise to a number of breakthrough innovations and high technologies, which allowed forming the basis of the exabyte economy and the gig economy.

Keywords: Metaverse, exabyte economy, disruptive innovation, high technology, hyperreality, digitalization, virtual environment.

JEL Classification: O10, O17, O31, C45

1. INTRODUCTION

The technological wave of the last 5 years has given rise to a number of breakthrough innovations and high technologies, which allowed them to form the basis of the exabyte economy and the gig economy. Among the technologies that are actively developing these economies, it is worth mentioning AI, IoT, Big Data, and blockchain technology.

A global network of spatially organized, mostly 3D content, will soon become accessible to a larger

number of participants without any particular restrictions. The goal is clear – for use in all human endeavors, namely: a new and deeply transformative environment of the gig economy, created by breakthrough innovations in hardware, human-computer interfaces, network infrastructure, creator tools, the digital (Parisi, 2021), and the exabyte economy.

The Metaverse market size was estimated at \$71.27 billion in 2024. According to expert forecasts, it is expected to reach \$807.29 billion by 2031, growing at a CAGR of 39.10% from 2024 to 2031 (Global Metaverse Market Size, 2024). The Metaverse market is expected to be worth about \$2,346.2 billion by 2032. As of 2024, there are 400 million active users worldwide in the Metaverse, 80% of whom are under 16 years old. By 2026, 25% of people will spend 1 hour per day in the Metaverse. The global virtual reality tourism market will grow by 33.0% per year from 2023 to 2030. Between 2023 and 2033, the Metaverse will grow by 44.4%. This growth will be driven by increased demand for Metaverse technologies in the healthcare, education, and commerce sectors. North America leads the Metaverse adoption. China and Japan rank second and third in Metaverse usage, respectively (Layram, 2024).

2. RESEARCH METHODS

The following scientific methods were used in the article: the analysis method – to study the existing scientific literature on understanding the essence and prerequisites for the emergence of the Metaverse, as well as assessing the scale of the impact of the exabyte and gig economies on it; synthesis methods – to review the structural components of the Metaverse engineering in the context of the digital transformation of the global world-system; comparison method – to compare the characteristic features, types, and models of the Metaverse in the context of the development of the gig economy; generalization method – to identify products, services and national projects of the Metaverse in the context of the accelerated formation of the exabyte economy.

3. LITERATURE REVIEW

The names of Parisi (2021), Layram (2024), Blazquez, and Domenech (2018), Kraus, Bullini Orlandi, and Vonmetz (Kraus et al., 2023), Lasso-Cardona (2019), Matthew (2023), Prozorov (2024), Hackl (2023), etc. are associated with the study of general aspects of the formation of the Metaverse through the prism of digital transformation and innovative development of the global world-system. At the same time, a number of issues, such as the improvement of the Metaverse as a result of the accelerated development of the exabyte economy, the formation of the Metaverse ecosystem and the development of its digital infrastructure, and the tools and basic components of implementing high-quality interaction in the virtual-real space, require thorough study and scientific knowledge. In addition, there is no clear understanding of the importance of the digital development of the gig economy for the Metaverse.

Matthew Ball, CEO of Epyllion, a diversified holding company that provides consulting, investments, and the development of films, video games, and television programs, published his work “The Metaverse. How It’s Changing Our Reality,” which became a bestseller worldwide (Matthew, 2023). The author of the bestseller made an attempt to explain in detail the content of the “Metavas” category through the prism of already published novels, works, and stories such as “Neuromancer” (1984, William Gibson), “Snowfall” (1992, Neal Stevenson), “Pygmalion Glasses” (1935, Stanley J. Weinbaum), “Weld” (1950, Ray Bradbury), “The Bubble Problem” (1953, Philip K. Dick) and the functioning of large corporations in the global business space and the products, goods and digital services they produce (Matthew, 2023, pp. 21–24).

The world-renowned futurologist and one of the world’s first Metaverse leaders, Hackle, in her works of 2023 points to the need to create the positions of chief executive of the Metaverse in companies. She gives an example of an algorithm for implementing a progressive protection system for companies operating in the Metaverse from her own experience. Hackle notes that quick money-making in the Metaverse is possible if spatial computing, synthetic media, and artificial intelligence are used (Hackl,

2023).

A team of Italian scientists Kraus, Vonmetz, Bullini Orlandi, Zardini, and Rossignoli conducted a thorough empirical analysis of the role of entrepreneurial orientation and digitalization for the development of breakthrough innovations (Kraus et al., 2023, p. 1). The researchers processed questionnaires of 242 companies from different industries, different in size and territorial location. This allowed them to conclude that companies should rely on entrepreneurial orientation in order to ensure the implementation of breakthrough innovations and strengthen or weaken the implementation of the digitalization strategy depending on the level of entrepreneurial orientation (Kraus et al., 2023, pp. 4–8).

Based on the analysis of scientific developments, the purpose of the article is to propose the structural components of Metaverse engineering in the context of the digital transformation of the global world-system, to identify its characteristic features, and to present their actualization; to indicate the products, services, and national projects of the Metaverse in the context of the accelerated formation of the exabyte economy; to present the connections of the Metaverse with the exabyte economy and the gig economy; to identify the characteristic features, types, and models of the Metaverse in the context of the development of the gig economy.

4. RESULTS AND DISCUSSION

The world leader in the development of the exabyte economy is currently the United States, as it has the best indicator of device connectivity and advanced machine learning equipment (Future possibilities. Index 2024, 2024, p. 10). Singapore is in second place in terms of the development of the exabyte economy, the United Kingdom is in third place, Canada is in fourth place, and South Korea closes the top five (Future possibilities. Index 2024, 2024, p. 19). According to forecast expectations, the exabyte economy sector will be from \$11 to \$17 trillion by 2023. This is due to the fact that Big Data is becoming a new currency, and therefore great hopes are placed on the exabyte economy, which could revolutionize most industries in a technical, technological, innovative, and digital sense and stimulate breakthrough innovations and change the global digital landscape of the world-system beyond recognition (Future possibilities. Index 2024, 2024, p. 11).

The hyperreality that is currently inherent in the global economy and most national economies has led to the emergence of a new category that has been actively discussed in the world for the past 10 years, and this is the “Metaverse”. The English word “Metaverse” consists of two parts: “Meta”, a word of Greek origin, which is interpreted as “beyond, after” and the English word “universe”.

We consider the definition of the category “Metaverse” by Ukrainian scientist Prozorov through the prism of the economic-network approach to be valuable. The researcher believes that the Metaverse should be understood as “a virtual-real hybrid space in which people and avatars generated by artificial intelligence interact with each other using transitional analog-to-digital and digital-to-analog reality converters: 5G and 6G smartphones, portable gadgets, virtual and augmented reality glasses, brain implants and other DAC/ADC input-output technologies of “human-machine” systems (Prozhorov, 2024, p. 92).

Through the use of the Internet, various gadgets such as smartphones, tablets, and with the help of the application in the production and logistics of “smart” sensors, the profitability, and productivity of company employees increase, and business processes in organizations are accelerated. Working with Big Data allows you to improve work in the online market. Sensors placed on the roads make it possible to control law and order in cities and on the roads (Blazquez & Domenech, 2018, p. 99). These opportunities are produced precisely by the exabyte economy, supported by the processes of innovation and digitalization in the country. We are convinced that the further development of the Metaverse will be due to the development of the exabyte economy and the gig economy. We have presented their relationship visually in Fig. 1.

The exabyte economy is driving the development of the Metaverse. The fact that the United States is

the leader in the development of the Metaverse ecosystem is the result of the high-quality, progressive, productive, and efficient functioning of the exabyte economy. The basis for such results is the highest level of cybersecurity in the world, comprehensive 5G coverage, 1st place in the development of the gig economy, and the number of new unicorn companies worth over \$1 billion (Future possibilities. Index 2024, 2024, p. 24).

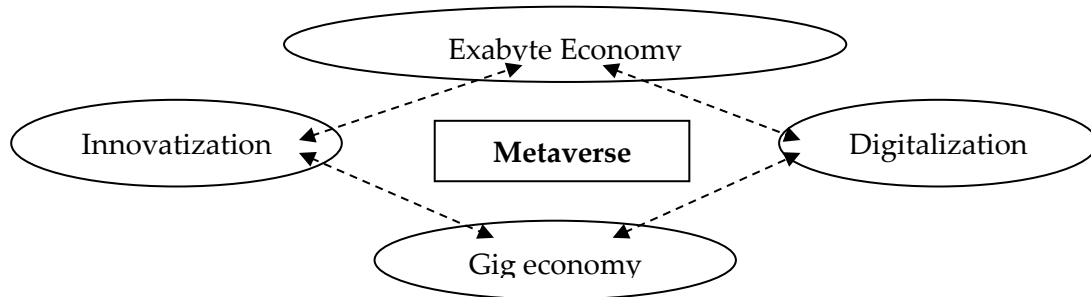


Fig. 1. The Metaverse's Connection to the Exabyte Economy and the Gig Economy

Source: author's scientific vision

In the era of digital transformation, firms typically create their official public image on the Internet by designing and launching corporate websites. These websites can have three different functionalities, namely: disseminating information about the firm (related to creating a public image), conducting transactions (e-business processes), and facilitating the exchange of ideas (electronic word-of-mouth accelerator (eWOM)) (Blazquez & Domenech, 2018, pp. 102–103).

The modern Metaverse functions and develops according to its “7 rules”, namely: there is only one Metaverse; the Metaverse is for everyone; no one controls the Metaverse; the Metaverse is open; the Metaverse is independent of hardware; the Metaverse is a network; the Metaverse is the Internet. “The Metaverse is not a single computer program, but several computer programs and processes that exchange information via network protocols... it is not a browser or other program or executable file; rather, the programs act as user agents (called “clients”, “browsers”, “engines”) to provide access to the Metaverse” (Parisi, 2021).

Big Data and breakthrough innovative technologies are rapidly developing the exabyte economy, reducing the digital divide between countries, producing profound transformational changes in traditional business models and modeling a new virtual-real space of interaction between a physical person and a hybrid person.

Hyperreality is currently being studied by world experts as “a state in which reality and simulation are so intertwined that they cannot be distinguished, and the key aspects of the Metaverse are not dominance and profit, but cooperation, creativity, and self-expression” (Matthew, 2023, p. 26). We have attempted to visually present the structural components of Metaverse engineering in the context of the digital transformation of the global world-system in Fig. 2.

The digital society of the Metaverse is emerging “as a result of the introduction of revolutionary technologies that have digital tools and expand horizons to new knowledge and skills. Areas such as education, research, organizational management, politics, science, economics and the humanities are influenced by the application of information and communication technologies, which leads to a number of benefits for individuals and organizations that find new ways to solve the tasks and problems of today” (Lasso-Cardona, 2019).

“The Metaverse... a stable virtual world... that affects almost every sphere of human life” (Matthew, 2023, p. 20). The Metaverse is being popularized through the use of digital marketing tools. Experts believe that trends that will be observed in the next 5 years are: increased investment in virtual and augmented reality; the growth of the number of social and gaming platforms; the emergence of work environments with features of inclusiveness and barrier-freeness; high-quality innovative digital customization and user personalization (Global Metaverse Market Size, 2024).

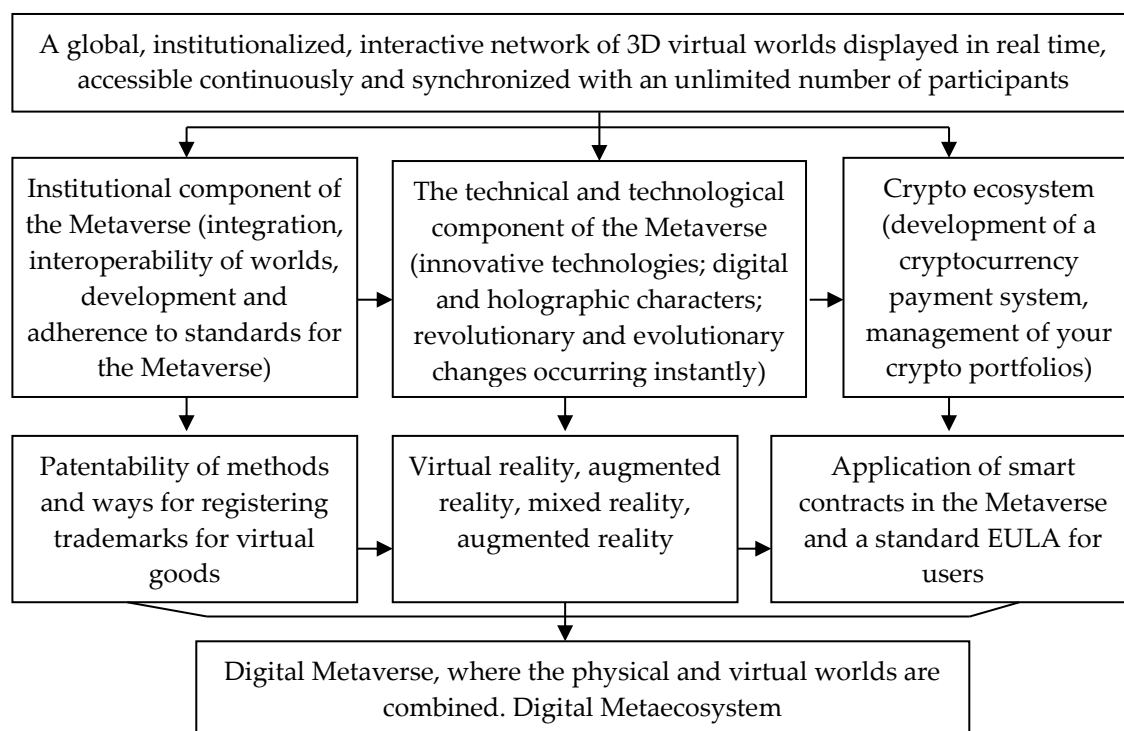


Fig. 2. Structural components of Metaverse engineering in the context of digital transformation of the global world-system

Source: author's scientific vision

The emergence of the exabyte economy, the "Big Data explosion", the development of information and communication technologies accelerate the receipt of digitized current data by people and companies (Blazquez, & Domenech, 2018, p. 99). "The Metaverse offers shelter and prospects to millions of people... and is a virtual space" (Matthew, 2023, p. 21). The characteristic features, types, and models of the Metaverse in the conditions of the development of the gig economy are presented in Fig. 3.

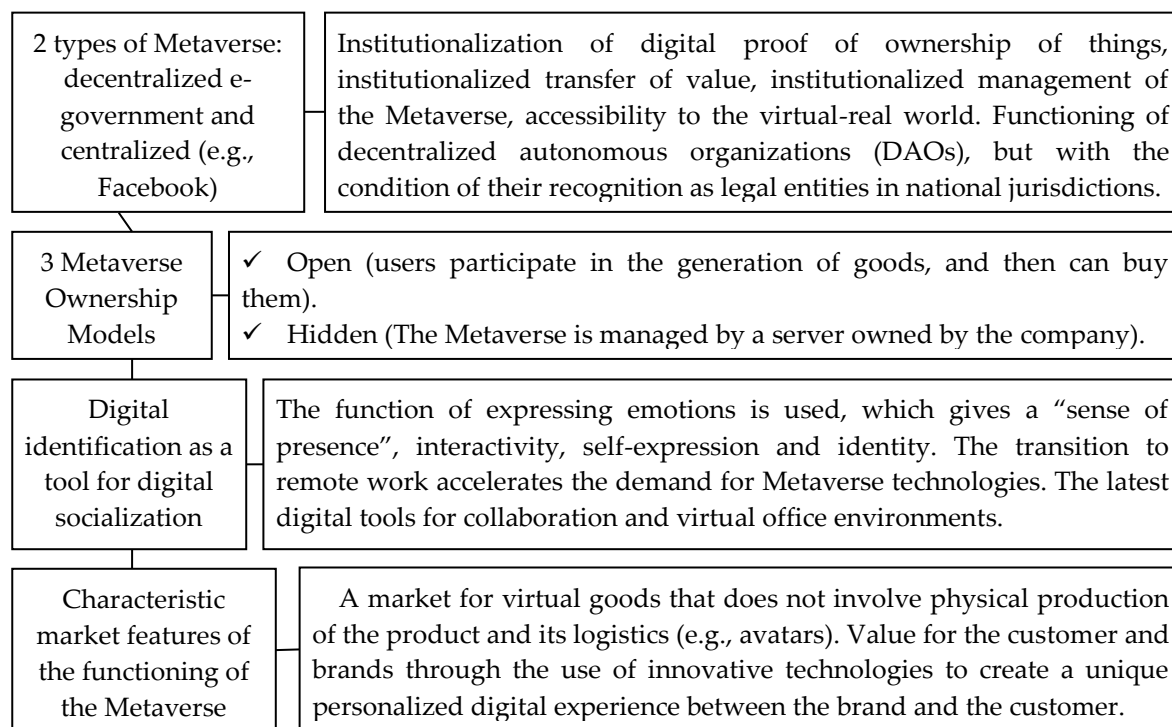


Fig. 3. Characteristic features, types and models of the Metauniverse in the conditions of the development of the gig economy

Source: author's scientific vision

The Metaverse connects people, places, businesses, and things. It easily connects traditional business, physical and digital life, and social media. The Metaverse is characterized by the application of breakthrough innovative technologies instantly and in parallel with deep digital transformations in business. For trade and economic operations in the Metaverse, 5 business models are characteristic: person-to-person or from physical to physical (P2P); from digital to physical (e-commerce, Internet trading); virtual to virtual (gaming); from virtual to physical (new model); from physical to virtual (new model) (Hackl, 2023).

According to experts, the Metaverse has the necessary potential to change the forms, methods, and tools with which people communicate, work, and interact in everyday life and the business environment. The Metaverse allows you to gain new digital experience. It opens up new economic opportunities but, at the same time, adds difficulties and poses new challenges to humanity. Among the challenges: confidentiality and data security; problems of platform and technology compatibility; high costs of developing and maintaining breakthrough technologies of the Metaverse; technological limitations, in particular, the bandwidth of the Internet network (Global Metaverse Market Size, 2024). We have attempted to present the products, and national projects of the Metaverse in the context of the accelerated formation of the exabyte economy in Fig. 4.

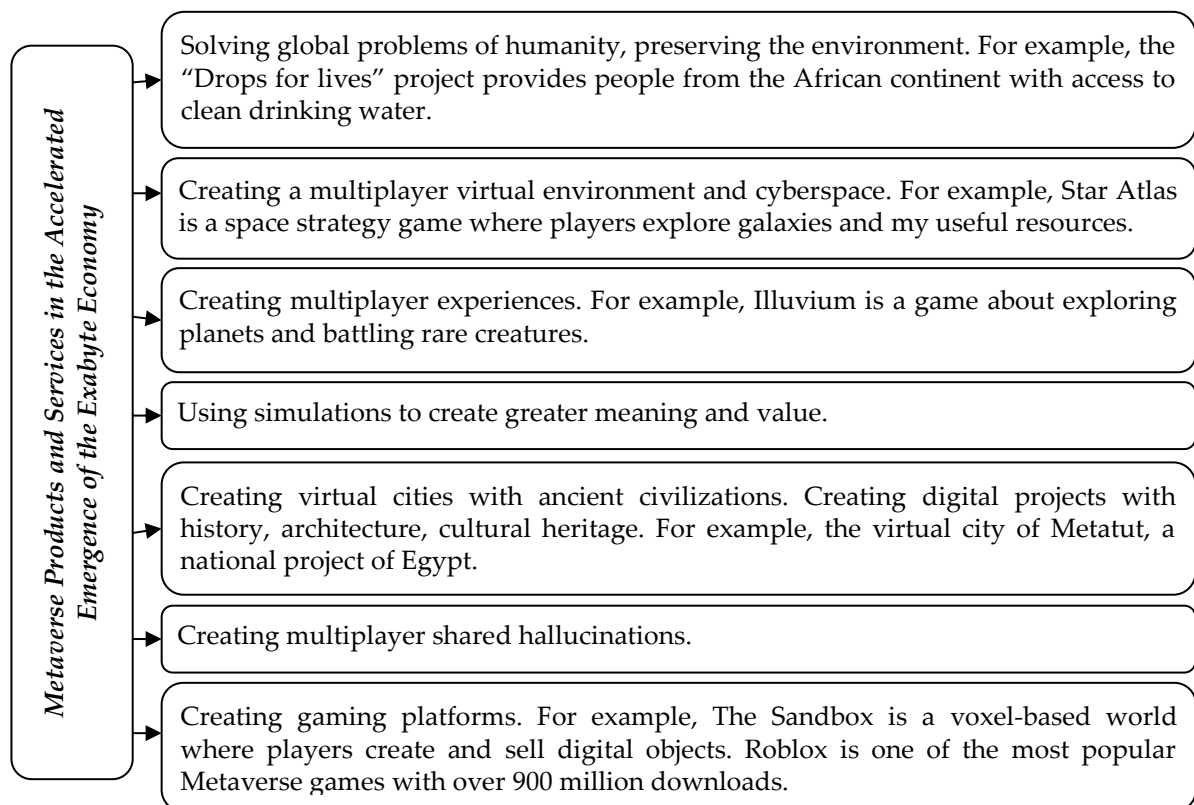


Fig. 4. Products, services and national projects of the Metaverse in the context of the accelerated formation of the exabyte economy

Source: compiled on the basis of sources (Egypt's National. IP Strategy, 2022, pp. 4–10; Ya'ari, 2025) and own observations

It is worth emphasizing that the new quality of computing systems, the strengthening of the content of the work of artificial intelligence technology and the Internet of Things, will have a more powerful impact on the further development of the Metaverse, the application of advanced high technologies, and

the operation of devices by the gig economy. The exabyte economy, improving its throughput, lays the innovative and digital basis for the development of the Metaverse ecosystem, the optimization of business processes through the digitalization of business models of entrepreneurship. We agree with the opinion of experts in part that “the future development of interconnections will depend more on the latest devices and equipment than on people” (Future possibilities. Index 2024, 2024, p. 29).

5. CONCLUSIONS

The development of the Metaverse will depend on the exabyte economy and a new technical and technological impetus to improve the tools for the functioning of the gig economy. To achieve this fact, it is worth relying on high technologies and breakthrough innovations, digital capabilities and their application, and increasing the level of digital skills of members of society. One of the important areas of funding should be the research and development sector in various sectors of the economy. Support from state institutions for digital and innovative entrepreneurship should become a priority task in the area of institutional support. We are convinced that goods produced by digitized businesses in physical space have every chance of becoming tools for the progressive development of the virtual environment of the Metaverse.

Further scientific exploration should be conducted in the field of cybersecurity of the Metaverse, development of tax mechanisms for business operations in physical and virtual space simultaneously. It makes sense to develop the basic components of state strategies for the formation, establishment, and development of national ecosystems of Metaverses in the conditions of the exabyte economy and gig economy.

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Краус Катерина, Краус Наталія. Інституціоналізація Метавесвіту на базі розвитку ексабайтової економіки та гіг-економіки. *Журнал Прикарпатського університету імені Василя Стефаника*, **12** (2) (2025), 6-13.

Розвиток Метавесвіту залежатиме від стрімкості розвитку ексабайтової економіки та нового техніко-технологічного поштовху для удосконалення інструментів функціонування гіг-економіки. В статті обґрунтовано наявні продукти, послуги та національні проекти Метавесвіту в умовах прискореного становлення ексабайтової економіки. Зазначено, що ексабайтова економіка, покращуючи свою пропускну здатність, закладає інноваційно-цифровий базис розвитку екосистеми Метавесвіту, оптимізації бізнес-процесів шляхом цифровізації бізнес-моделей підприємництва. Проаналізовано зв'язок Метавесвіту з ексабайтовою економікою та гіг-економікою крізь призму цифровізації і проривних інновацій. У статті з'ясовано, що технологіями, які активно розвивають ексабайтову економіку є ШІ, Інтернет речей, Великі дані, блокчейн технологія. Представлені структурні складові інженерії Метавесвіту в умовах цифрової трансформації глобальної світ-системи. Вказано, що інституціональний, техніко-технологічний складники та криптоекосистема є ключовими рушіями прогресивного розвитку Метавесвіту з допомогою віртуальної, розширеної і доповненої реальності, застосування смарт-контрактів та патентоздатності щодо віртуальних товарів. Зазначається, що глобальна, інституціоналізована взаємодіюча мережа 3D-віртуальних світів демонструються в реальному часі. Зроблено спробу розкрити характерні особливості, види та моделі Метавесвіту в умовах розвитку гіг-економіки, серед чого вказано на наявних наразі: 2 види Метавесвітів (децентралізований і централізований); 3 моделі власності Метавесвіту (відкрита, прихована і безпосередньо цифрові активи). Висловлена думка про те, що продукovanі товари відцифрованим бізнесом у фізичному просторі мають всі шанси стати інструментами прогресивного розвитку віртуального середовища Метавесвіту. Науковці стоять на позиції того, що саме технологічна хвиля останніх 5 років дала змогу з'явитись низці проривних інновацій та високих технологій, що дозволило сформувати базис ексабайтової економіки і гіг-економіки.

Ключові слова: Метавесвіт, ексабайтова економіка, проривні інновації, високі технології, гіперреальність, цифровізація, віртуальне середовище.