

METAVERSE WORLD AS A FACTOR FOR THE FORMATION OF DIPLOMATIC RELATIONS

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Over the past ten years, the world has experienced incredible progress in science and technology, which is leading to a new stage of the techno singularity. Humanity is increasingly becoming dependent on digital systems, which requires new approaches to increase the stability and inclusiveness of the economy, reduce risks, and ensure the national interests of Ukraine. According to World Bank estimates, as of the end of 2023, the war has caused losses to Ukraine's electronic communications sector of \$2.3 billion. In total, 25% of fixed networks and more than 4,000 base stations of mobile communications were damaged or destroyed [1]. A scientific study by scientists of the American analytical center *Brookings Institution* "Ukraine: digital stability during the war", published at the end of January 2024, outlined the patterns of large-scale digital transformation in Ukraine for the period from 2012 to the end of 2023 [2]. The conclusions state that the existing digital capacity and electronic services, despite the losses during a full-scale war, allowed to adapt and create new opportunities to ensure the stability of the country and lay the foundations for building *win-win* relations with global partners, and further development of digital capabilities can become a catalyst for significant progress, including cloud data storage, low-code development tools, improved cryptography standards, the formation of a metaverse (Metaverse), European recognition of Ukrainian digital credentials, which requires, in its the order of settlement of issues at the legislative level.

A comprehensive assessment of the state of the global economy and prospects for 2025 according to the report of the World Economic Forum (WEF) "Forecast of Chief Economists" mostly focuses on trends affecting the world economy in the context of the rapid development of innovative technologies, especially in the field of artificial intelligence (AI) [3]. Council of Europe Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law (CETS 225), signed in September 2024, establishes a new legal order regarding the regulation of AI at the

international level [4]. In particular, it is about the need to create risk assessment systems and mechanisms for their management, the issue of personal data protection and privacy, which is especially important in the digital age. The concept, which aims to define a general digital transformation in every aspect of physical life, has been called the "metaverse". In the conditions of the full-scale invasion of the Russian Federation in Ukraine and Russia's efforts to create an information vacuum, the need for the formation of normative and regulatory support for the functioning of the metauniverse in Ukraine is determined.

A metaverse as a digital version of our reality, representing cities, buildings, streets, individuals, etc., as well as virtual events and digital places, can completely change the way people, communities, governments, and business entities interact. The use of innovative digital technologies leads to rapid changes in the "data-driven" economy and requires the outline of a holistic approach to the functioning of the metauniverse ecosystem.

In the scientific literature, virtual worlds are interpreted as stable, exciting environments based on technologies, in particular, three-dimensional representation of the surface of an object based on *3D mathematical coordinates* and augmented reality (XR), which allow combining the physical and digital worlds in real-time for various purposes such as designing, modeling, collaborating, learning, communicating, transacting, or providing entertainment. Virtual worlds, commonly known as the "meta-universe", represent a persistent, immersive 3D environment based on technologies such as augmented reality (AR) and virtual reality (VR), in which real physical objects are integrated into a digital environment in real-time for various purposes [5]. However, the most revolutionary idea of the metauniverse is not only the technological aspect but also the concept of social and economic infrastructure, which enables new types of behavior, transactions, ownership, and organization in and between virtual environments [6].

The EU initiative on Web 4.0 and virtual worlds [7] defined Web 4.0 as the next innovative technological interrelated transition and support of the European Web 4.0 industrial ecosystem, the promotion of virtual public services, and the formation of global standards for open and interoperable virtual worlds. The goal is to create a new model of economic growth to achieve a breakthrough in the technologies of the metaverse, their application, and management. Web 4.0, as a continuation of Web 3, includes platforms and applications that enable the transition to a future, decentralized Internet with open standards and protocols, while protecting the ownership of digital information, giving users more ownership of their data, and catalyzing new business models. The fourth generation of the Internet (Web 4.0), as the Internet - infrastructure of the next generation, and virtual worlds combine AI, the Internet of Things (IoT), blockchains, and augmented reality. To support the growing amount of information and increase the effectiveness of AI solutions, the co-founder and general director of OpenAI S. Altman proposed the creation of a global infrastructure for AI worth more than 7 trillion US dollars based on the convergence of human and machine intelligence.

WEF's "Defining and Building a Metaverse" initiative on metaverse governance and value creation aims to guide the development of a secure, interoperable, and economically viable metaverse by bringing together stakeholders from various sectors, including government, academia, business, and civil society [8]. Given the vast amount of personal data that can be collected about members of a metauniverse platform, in addition to its benefits, the data poses significant privacy concerns.

According to a *Deloitte report*, the industrial metauniverse and generative artificial intelligence (*GenAI*) are the new trends of 2024, ushering in a new era in the digital landscape and aiming to create an ecosystem of economic value in various industries. According to the company's analysis, revenues from the industrial metauniverse by 2030 can reach 100 billion dollars. USA, significantly exceeding the consumer (up to USD 50 billion) and corporate (USD 30 billion) segments. Analysts also point to the potential growth of the global market of digital doubles from \$ 6.5 billion. The USA in 2021 up to 125.7 billion dollars. USA in 2030, which is enhanced by the use of augmented reality. It is predicted that the global augmented reality markets by 2030 will be able to reach a capitalization of 38.6 billion dollars. USA, showing an annual growth rate of 35%, and the global volume of data transfer will grow to 181 zettabytes in 2025 [9]. According to statistics published by the European Commission, the estimated share of the impact of the data economy on GDP in the EU-27 and the UK was 2.6 percent in 2019 and is expected to reach 4.2 percent by 2025 under the baseline scenario.

With the rapid development of innovative technologies, issues related to the management of large amounts of web data (acquisition, data exchange, integration, reuse, etc.) are among the most demanded today. The resource description framework (*Resource Description Framework, RDF*), provides a standardized exchange of data based on relationships from many sources. Interplanetary file system (*Interplanetary File System, IPFS*) is open for managing digital data without a central server in a distributed file system. To implement the use of the metaverse, companies face challenges such as insufficient high-speed connectivity and managing large amounts of web data. In addition, data interpretation due to format incompatibility is observed. The creation of new 3D content using 3D scanning devices or AI-generated content is promising, but the associated costs are still considered high.

Based on various industry perspectives, the metauniverse is seen as an open ecosystem platform built on defined and shared standards and providing economic, social, and environmental value. At the same time, AI has become a significant factor in the development of the industrial metauniverse with its potential to enhance other favorable technologies. The use of 3D modeling and software is also becoming increasingly common for system development and testing. However, these pilot projects are often not integrated into the existing software infrastructure or industrial platform of the metaverse. To date, there are significant differences in manufacturing processes regarding the adoption of the industrial metauniverse due to the leading positions of individual technology companies, particularly in the

automotive, aerospace, energy, and pharmaceutical sectors. Despite the different levels of development in these industries, the opportunities and challenges faced by companies in its adoption are similar. However, there is currently a lack of a clear vision, strategy, and management processes for the industrial metauniverse concept. In addition, the complexity and speed of innovation in large companies in the industrial metaverse, as well as the lack of open information about metaverse platforms and their further development slow down the widespread adoption of the metaverse. Large companies are developing their versions, each adapting the metauniverse idea to their strengths. Examples are leading social platforms media, gaming companies, online stores, etc. Among the well-known companies developing Metaverse today are:

- *Apple* is known as the Meta company, which has created virtual meeting applications with a system THAT includes physical movements to be present and interact during virtual meetings;

- *Meta* - the main company developing Metaverse for users to be in a network of 3D virtual worlds in real-time, storing identification data and payment history, and focused on developing a supercomputer with quintillion operations per second. *Meta* chose the EU to develop Metaverse technology and create new jobs in Europe;

- *NVIDIA* is one of the best Meta companies that has made an agreement with the Metaverse market and initiated the distribution of free copies of the program created for the development of Metaverse assets, known as Omniverse, which supports artists and content creators to create virtual worlds and products, and helps users create personalized avatars to bring their visions to life;

- *Decentraland* develops Metaverse as a platform for content producers and enterprises that helps users create and monetize various applications and content by purchasing virtual plots of land in Metaverse technology;

- *Roblox Corporation* focuses on building a Metaverse business model and offers several games on its platform, some of which offer virtual worlds where players can interact effectively and freely with each other;

- *Unity Software* offers a platform for the development of 3D programs in real-time with access through augmented or augmented reality using innovative tools and technologies such as 3D, 2D, virtual, and augmented reality for the development of Metaverse technology.

- *Snapchat* announced the launch of a new avatar lens that allows avatars to change clothes and faces according to their mood, helping to increase the speed of Metaverse technology;

- *Amazon* develops Metaverse by hiring a product manager to deliver Metaverse cloud services in the gaming technology division;

- *Epic Games* has announced a \$1 million investment in the development of Metaverse in 2021 to pave the way for game developers to explore the many possibilities of Web 3.0.

Some brands also claim virtual real estate on metauniverse platforms with their digital properties.

One of the ways to solve these problems in international practice is considering the possibility of strengthening diplomatic and international relations in the metauniverse. The creation of virtual embassies under the 1961 Vienna Convention on Diplomatic Relations (VCDR) and the 1963 Vienna Convention on Consular Relations (VCCR), as an opportunity to begin the evolution of global diplomacy beyond the physical world, initiated the creation of metaverse diplomatic embassies (Metaverse Embassy) such countries as Barbados [10], Israel [11], Malta, the Philippines, Estonia, Serbia, Sweden, Kazakhstan [12], South Korea, etc. [13]. Since more and more states are beginning to use the metauniverse for diplomatic and consular relations, which are gaining more and more importance in the metauniverse, these processes require the analysis and construction of new, separate norms of international law in the metauniverse in domestic legislation.

Another direction of the implementation of the metauniverse is the initiation and implementation of the domestic regulatory framework for the metauniverse. Currently, the main reason for the slow adoption of the concept of the metaverse is the lack of infrastructure - mainly a good Internet connection, artificial intelligence chips that can support this vision, and the availability of devices and computing power. To facilitate metauniverse pre-standardization initiatives in March 2023 in Riyadh (Saudi Arabia) International Telecommunication Union (ITU) started the development of a road map for establishing technical standards of the metauniverse, which would ensure compatibility, high-quality interaction with the user, security, and protection of personal data. In addition, defining the fundamental advanced technologies for multimedia and network optimization, digital currencies, the Internet of Things, digital doppelgangers, and environmental sustainability is extremely important for establishing the technical requirements for the formation of the metauniverse. These factors require the combined efforts of all major companies and governments to build protective layers to ensure data protection.

The metauniverse is now a vision of the existence of humanity in two worlds at the same time, which transforms the perception of physical reality into a virtual one and promotes the creation of its own, fully functioning economy based on immersive technologies and scientific discoveries, the convergence of human and machine intelligence, biotechnology, quantum computing, etc. To achieve sci-fi ambitions and challenges, countries in the coming years need to plan the development and implementation of fundamental and applied research on the problems of the metaverse through the evolution of virtual diplomacy outside the physical world. Despite the challenges, the metauniverse opens up opportunities for diplomatic relations. The question is how countries will try to join the fundamental issues of the metaverse, whether they will form their vision, and what they will be able to control in terms of content, commerce, and user tracking, the future will tell. Perhaps the biggest challenge presented by the Metaverse will be in the area of regulation, given the data collected during physiological processes, including pupil dilation, heartbeat, biometrics, and more.

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