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Metaverse development and changes under the new economic landscape

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Abstract

Abstract: In recent years, Metaverse has become a global discussion topic, which has made major progress in policy support, monetary investment, technological advancement, and strategic layout of big internet companies. However, at present, its popularity has obviously decreased. This article examines the current state of the Metaverse's development using factors like federal regulations, internet giants' structure, and Metaverse market structures. It gives conclusion that the Metaverse is still far from meeting expectations, despite that it already has considerable progress. The main challenges it faces in the short-term are technical limits, device constraints, lack of large-scale application scenarios, economic downturn, and security issues. In the long-term The Metaverse will still experience a significant growth by taking several measures, such as improving and enhancing the construction of new infrastructure, lowering unit costs through technological innovation, fully integrating with the real market, and enhancing protection system construction.

CCS Concepts

• Social and professional topics; • Professional topics; • Computing and business; • Economic impact;

Keywords

Metaverse, New economy, Technology

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1 INTRODUCTION

The appearance of Metaverse open a new chapter in the development of modern technology. All the governments in the world are paying close attention to the Metaverse, at the same time big companies compete to build their presence, too[1]. The Metaverse

is a new business concept, all the sectors are eager to pursue during an economic boom. However, the budget significantly impacts the expansion of metaverse systems when the economy slows down. Metaverse has lost momentum, faced development issues, and experienced temporary losses in the new economic surroundings, especially with the recent explosion of General Artificial Intelligence (AGI), represented by ChatGPT and DeepSeek. However, Metaverse also has a lot of potential for development in the long run, and developments in AI technology will help developing Metaverse's underlying technology.

2 THE CONCEPT RELATED TO THE METAVERSE

2.1 Technical support for Metaverse

The technologies related to the metaverse include artificial intelligence, blockchain, cloud computing, digital twins, virtual reality, 5G/6G networks, as well as other information-creating technologies, such as knowledge-based conceptual algorithms. All these technologies are built on the Web 3.0 architecture for the next generation of the Internet[2]. Artificial intelligence systems infiltrate all aspects of the metaverse, such as smart contracts on the blockchain and the automatic generation of code, figures, objects, and plots in online cases. The most important element of the metaverse's financial system is blockchain technology, which encourages content developers to create new ideas using blockchain-based tools, such as NFTs, DAOs, and smart contracts. Furthermore, it provides the metaverse with payment systems such as traceable data and privacy protection. As a distributed computer system, cloud computing, thanks to its powerful mathematical capabilities, enables the practical application of the metaverse online concept. The metaverse needs digital twins to construct extremely realistic digital environments where the functional state of the real entity and additional economic data can be mapped in real-time onto the digital twin via sensors[3]. The foundations of the metaverse allow for the digitization and three-dimensional reconstruction of natural objects in virtual zones, thanks to three-dimensional modeling technology. Virtual reality, as the main device and interaction technology of the metaverse, directly maps people's vision, hearing, and touch into the online world, providing users with an immersive experience. 5G/6G networks can improve high-speed, low-latency, and secure network connections, enabling real-time interaction among many users in the online world [4].

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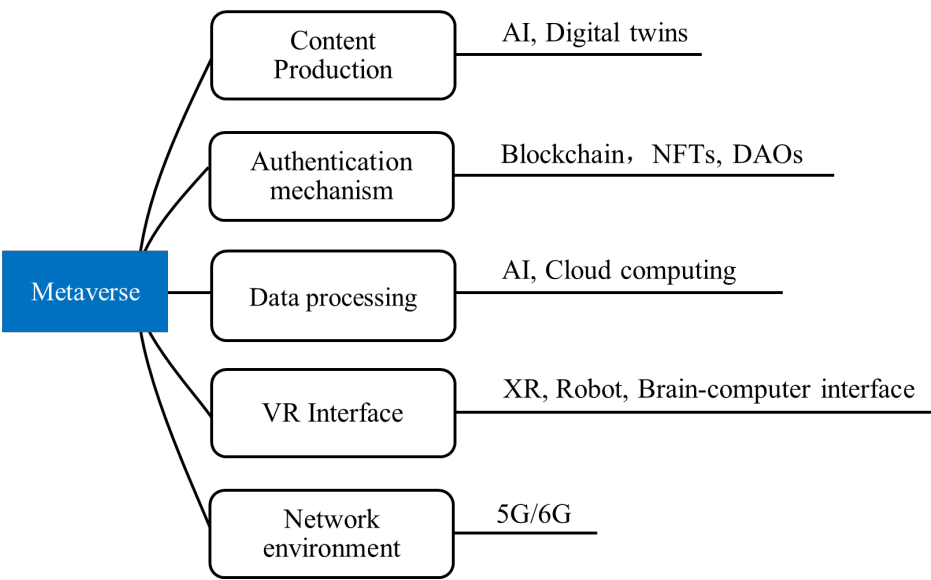


Figure 1: Mechanism of Metaverse Technology.

Table 1: Architectural Diagram of the Metaverse Technology System

| | | | | |
|-------------------------------|---------------------------------------|--|---|---|
| The application service layer | Game, social, VR immersive experience | Digital factory, cultural tourism, medical care, education | Politics, agriculture, digital economy, urban planning | |
| Platform layer | Digital assets NFT | Web3.0 Blockchain, smart contract | Artificial General Intelligence (AGI) Machine learning, big language model | digital twin Data acquisition, 3D modeling |
| Infrastructure layer | network technology 5G/6G | Computational power cloud computing | save Cloud Storage | Big data |

2.2 The construction of Metaverse’s technical system

As a comprehensive technical system, the metaverse encompasses various fields within its commercial network, particularly the infrastructure layer, the platform layer, and the software support layer. The infrastructure layer provides the foundation for communication in the metaverse, encompassing communication systems, computing power, and continuously evolving technical infrastructures[5]. Thanks to equipment such as headsets, gloves, and other natural interaction devices, this part is primarily responsible for data transmission, backup, computation, and analysis. The platform layer provides online spaces, terminal interfaces, and other necessary hardware and software, which are essential for the construction of the metaverse. The application services layer includes government-oriented application services (to G), commerce or enterprise-oriented application services (to C), as well as

consumer-oriented application services (to B). Once the metaverse is fully established, it will ultimately change people’s lifestyles and production modes, bringing revolutionary changes to traditional industries such as commercial manufacturing, entertainment, education, training, and healthcare.

3 THE DEVELOPMENT STATUS OF THE METAVERSE IN THE NEW ECONOMIC LANDSCAPE

The development of traditional economic forms has approached saturation point. From the perspective of human economic development history, the essence of all previous industrial revolutions is to constantly break through the restrictions of technology and space on human beings and provide new energy modes for human beings[6]. Metaverse, by creating a new digital economic space,

Table 2: Internet Companies' Layout in the Metaverse

| Enterprise name | Metaverse layout | Main products |
|-----------------|---|--|
| Microsoft | Layoff employees in VR business and increase investment in AI direction. | Azure (Microsoft Cloud), copilot (Artificial Intelligence), Microsoft mesh (Office Metauniverse) |
| Meta | Continue to invest in the Meta-Universe, and increase the investment in the Meta-Universe, and at the same time lay out the AIGC track. | Oculus(VR service), LLaMA (artificial intelligence model) |
| Google | In-depth exploration of AR glasses and VR fields, launch of immersive maps | Google glass, PaLM (Artificial Intelligence Model) |
| Apple | Increase efforts to develop MR headset business | Apple Vision Pro (MR Business) |

breaks the constraints of geography, time, and production organization that traditional economic systems must rely on. Through Metaverse, digital factories and trading systems can be formed, allowing for the simulation and calculation of transformations and strategic decisions that would otherwise require high costs in the real world, which greatly reduces the cost of trial and error.

3.1 Present situation of technical development

The technical support required by the metaverse is mainly manifested in VR/AR, blockchain, artificial intelligence, 5G/6G, cloud computing, etc. The technical development status of the metaverse presents a trend of rapid iteration and continuous innovation.

3.2 Status of the competitive landscape

With the rise of AGI, international head internet companies have made in-depth adjustments to the capital investment and personnel layout of the metaverse, and some internet giants have reduced their investment in the metaverse and increased their investment in artificial intelligence. Internet head companies, such as Microsoft, reduced their investment in VR equipment, reduced their investment in consumers, and increased their investment in industries, turning to artificial intelligence projects. Microsoft laid off employees in VR and XR businesses and dissolved the four-month-old Metaverse team. Some internet giants have increased their investment in the metaverse and accelerated the ecological construction of the metaverse. Some Internet giants, such as Meta (formerly Facebook) and Google, continue to invest in Metaverse, and carry out the ecological layout of the Metaverse from multi-scene applications and various layouts. As early as 2012, Google launched the AR glasses Google Glass, which is an innovative product that combines mini-projector, camera, sensor, storage, transmission and control equipment. Google has also made in-depth exploration in VR technology. For example, it cooperated with YouTube to realize a 360-video live broadcast project on Google I/O 2016, which shows Google's strength in VR live broadcast technology. Google has also launched an Immersive View function, which combines satellite street view photos and computer vision technology to provide users with a high-resolution and vivid 3D map experience, which can be regarded as an important progress in the application of VR technology[7].

4 The challenges faced by the metaverse under the new economic situation

In the new economic situation, Metaverse is facing practical challenges such as technical restrictions, equipment restrictions, economic downturn, security risks and so on.

4.1 Technological Challenges

4.1.1 Network restriction. A high-bandwidth, zero-latency network infrastructure is necessary for Metaverse to be built. The online and real worlds may be synchronized, meaning the creator economy and virtual factories must be communicated online and in real time. Coordinating both worlds for data exchange in large quantities necessitates a disproportionately large transmission speed. Real-time interactivity is the driving force behind the innovation, which calls for no networking overhead. Barring this, the latest network topology and practices have yet to join the system requirements of the Metaverse.

4.1.2 Computing power limitations. To enable users to have an imaginative and unrestrained experience in the Metaverse, the latest computing power needs to be increased by at least 1 000 times. In metaverse settings, the current level of computing power is insufficient to meet the need for computing power[8]. The limitation in computing power is largely a limitation in chips, specifically higher-end chips. The width and depth of the Metaverse's growth will be directly affected by computing power. Specifically, several sophisticated labor tools may not be able to maximize their effectiveness, the economic development of creators in the virtual world will be constrained, and people's access to the Metaverse will be immediately restricted, considerably diminishing the embodied experience.

4.1.3 Equipment Limitations. The biggest obstacles to the execution of the Metaverse in software cases are the product's value limitations and software limitations. Equipment costs constrain the Metaverse's ability to empower new productivity, primarily in research and development (R&D) and technical cost limitations. Technical cost limitations generally stem from the great technological obstacles to metaverse products. High-tech and based on a basis of high-tech convergence, the Metaverse is. Due to this, many production departments cannot afford or create metaverse equipment,

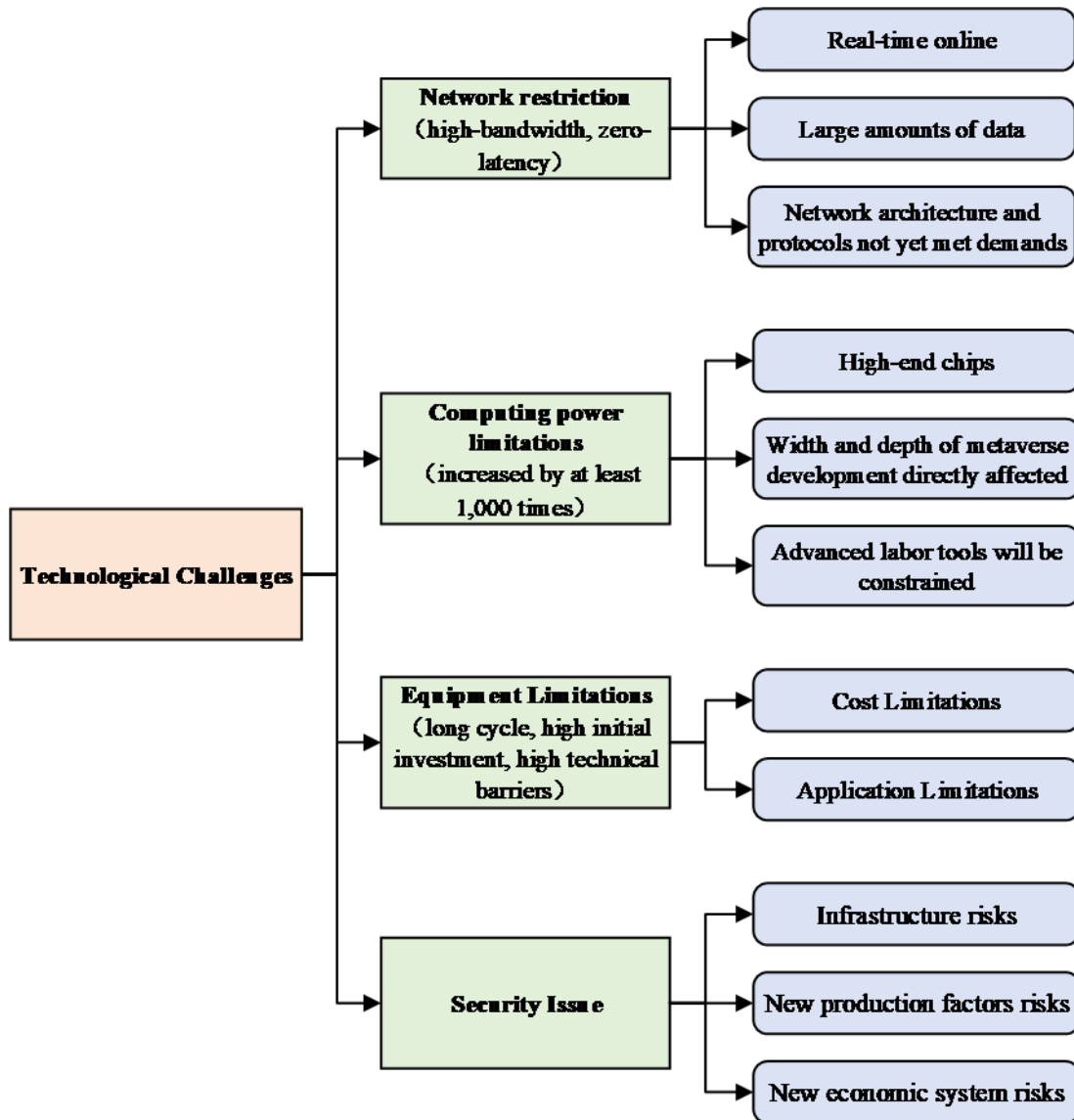


Figure 2: Technological Challenges of Metaverse

which causes a somewhat slow socialization and metaverse technology's production and prevents it from completely empowering new productivity[9].

4.1.4 Security Issue. Network risks are the first security concern. At the power levels, risks are associated with weak approval and access control in cybersecurity. Next, dangers are brought on by novel generation factors. Data governance has risen to the top of the priority list. Metaverse's need for gathering and processing more information will increase exponentially, which could introduce new threats. Third, the new economic system's challenges. Challenges brought on by digital technologies and challenges brought on by inadequate regulation and institutional deficiencies.

4.2 Operational Challenges

4.2.1 Economic downturn trend. Significant cashflow is needed to support metaverse scientific research and development. However, capital flows are restricted by the recent economic downturn, and traders' enthusiasm for investing in the metaverse may weaken. This will make raising money for the metaverse business more difficult, causing a slowdown in its creation. Besides that, market competition intensifies in a recessionary economy[10]. Metaverse-connected companies perhaps compete to fight for market share and resources. Because of this, weaker businesses might be eliminated. In contrast, stronger businesses may combine their jobs through mergers and acquisitions, which leaves the entire business

inactive and the formation of oligopolies or monopolies. Additionally, government regulation of the metaverse increases in the event of an economic downturn to reduce economic challenges and maintain financial market stability, which will also significantly influence the metaverse's capital flows and growth.

4.2.2 Lack of large-scale application scenarios. Conceptual ambiguity and post-pandemic demand contraction are two issues facing the metaverse. While integrating diverse technologies (IoT, AI, blockchain, interactive systems), its vague conceptual framework impedes concrete guidance for R&D and policy implementation, necessitating exploratory development paths. Demand has declined due to pandemic normalization, which was initially supported by COVID-19 limits as a substitute for physical actions (work, education, and business) (Zhou, 2022). Further erode its appeal as electronic alternatives lose intensity due to underdeveloped infrastructure, poor user immersion, and primitive application scenarios. This intermediate stage highlights the strain between useful socioeconomic needs and fanciful technological convergence, which requires a strategic adjustment to maintain momentum past adoption based on emergency.

5 New development trends of the metaverse in the new economic landscape

5.1 Breaking Free from Network and Computing Constraints

Strengthen and optimize the construction of new infrastructures, enhance support functions and design in key sectors such as artificial intelligence. Improve the basic levels of network and computing capabilities (Xiang, 2022). Expand network support for the creation of the metaverse in terms of communication. Promote the construction of 5G and gigabit fiber optic network infrastructures, constantly explore 6G networks, and build an integrated network with ultra-wide band, ultra-low latency, and ultra-high reliability that coordinates terminals, cloud, and edges to support the realization of various metaverse scenarios.

In terms of computing capacity, in response to the diverse and changing computing needs of metaverse scenarios, constantly increase the deployment of infrastructures such as data centers and computing networks, strengthen the capabilities of data platforms, and ensure the smooth flow of digital resources.

5.2 Promoting Deep Integration of the Metaverse with the Real Economy

Promoting Industrial Upgrading: By applying metaverse technology, drive the transformation and change of traditional industries, enhancing the value added and competitiveness of businesses (He, 2022).

Creating a New Engine for the Digital Economy: Making the metaverse a new engine for the digital economy, supporting the planned growth of the digital economy and the real economy, and giving a new boost to economic growth.

5.3 Innovate the driving forces for the development of the digital economy

The reallocation of social tools and the overcoming of physical space constraints could markedly enhance the efficiency of the digital economy. In the context of the metaverse, the traditional production factors of property, labor, capital, and systems are being redefined. Data, as the second-generation element, forms the bedrock of digitization, networking, and intelligence. Alongside other production factors, it is transforming production methods, lifestyles, and cultural governance, thereby infusing new vitality into the digital economy. Digital currencies leverage blockchain technology to grant real-world value to virtual goods, expedite asset automation, and establish ownership rights in digital assets. The potential economic framework of the metaverse could integrate a unified online Renminbi and non-fungible NFTs.

6 Summary

With the constant progress of technology and the expansion of the market, the metaverse market has the potential for even broader growth prospects. At the same time, it is crucial to address the challenges and risks associated with the development of the metaverse, such as technological limitations, economic downturns, the lack of large-scale application scenarios, and data security issues. Therefore, in promoting the development of metaverse-related businesses, it is also necessary to overcome technological barriers, lower the thresholds for equipment and application use, leverage the role of capital, strengthen supervision and risk prevention efforts, and ensure the healthy and sustainable development of the metaverse industry.

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