



Metaverse and the Unified Chinese Market

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Abstract. A metaverse is a collection of interconnected and immersive virtual worlds that provide users with a sense of presence through agency and influence. The fundamental technologies required for the metaverse—augmented and virtual reality, head-mounted displays, 3D simulations, and AI-powered virtual environments—are already in use in the military. This paper examines and investigates the real and potential contribution of metaverse technologies to world and Chinese market economy activities and analyses their significance to the construction of a unified large market in China. A virtual experiment for the Chinese unified market is carried out and analyzed using metaverse technology.

Keywords: metaverse · augmented reality · digital twin · national unified marketplace · equity · smart logistics

1 Introduction

By interpreting the application of the main technologies of the metaverse, the successor of the Internet: virtual reality, augmented reality, cloud computing, Internet of Things, blockchain, and digital twin, this paper makes its own valid insights in estimating the impact of metaverse technology on the economy, thus recognizing its great significance for the healthy development of China's market economy. In summary, metaverse technology can largely contribute to the development of a large national unified market, which provides technological security, reduces commercial logistics costs, enhances resource allocation efficiency, promotes fairness and justice in the distribution of social revenue, activates the stock of resources in China's society and stimulates new business demand, among other things, has real and significant value. These have already received the attention of relevant companies, research institutes, social organizations and the government. The major contributions of this article are to:

- study of metaverse and its diverse applications
- discuss the significance of metaverse technology for the construction of a unified large market in China.
- conduct Virtual Experiments in Metaverse and their applications to Chinese Unified Market

The remaining sections the article is structured as follows. Section 2 discusses about the metaverse technology and its applications. Section 3 briefs about significance of

metaverse technology for the construction of a unified large market in China. Virtual experiments are conducted for building unified large market in China with the help of metaverse technology is presented in Sect. 4. Section 5 concludes the research work.

2 Metaverse Introduction

2.1 Metaverse Concept

1. The term Metaverse was first introduced in 1992 in Neal Stephenson’s science fiction novel Snow Crash. Meta means beyond and verse means universe, which together can be understood as creating an artificial virtual space parallel to the real world, gradually integrating with the real world, extending and expanding each other, and finally reaching a “metaverse” that “transcends” the virtual and the real [1] The metaverse is a “beyond” virtual and real world.
2. This paper summarizes the concept of metaverse as follows: metaverse collects the latest Internet technology, connects individuals into various levels, scattered, independent but interconnected virtual digital spaces, individuals are both creators and users of digital worlds, and people and digital creations can interact with each other in digital space and real space in real time and seamlessly in some series of digital space connectors.

2.2 Metaverse Structure and Application Status

2.2.1 The Technical Structure of the Metaverse

The technical scope of the metaverse is constantly expanding according to the dimensions of its application, and the main broad categories of technologies it contains can be represented by Table 1 [2].

Table 1. Broad categories of technologies involved in Metaverse

Metaverse					
Ultra-high-speed computing and interconnection networks	Multi-interaction technology	AI	Internet of Things	Blockchain	Visual and simulation processing
Decentralized Cloud Computing	VR Virtual Reality AR Augmented Reality MR Mixed Reality	Computer Vision	Machine Perception Systems	Decentralized Computing Secure Storage	Real-time rendering of models
5G/6G high wireless network	brain-computer interaction	Natural Language Processing	Internet of Everything	Public safety and privacy security technologies	Physical Simulation

2.2.2 The Application and Business Status of Metaverse's Technology

The metaverse market map demonstrate the structure and distribution of its applications, which are divided into the seven segments: infrastructure, human-computer interaction (VR/AR), decentralization, spatial computing, creator economy, discovery platform, and experience. Among these skills, the application of virtual reality is rich in relevance to the development of our economy and society.

Virtual Reality (VR) is a computer-generated environment with realistic-looking scenes and objects that immerses the user in their surroundings. This environment is viewed using a Virtual Reality headset. It is completely immersive, and everything we see is part of an environment created artificially through images, sounds, and so on. In augmented reality (AR), on the other hand, our own world becomes the framework within which objects, images, or similar are placed. Virtual reality is expected to grow exponentially in the next five years, according to various market studies.

In recent years, the use of mixed reality has increased in the healthcare, education, shopping, defense, and tourism industries, even during a coronavirus pandemic. In healthcare, for example, it is being used in virtual-home-based therapy and surgery. In this instance, it is used in conjunction with other technologies such as video, sensors, and monitors. Virtual reality could be widely used to treat patients suffering from phobias and anxiety disorders. AR and VR-based eye-tracking technologies are used to diagnose patients with visual or cognitive impairments. Remote VR and AR training systems are increasingly being used in education and training during the COVID-19 outbreak, even as lockdowns or partial economic inactivity continue. The combination of artificial intelligence, augmented reality, and virtual reality will improve customer customization of VR and AR content.

2.2.3 The Significance of Metaverse Technology to Our Economic Development

This paper argues that the metaverse contains the worldwide market and at the same time sinks down to the individual-based market, which has the economic value of macro to niche market (shown in Fig. 1). At the same time, the economic behavior in the metaverse feeds back the human perception of the world, the innovation of collaboration and organizational model, and has the significance of social civilization.

According to the “Metaverse Industry In-depth Report” by Everbright Securities, the domestic metaverse market is expected to reach 340–640 billion yuan in 2025. According to a recent analysis of the “Global Metaverse Market” published by the impurity “Growth Market Report”, the metaverse market is expected to reach \$659.7 billion by the end of 2030, with a CAGR of 37.5% from 2022 to 2030. Analysis Group, an international economic consulting firm, prepared a white paper on the metaverse [3]. According to the report, if metaverse technologies are adopted starting in 2022, metaverse technologies will contribute \$3.01 trillion to global GDP by 2031, with one-third (\$1.04 trillion) coming from the Asia-Pacific region.

Since the prospect of metaverse technology and application is currently under continuous exploration and development, there is no valid measurement tool based on the economic significance and potential impact of metaverse, this paper refers to relevant materials and data to compare the economic impact analysis of Internet technology [4–6]

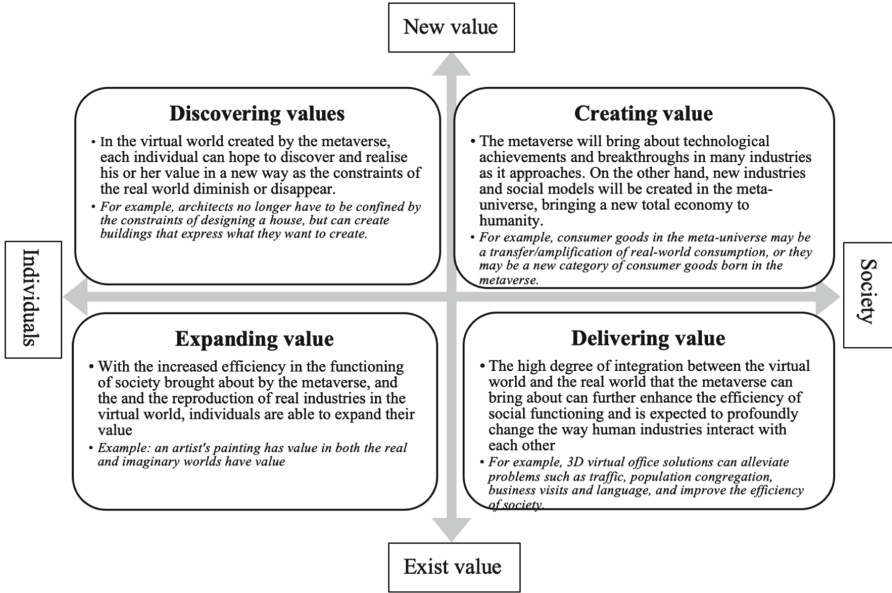


Fig. 1. The pluralistic value of metaverse

The impact of metaverse technology on China’s economy through statistical methods [7–9] Mathematical modeling.

$$\ln(\text{GDP}_{pc,t}) = \alpha \ln(\text{GDP}_{pc,t-1}) + \beta \ln(\text{MetaAction}_{pc,t}) + \chi'_t \Gamma + v_t$$

$$v_t = \eta + \varepsilon_t$$

$r = \text{CAGR} \cdot \beta$ (contribution of the metaverse to the additional GDP growth rate, CAGR is the compound annual growth rate).

Metaverse’s share of 10th years GDP = $\frac{(1+\gamma+\gamma r)^{15} - (1+\gamma)^{15}}{(1+\gamma+\gamma r)^{15}}$ (γ is the average expected GDP growth rate of China).

$\text{GDP}_{pc,t}$ is the GDP per capita in China in year t . $\text{MetaAction}_{pc,t}$ is the metaverse active time per capita in year t . $\chi'_t \Gamma$ includes control variables: metaverse device ownership per person, online hours per capita, years of use, hardware and software expenditures as a percentage of income, number of digital identities and digital products, transactions of metaverse tokens and real money, and income level. η are macro policy effects. ε_t is the idiosyncratic error.

In the literature [10], the impact of digital economy on economic growth was studied and it was concluded that the global Moran index was significant at the 1% level, with values ranging from 0.4 to 0.6, indicating that there is a significant spatial correlation between digital economy development and economic growth between cities. In the literature [11], it is shown that when the level of Internet development increases by 1 unit, the GDP per capita growth rate will increase by 0.167 units. In this paper, we use this data $\beta = 0.167$, i.e. a 1% increase in Internet penetration is associated with a 0.167% increase in GDP per capita. According to the “China Digital Economy Development White Paper”

Table 2. Summary of Annual growth rate of digital economy and GDP share of digital economy output from 2017 to 2021

Year	The size of digital economy (billion RMB)	Annual growth rate of digital economy	GDP share of digital economy output
2017	27200	20.35%	32.7%
2018	31300	15.07%	34.0%
2019	35900	14.79%	36.3%
2020	39200	9.19%	38.6%
2021	45500	16.07%	39.8%

series of reports by the China Academy of Information and Communication Technology, this paper summarizes the information using Table 2.

The five-year CAGR of the digital economy is obtained as $r = 13.73\%$, from which we can approximate the metaverse's $r = 2.29\%$. According to the goal of the "Proposal of the Central Committee of the Communist Party of China on Formulating the 14th Five-Year Plan for National Economic and Social Development and the 2035 Visionary Goals", the total GDP of China will double in 2035 compared to 2020, and the CAGR of China's GDP = 4.43% to obtain the value of γ . Using the formula, we can obtain the share of the meta-universe economy in China's GDP in 2035 after 10 years: 1.45% , which is about 2,939.3 billion RMB. This conclusion is in line with the prediction that "the contribution of China's digital industry to China's GDP will reach 21% in 2030"⁶ and the prediction in the Metaverse White Paper [3]: "the Asia-Pacific metaverse will account for 2.3% of GDP in 2032 in the next decade." According to the report, the future metaverse has a US\$3 trillion to US\$30 trillion industry when widely used, with optimistic estimates reaching US\$80 trillion [12].

This paper argues that vigorously studying and developing the metaverse is an important economic growth pole in the development of our country in the second century, which is of great strategic significance to our country.

3 The Value of Metaverse Technology for the Construction of a Unified Large Market in China

3.1 Introduction to China Unified Market

3.1.1 China's Unified Market is One of the Cores of China's "Double-Cycle" Economic Development

China's new economic development pattern of "dual circulation" is set to get a vital boost as authorities unveiled an ambitious plan for creating a national unified market to allow for a more efficient and smooth flow of labour and goods across the country. Authorities issued a guideline on accelerating the establishment of a unified domestic market that is efficient, rules-based, fair, and open, as part of a comprehensive push for the country's market to evolve from being big to becoming powerful. According

to the guideline, the goal is to eliminate local protectionism, market segmentation, and impediments to economic circulation in order to facilitate the smooth flow of products and resources on a larger scale.

In China, the concept of a unified market is not new. Several government agencies jointly released a work plan in 2013 to remove regional blockades across the country in order to build a unified and open market system, and incremental steps have been taken toward that goal. The task has become more pressing since the government proposed the dual circulation policy in 2020, which prioritises the domestic market while allowing internal and external markets to complement each other as a strategic solution to build resilience against external shocks.

3.1.2 The Construction Requirements of the Unified Large Market

Coordination and unification of standards, rules, and policies in various regions and industries will be required to make the domestic market function more efficiently. “The key to establishing a new development pattern is an unobstructed economic cycle, which necessitates hastening the construction of a unified national market, as a scattered and fragmented market cannot ensure the free flow of factors, as well as the fair distribution and smooth circulation of products.” Despite decades of market-oriented reforms that have improved the flow of goods and services, local protectionism and market segmentation have remained major impediments to fostering a unified market.

The standardizations specified in the guideline included the unity of basic market institutions in property rights protection, market entry, fair competition, and social credit. Building a unified market, whether in its basic concept, principles, targets, or policy measures, is consistent with the country’s market-oriented reforms, dismissing concerns that the country may revert to a planned economy. Concerning the effects on the global market, the construction of a unified national market does not imply self-imposed closures or closing doors, but rather advances institutional openings to better utilise global factors and resources.

The guideline, which adheres to open thinking, focuses on cultivating new advantages in international competition and cooperation, encouraging improved connectivity between the domestic market and the international market in terms of market rules and infrastructure, and increasing influence in the global industry chain, supply chain, and innovation chain. Analysts believe that once the task is completed, the relatively unified domestic rules can be better aligned with international rules, and China’s mega-market advantages can be used more extensively, accelerating the development of a new development pattern of dual circulation.

3.2 The Role of Metaverse Technology in the Construction of the National Unified Market

3.2.1 Metaverse Technology Drives Growth in Economic Potential

Metaverse architecture technology penetrates deeply into various industries and becomes a technical means and tool for informationization, intelligence, green and efficient



Fig. 2. Production simulation process of BMW Digital Twin Factory

upgrading of traditional industries. It can improve the production efficiency of traditional industries, reduce production costs, enhance management and quality control, and shorten the product iteration cycle.

Metaverse's digital twin technology is a digital copy of the mapped physical world. By integrating artificial intelligence, machine learning and sensor data, it creates a "real" model that can be updated in real time to support decisions on physical product lifecycle activities. For example, the NIO Energy Cloud's intelligent site selection system helps to deduce the layout of the exchange station address, enabling a clear understanding of the daily volume of new sites under current ownership, the exchange time, and the impact on neighboring exchange stations. For example, BMW invested 15 billion to build the Rida plant in Shenyang, whose plant planning, architectural design, production line layout and equipment commissioning are all being created and simulated using NVIDIA's Epic Games Unreal Engine creation platform as the first plant to utilize metaverse technology [Fig. 2].

3.2.2 Metaverse Technology Reduces Market Circulation and Transaction Costs

Integrated and efficient, low-cost logistics is the basic guarantee of the national unified market, which can be understood as the status and role of blood vessels in the human body.

Professor Wang guoquan's team in the Department of Industrial and Manufacturing Systems Engineering at the University of Hong Kong is leading a project on "Interactive Intelligence Network for Cross-border Logistics Hubs in the Greater Bay Area". The project advocates the Cyber-Physical Internet concept, which uses intelligent sensing and IoT technologies to integrate logistics and information flow to form a logistics metaverse, hoping to "send and receive objects like sending and receiving SMS messages on an online real-time chat platform".

Dai dingyi, Director of the Expert Committee of the China Federation of Logistics and Purchasing, believes that. [13] the successful construction and deployment of metaverse blockchain technology, digital twin technology, and multi-sensor technology will significantly reduce national logistics costs, improve operational efficiency and service quality, and optimize trade-offs between economic performance metrics and environmental concerns, while facilitating the upgrade and transformation of logistics systems and operations across regions in a unified market. "



Fig. 3. 3D Virtual World in a Second Life

3.2.3 Metaverse Technology Enhances Resource Production Efficiency, Fairness and Justice in Market Allocation

A large national unified market requires efficient and equitable distribution of educational resources [14]. The metaverse brings efficiency and equity in the field of education. China's vast geographic area, the scarcity and extreme concentration of educational resources centralized in central cities, coupled with the college entrance examination as an important pathway for individuals to move up in society, exacerbates the cost of access to educational resources and inequitable distribution of educational resources [15].

We can foresee that students from primary and secondary schools across the country are connected to the classroom environment through VR and AR devices, and the digital avatars of famous teachers in key schools can switch teaching environments at any time and lead student avatars into any place in the world where 3D teaching can be carried out in order to improve teaching quality and student learning interest; student avatars can step into virtual laboratories and operate various experiments that are not in reality, thus reducing the cost and risks associated with real experiments; the student avatars can carry out various skills training operations through the virtual training platform [16]. These will facilitate the production of educational products. All these will promote the productivity and fair distribution of educational products, cultivate better talents for all parts of China, and contribute to the scientific and educational and economic development of the region.

4 Virtual Experiments in Metaverse and their Applications to Chinese Unified Market

As illustrated in Fig. 3, the metaverse is a 3D world in which avatars act on behalf of users in the real world. Typically, users with appropriate personal computers and a special application can access the virtual world composed of computer graphics (a viewer).

Second Life (SL) is used for these projects. Second Life is a massive 3D-generated virtual world and platform filled with user-generated content in which people can interact

in real time. It also has an active in-world economy. Linden Lab officially launched the platform to the public on June 23, 2003, but its development dates back to at least the late 1990s. Second Life residents, as users are known, do not have a specific goal, and there are no traditional gameplay mechanics or rules in place. Second Life aims to emphasize social interaction, user-generated content, and user autonomy. As a result, the virtual world is more closely associated with social media than with the videogame industry. However, because it predates many major social platforms, Second Life has frequently been regarded as a video game. Not only do its residents have the freedom to roam the world and interact with one another, but it also has a thriving, fully-fledged in-world economy and user-generated content.

Avatars are roles that Second Life residents use to represent themselves. These are highly customizable, and we can be almost anything we want. The most revolutionary aspect of Second Life is that residents can do almost anything that people do in real life, such as watching movies, listening to music, playing games, attending parties, buying or selling items, and creating new content for the world, such as items or even buildings. In fact, residents create the majority of the world's content, landmarks, and even animations. Furthermore, economic activity is not limited to purchasing and selling items. Real estate can also be purchased or sold. Ordinary Second Life residents typically buy plots of land and houses to live in.

The unique characteristics of SL are:

1. The digitized structures can be built in VR
2. Mutual communication is possible in the metaverse, just as it is in the real world.
3. SL can be used for a variety of real-world activities.
4. Tasks can be simplified and personalised.

Many market-related activities and services, such as supply chain, capital, stores, shopping malls, theatres, and hotels, are made possible by these characteristics. There is no need to say more; the user can vividly participate in the market and virtual activities with a strong sense of reality. With all of these distinguishing features mentioned above, we devised a project plan to establish a system for the Unified Chinese Market.

4.1 Trials

The flowchart of the virtual system for unified Chinese market using Metaverse is shown in Fig. 4. To begin, we should have a virtual space for service providers with the necessary resources to provide the best services using necessary files. As shown in Fig. 4, service providers could exchange messages verbally or via text-based messages in the virtual space. Users may wonder why we require such a virtual space. The most important reason is that we want to provide users with a vivid sense of reality, which must lead to the maximum enhancement of the buying or selling effect in the unified market. Users should be impressed if they can obtain services through the movement of an avatar in realistic marketing spaces. We could anticipate successful marketing services for the fundamental elements of marketing and the general sketch for supply chains, capitals, and so on.

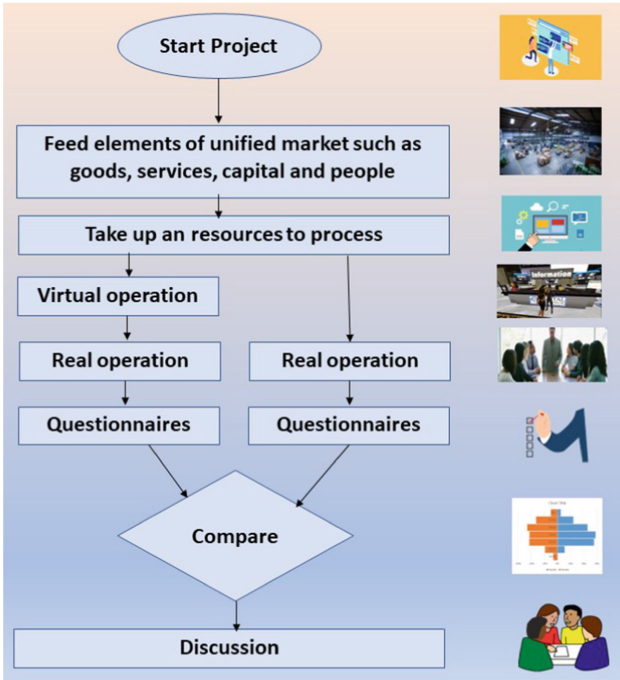


Fig. 4. Flow of trial experiments for Chinese Unified Market

Second, we will select one of the marketing elements and create virtual objects with real-world resources. We are unable to show the system’s concern model because we have only recently begun the project. The purchase of goods, for example, could be chosen. When the consumer pressed various fundamental buttons, text would appear to explain what function the button would express. Because the goods-based virtual objects have not yet been built, we will continue to build them one by one and carry out the trial usage.

Finally, we conduct feedback analysis. The customers would be divided into two groups. The first group would be for virtual purchases, followed by real-world purchases. The second group would have real-world purchases but not virtual ones. We will distribute questionnaires to participants in both groups. The questionnaire outlines are provided below. Their impressions will be graded on an eight-point scale.

1. Did you understand the way to purchase the product?
 - a. Very much
 - b. Pretty much
 - c. Neutral
 - d. Not so much
 - e. Not at all.
2. Did you feel the sense of reality?
 - a. Very much
 - b. Pretty much
 - c. Neutral
 - d. Not so much
 - e. Not at all.
3. Did you understand how to use the virtual objects?
 - a. Very much
 - b. Pretty much
 - c. Neutral
 - d. Not so much
 - e. Not at all.
4. Did you understand the way to complete the payment process?
 - a. Very much
 - b. Pretty much
 - c. Neutral
 - d. Not so much
 - e. Not at all.
5. Were you interested in the purchase of goods?
 - a. Very much
 - b. Pretty much
 - c. Neutral
 - d. Not so much
 - e. Not at all.
6. Was the display of goods in the virtual / real-world space useful?
 - a. Very much
 - b. Pretty much
 - c. Neutral
 - d. Not so much
 - e. Not at all.
7. Did you able to purchase the goods sold by various sellers all over the world?
 - a. Very much
 - b. Pretty much
 - c. Neutral
 - d. Not so much
 - e. Not at all.
8. Was the purchase the of product safe and secure?
 - a. Very much
 - b. Pretty much
 - c. Neutral
 - d. Not so much
 - e. Not at all.

The trials would be repeated for various elements of the unified market, with the results analysed and discussed for each group. We would discuss the impact of virtual marketing using the results.

5 Conclusion

The potential for market opportunities in the metaverse is enormous, and it will not only be dependent on, but will also drive, global trends, investments, customer interest, and growth. The metaverse is in its early stages, and it requires inventors and innovators to create new programs and products that intelligently combine the superlative rudiments of 2D, 3D, and AI technologies. This paper synthesizes and researches relevant literature and materials and integrates various views and data to argue that metaverse technology has a constructive role as an infrastructure development and construction to bring positive and positive solutions to China's unified large market in terms of system, efficiency, equity, and sustainability. In this study, a virtual experiment for the Chinese unified market is carried out and analyzed using metaverse technology. To achieve the goal, we focused on the metaverse to create a unified market system for purchasing items and making payments via the internet. In the future, we recommend implementing virtual experiment to demonstrate its effectiveness, accurately provide all of its functionalities, and benefit people.

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