

# ***The Impact of the Metaverse on the Economic Development of Manufacturing Industry***

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**Abstract:** Since social media Facebook announced its renaming to Meta in October 2021, Metaverse has become a widely discussed topic. After Facebook, companies such as Nike and BMW announced plans to launch Metaverse. A large number of cases have shown that the Metaverse plays an important role in the development of the real economy. Based on existing research, the goal of this article is to study the important role of the Metaverse in the development of the manufacturing real economy and how to promote the development of the manufacturing industry. This article studies the characteristics of the virtual and real combination and decentralization of the Metaverse through qualitative analysis and case study. Meanwhile, it was further discovered how the Metaverse promotes the economic development of the manufacturing industry by influencing its research and development, production, and marketing processes. Research has shown that, the Metaverse can affect the entire process of manufacturing product research and development, production and manufacturing, and marketing. Therefore, through the Metaverse, enterprises can achieve digitalization, cross time and space, and collaborate with multiple departments for research and development, production, and marketing. Thus, enterprises can achieve the goal of improving production efficiency and efficiency while improving consumer experience. On this basis, feasible policy recommendations were proposed.

**Keywords:** Metaverse, manufacturing industry, economic development

## **1. Introduction**

### **1.1. Background**

In 2021, the concept of Metaverse, derived from science fiction works, suddenly received heated discussion. Simply put, many people associate the Metaverse with games, Web 3.0, and more. However, as a concept that can connect the virtual world with the physical world, the Metaverse should not be limited to games.

There is currently controversy over the definition of Metaverse. Smart et al. believe that the concept of the Metaverse should be explained from at least four aspects: a virtual world that experiences a perfect virtual story, a mirrored world that reflects the current real world, augmented reality that displays the real world, and a mixture of augmented information and life logs in the real world [1]. As Calhoun pointed out, simply looking at the impact of Amazon, and eBay on business

can imagine how the Metaverse will have a devastating impact on manufacturing. This may herald the beginning of the next manufacturing revolution.

## 1.2. Related Research

Wei et al. researched the application of VR in the manufacturing industry. The authors introduce the concept and characteristics of virtual reality technology. Then, the authors analyze the characteristics and application cases of virtual manufacturing and virtual design. Finally, the authors believe that virtual manufacturing can simulate the logistics and information flow in the factory. This is of great significance for controlling materials and conducting production in actual production [2]. Zhang et al. analyzed the impact of VR on economic development. The authors analyze it from three aspects: microeconomics, industrial economy, and macroeconomy. The authors analyzed the positive and negative impacts of VR on economic development. Finally, the authors propose feasible strategies to adapt VR to economic development in response to its impact [3]. Sun analyzed the market situation of VR technology's virtualization products. By analyzing the market situation, the author further studied the impact of VR on the market economy. The conclusion is that the impact of VR on the real economy has more advantages than disadvantages. Research shows that government policies to promote VR development are effective for the development of the real economy [4].

Qin studied the impact of AR technology on addressing labor shortages in the manufacturing industry. The author analyzed the impact of AR on workers' learning styles, training methods, and product development through empirical analysis and survey questionnaires. Therefore, the author concludes that AR can enable the younger generation to learn manufacturing skills faster, thereby solving the employment difficulties in the manufacturing industry and promoting the development of the manufacturing industry [5].

Kshetri analyzed the application of the Metaverse in developing countries. Thus, the author analyzed the benefits of the Metaverse for economic development. On this basis, the author further identified the risks faced by developing countries in the Metaverse and provided corresponding measures [6]. Yuan and Zhang analyzed the Generation principle of the Metaverse from three aspects: technology, production, and economics. On the other hand, the author analyzes the inherent logic of the Metaverse economy as a new type of digital economy from three levels: fundamental, commercial, and theoretical. Finally, the author explained that the Metaverse is an inevitable trend in economic development and developed an overall cognitive framework for the impact of the Metaverse on the economy. This study lays the foundation for further research on the economic impact of the Metaverse [7]. Li first studied the logic of the integration and development of the Metaverse and the real economy from a theoretical perspective. Through the case study, the author analyzed the path of the Metaverse promoting the development of the real economy from four aspects: product research and development, production and manufacturing, marketing, and service upgrading. The conclusion drawn by the author is that the Metaverse has a significant impact on the development of the real economy, and the government should introduce relevant policies to eliminate obstacles to the integration of the Metaverse and the real economy [8]. Yao et al., Yao et al. studied a socio-technical revolution based on the socio-cyber-physical system. The authors put forward an intelligent manufacturing framework involving artificial intelligence, big data, and the Metaverse. On this basis, the authors proposed the industrial Metaverse route. Through this route, the resource utilization rate of the manufacturing industry can be improved, and customized products and services can be provided to meet customer needs [9]. Zheng studied the significance of the industrial Metaverse for the Digital transformation of the manufacturing industry. The author analyzed the background and conceptual framework of the industrial Metaverse. On this basis, the author further deepened the understanding of the industrial Metaverse and analyzed its elements.

Finally, the author proposed the application scenarios and economic value of the industrial Metaverse through examples [10]. Wang et al. analyzed various data such as prices and inputs of NFT through case studies, thereby analyzing the value of NFT. On this basis, the author reviews the value of the Metaverse via two academic resources, the attention economy, and media theory, and describes the principle of value creation in the Metaverse economy [11].

### **1.3. Objective**

This article believes that the rise of the Metaverse will bring significant changes to the manufacturing industry. Firstly, this article attempts to explore why the Metaverse can promote the development of the manufacturing economy by studying the characteristics of the Metaverse. What are the characteristics that affect the development of the manufacturing industry? Secondly, further speaking, the article hopes to illustrate how the Metaverse specifically affects the development of the manufacturing industry in the process of product research and development, production and manufacturing, and marketing promotion through case studies. Finally, the article hopes to further promote the development of manufacturing in the Metaverse and minimize risks by proposing policy recommendations.

## **2. Characteristics of the Metaverse**

### **2.1. Integration of Virtual and Real Worlds**

From an economic perspective, the Metaverse connects the virtual economy with the real economy. In the process of product manufacturing, virtual factories and technologies in the Metaverse can improve production efficiency in the real economy. In the product development process, enterprises can try to develop virtual versions of physical products. In the marketing process, physical enterprises can conduct trial runs in the Metaverse to attract customers. Marketing through the Metaverse can reduce marketing costs for enterprises while providing customers with a genuine trial experience. Thus, it can be seen that through the Metaverse, the barriers between the real economy and the virtual economy have been broken.

### **2.2. Decentralization**

Many applications and platforms are centralized models. These platforms are all controlled by companies or capital. The Metaverse is different from its previous pattern. In the Metaverse, everyone is equal. Commercial trade is not influenced by power or status, and there is no ruler. The Metaverse only builds a platform for everyone or a world that blends with reality. In this world, there are no well-defined rules. Every user is to some extent the master of this world. Everyone can develop their own resources and formulate rules.

## **3. The Impact of the Metaverse on the Manufacturing Industry**

### **3.1. Research and Development**

In the research and development process, on the one hand, through the Metaverse, the product development process can be fully digitized from multiple perspectives. Technicians can test products in the Metaverse, allowing companies to identify product issues. Through data support from the Metaverse, the material, structure, performance, and other aspects of the product can be improved. Moreover, products can be synchronously optimized from multiple dimensions through virtual research and development. Thus, all processes of product development can be simplified.

Conducting research and development in the Metaverse can greatly improve the efficiency and feasibility of research and development.

On the other hand, through the Metaverse, multiple entities and departments can conduct joint research and development across time and space. The Metaverse is a public three-dimensional space. Due to the integration of virtual and reality, each member can engage in deep interaction in the Metaverse. As a result, communication and interaction between members become simpler, eliminating unnecessary links. In this way, the process of product development can be shortened. Enterprise research and development costs can be reduced.

For example, the Microsoft Mesh Metaverse platform developed by Microsoft creates an interactive digital environment. In this digital platform, people from all over the world are gathered together. In an immersive Metaverse environment, personally designed components can be uploaded to virtual space on time, and the development and testing of various products are carried out using virtual images by people in different times and spaces.

### 3.2. Produce

The Metaverse also plays an important role in product production. In the process of manufacturing development, many digital factories have emerged. The Metaverse plays an important role before, during the product production.

Before production, virtual factories in the Metaverse can simulate the production process, allowing companies to directly see potential problems and required raw materials during the production process. Through this method, enterprises can have a relatively good expected cost before production, so as to make appropriate materials and labor inputs. During the production process, cost waste in the production process can be reduced.

During the production process, enterprises can determine the optimal production path through virtual factories in the Metaverse. Meanwhile, by comparing virtual factories with reality, enterprises can identify which link in production is not in place. Thus, enterprises can continuously optimize their production processes and achieve optimal configuration.

For example, BMW has created a virtual factory in NVIDIA Omniverse. The same production mode and process are adopted in both virtual and actual factories. Enterprises can simulate and optimize the layout of factories through Omniverse. At the same time, employees can also perform remote operations in virtual spaces. Thus, more precise production processes can be achieved.

### 3.3. Marketing

The Metaverse has created a new marketing model. Enterprises can produce virtual products in the Metaverse. As a result, many Metaverse users can experience new products in the Metaverse. Due to the integration of virtual and reality in the Metaverse, enterprises can showcase their products more realistically. Users can also experience reality in the Metaverse. Meanwhile, due to the decentralized nature of the Metaverse, users can more freely participate in the production process of the enterprise, improving their sense of experience. By conducting surveys on user preferences in the Metaverse, companies can accurately discover user preferences. Through this approach, enterprises can not only attract users from the Metaverse but also develop more targeted products for different user groups.

Nowadays, many companies utilize Metaverse platforms for marketing. For example, clothing companies such as Nike and Adidas have conducted marketing in the Metaverse space. A virtual space called Nikeland has been created. In this space, users can try on shoes and interact with Nike. Nike is attempting to use the Metaverse as another marketing tool to create a new communication channel for potential users.

## **4. The Development Trend and Policy Suggestions of the Manufacturing Industry in Metaverse**

### **4.1. The Development Trend of the Manufacturing Industry in Metaverse**

The development trend of the manufacturing industry in Metaverse includes three aspects: Firstly, for manufacturing enterprises, the Metaverse Expands 2D Virtual Space to 3D Virtual Space. With the development of the Metaverse, the development of manufacturing in the Metaverse is also more three-dimensional. The Metaverse has opened up a new world for manufacturing. Enterprises can not only develop virtual products such as software through the Metaverse, but also utilize the Metaverse to better produce products and promote the development of the real economy. Secondly, for consumer and business relationships, the consumer experience mode has shifted from offline to online. Through the Metaverse, manufacturing enterprises can directly communicate with consumers online. In the past, since the manufacturing industry mostly produced actual products, consumers were unable to experience them from afar. But through the Metaverse, consumers can experience it online, spanning time and space. This can greatly reduce the trial and error costs for consumers. At the same time, this model also improves enterprise efficiency.

Thirdly, for the entire manufacturing industry, the Metaverse provides opportunities for many small and medium-sized enterprises. At the same time, the Metaverse connects various industries and reduces the cost of industrial integration. It also lowers the threshold for the integration of manufacturing with other industries. Meanwhile, with the popularization of the Metaverse, the marginal cost of using the metauniverse will be greatly reduced. In this situation, the cost of small and medium-sized enterprises entering the industry through the Metaverse will also decrease accordingly.

### **4.2. Policy Suggestions for the Government**

From the above, it can be seen that the Metaverse plays an important role in the development of the manufacturing industry. However, there are still many problems in practical development, such as monopolies, digital risks, etc. McKinsey & Company's survey of hundreds of corporate executives worldwide shows that executives still have doubts about Metaverse applications, with data privacy and cybersecurity ranking the top two (86% and 85%, respectively) [5]. This requires the government to introduce relevant policies to support the development of manufacturing in the Metaverse.

Firstly, the government should encourage innovation. The important driving force for the industrialization development of the Metaverse is technological innovation. On the one hand, the government should introduce relevant policies to promote core technological innovation in the Metaverse. The Metaverse involves multiple technologies such as blockchain, VR technology, and artificial intelligence. Only through continuous technological breakthroughs can the development of the Metaverse be better. On the other hand, because the Metaverse is a new thing, many companies are hesitant to try it out. The government should encourage manufacturing enterprises to innovate within the Metaverse, such as producing Metaverse products. Only in this way can the Metaverse truly empower manufacturing.

Secondly, the government should formulate comprehensive rules for the development of the Metaverse to maintain market order. Countries should work together to establish reasonable standards. Only in this way can the Metaverse develop in an orderly manner. Otherwise, monopoly or unfair competition is likely to occur. At the same time, network security management should be increased to avoid data leakage in the Metaverse.



Thirdly, the government should strengthen professional research on the integration of the Metaverse and the manufacturing industry. The government can establish a Metaverse economic research institute or cultivate professional researchers in this field to conduct a systematic and comprehensive research. They can guide the development of the manufacturing industry and promote the development of the real economy.

## 5. Conclusion

This article studies the characteristics of the impact of the Metaverse on manufacturing. On this basis, the impact mechanism of the Metaverse in the research and development, manufacturing, and marketing processes of manufacturing products was specifically elaborated. This study indicates that the Metaverse has achieved the organic integration of entities and virtual worlds. At the same time, the Metaverse has achieved decentralization. Therefore, through the Metaverse, enterprises can achieve fully automated, digital, and cross-time and space research and development. In production, enterprises can achieve repeated production across multiple departments, reduce trial and error costs, and improve production efficiency. In marketing, enterprises can form interactive experiences with consumers in the Metaverse and engage in customized and experiential marketing. As a result, the Metaverse can have a profound impact on manufacturing. Therefore, the government should introduce relevant policies to promote the development of manufacturing under the influence of the Metaverse. The government can promote the organic integration of the Metaverse and manufacturing industry by encouraging core digital technology innovation, building research and development centers, and formulating and improving market rules. All sectors of society should attach great importance to the Metaverse and make rational use of it to promote economic development.

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