Research on the Development Model and Practical Path of New Agricultural Product E-Commerce Driven by Metaverse Technology

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Abstract: With the rapid development of metaverse technology, virtual reality, augmented reality, blockchain, and other technologies have gradually penetrated into the field of E-Commerce, promoting the transformation of agricultural product E-Commerce towards immersion, interactivity, and credibility. Traditional agricultural product E-Commerce faces problems such as "serious product homogenization", "weak trust mechanisms", and "single consumption experience". The introduction of metaverse technology provides new ideas to solve these problems. Starting from the core characteristics of metaverse technology, this paper explores its integrated application and innovative models in agricultural product E-Commerce, analyzes the current practical challenges, and proposes feasible practical paths. The study believes that building a "virtual-real integration" agricultural product E-Commerce ecosystem will help enhance user stickiness, strengthen brand value, and realize the digital transformation of rural economy.

Keywords**:** metaverse; agricultural product E-Commerce; virtual reality; digital agriculture; immersive experience

1. Introduction

In recent years, with the in-depth advancement of the "Digital Countryside" strategy and rural revitalization policies, agricultural product E-Commerce, as an important means to promote rural economic development and expand channels for farmers' income increase, has achieved rapid development. This paper focuses on the new development model of agricultural product E-Commerce driven by the metaverse, and proposes feasible innovation strategies through theoretical analysis and exploration of practical paths.

2. Logical Basis for Metaverse Technology Empowering Agricultural Product E-Commerce

2.1 Overview of Core Technologies and Characteristics of the Metaverse

The core technology system of the metaverse includes virtual reality (VR), augmented reality (AR), blockchain, digital twin, etc. Virtual reality technology can build a completely virtual three-dimensional environment, allowing users to experience immersion through devices; augmented reality overlays virtual information on real scenes to achieve virtual-real integration. Blockchain technology ensures the authenticity and security of data with its decentralized and immutable characteristics; digital twin technology realizes real-time mapping and simulation of physical entities by building digital mirrors of them. The metaverse is characterized by immersion, interactivity, and persistence. Users can obtain an immersive experience in virtual space, interact in real-time with others or virtual objects through digital avatars, and the virtual world can operate continuously without being limited by physical space[1].

2.2 Key Challenges Faced by the Development of Agricultural Product E-Commerce

Agricultural product E-Commerce faces many key challenges in its development[2]. The lack of trust is a prominent issue: consumers find it difficult to intuitively understand information such as the production process and quality safety of agricultural products, and have doubts about the quality of online agricultural products, which affects purchasing decisions. The phenomenon of weakened brands is obvious: most agricultural products lack well-known brands and are seriously homogenized, making it difficult to form a differentiated competitive advantage in the market. Poor user experience also restricts development: traditional E-Commerce mostly displays agricultural products with pictures and texts, which has limited information transmission and cannot allow consumers to fully feel the characteristics of products.

2.3 Integration Points Between Metaverse and Agricultural Product E-Commerce

There are multiple integration points between the metaverse and agricultural product E-Commerce, which can effectively solve the pain points in the development of agricultural product E-Commerce. Immersive display allows consumers to "enter" virtual farms through VR technology, intuitively check the planting environment and growth process of agricultural products, enhancing their understanding and trust in products. Virtual live streaming with goods combined with AR technology enables hosts to interact with digital models of agricultural products in virtual scenes, vividly displaying product characteristics and improving the fun of shopping.

3. Metaverse-Driven Development Model of Agricultural Product E-Commerce

3.1 Construction of Virtual Exhibition Halls and Immersive Shopping Experience

Virtual exhibition halls built based on metaverse technology create an immersive shopping experience for agricultural product E-Commerce. Virtual exhibition halls can simulate real farm environments. After consumers enter with digital avatars, they can roam in virtual fields and observe the growth status of agricultural products. 3D product display presents agricultural products in a three-dimensional form, allowing consumers to view product details such as the color and texture of fruits from 360 degrees. Digital shopping guides, as virtual assistants, can answer consumers' questions in real-time and recommend suitable products.

3.2 Digital Human Live Streaming and Brand Personification

Digital human live streaming is an innovative model of agricultural product E-Commerce driven by the metaverse, which creates unique brand IPs through virtual hosts[3]. Virtual hosts have distinct images and personalities, and their personas can be set according to the characteristics of agricultural products, such as the image of a kind "farmer." During live streaming, virtual hosts can introduce the stories and characteristics of agricultural products in a lively and vivid way, and interact with users in real-time, such as answering questions and participating in games.

3.3 Combination of Blockchain and Agricultural Product Traceability System

Combining blockchain technology with agricultural product traceability systems has built a reliable trust mechanism for agricultural product E-Commerce. The immutability of blockchain ensures the authenticity of agricultural product traceability information. Every piece of data, from seed procurement, fertilization and pesticide use during planting, to quality inspection in processing, and temperature and humidity records during logistics and transportation, will be uploaded to the blockchain in real-time.

4. Development Path and Practical Suggestions for Metaverse Agricultural Product E-Commerce

4.1 Promoting Infrastructure and Platform Technology Construction

Promoting infrastructure and platform technology construction is the basic guarantee for the development of metaverse agricultural product E-Commerce. It is necessary to strengthen 5G network construction to ensure the smooth operation and real-time interaction of virtual scenes; develop edge computing technology to reduce data transmission delay and improve user experience. At the same time, increase the research and development and popularization of AR/VR hardware devices to lower the user access threshold. Build a professional metaverse agricultural product E-Commerce platform, integrating functions such as virtual exhibition halls, digital human live streaming, and traceability systems, to provide convenient technical support and services for agricultural enterprises.

4.2 Encouraging Collaborative Innovation Between Agricultural Enterprises and Technology Enterprises

Encouraging collaborative innovation between agricultural enterprises and technology enterprises is the key to building a metaverse agricultural ecosystem. Agricultural enterprises are familiar with the production process and market demand of agricultural products, while technology enterprises master core metaverse technologies. Cooperation between the two can achieve complementary advantages. Agricultural enterprises provide practical application scenarios and data support, while technology enterprises develop customized technical solutions according to needs. Build an integrated "industry-university-research-application" system, and work with universities and research institutions to tackle technical problems, such as improving the realism of virtual scenes and optimizing the efficiency of blockchain traceability.

4.3 Establishing a Framework of Policy Support and Supervision Mechanisms

Establishing a sound framework of policy support and supervision mechanisms is crucial for the standardized development of metaverse agricultural product E-Commerce. The government should formulate relevant standards for metaverse E-Commerce, clarifying technical requirements and operating specifications for virtual exhibition hall construction, digital human live streaming, data traceability, etc. Introduce support policies to encourage enterprises to invest in the research, development, and application of metaverse agricultural product E-Commerce, such as providing financial subsidies and tax incentives.

5. Conclusion

Metaverse technology has injected new development momentum into agricultural product E-Commerce, changing the operation logic and user experience methods of traditional E-Commerce. Through innovative applications such as building virtual exhibition halls, introducing digital human live streaming, and realizing full traceability, consumer trust and participation can be significantly improved, opening up new prospects for agricultural product brand building. Although there are still practical problems such as high technical thresholds, large cost inputs, and imperfect supervision mechanisms, as long as the government, enterprises, and research institutions work together, metaverse agricultural product E-Commerce is expected to become an important part of digital countryside construction and agricultural modernization.

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