Future Trend of Supply Chain Being Exposed to the Metaverse

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Abstract. Due to the skyrocketing development of the metaverse, there is an inevitable trend that the supply chain will one day be exposed to the metaverse environment. The supply chain system supported by metaverse can solve the problems that traditional blockchain platforms are separated and have different standards, and governance of them is not effective, etc. This system can also coordinate with other fields of industry, bringing up digital collections and other industries to develop consistently, helping to make food and medicine safer to eat and take. This study has recovered how the metaverse affects supply chain management and has created a conceptive model of blockchain under the metaverse. It also gives the solution to the existing problem in traditional supply chain systems supported by blockchain technology. The study shows how the supply chain can work more efficiently under the metaverse and guides the researchers afterward to complete the supply chain system more flexibly and scientifically.

Keywords: Metaverse, blockchain, supply chain management, laws in the metaverse.

1. Introduction

In the trend of an increasingly sophisticated metaverse, traditional supply chains have been and are facing frequent and dramatic shocks due to the COVID-19 epidemic [1]. Under this situation, a decentralized and shock-resistant block-chain model is urgently needed. Through literature research, this study argues that existing blockchain-related supply chain models present a legacy of unfavorable regulation and poor information transparency that needs to be further addressed. Based on the above analysis, this paper will adopt a qualitative research approach to describe the construction of a supply chain model to remedy the above shortcomings in a meta-universe environment, to investigate the decentralization of the supply chain and the enhanced regulation of information transparency, to reflect the current research on the optimization of the supply chain based on blockchain, and to illustrate the construction of a new model for the transparency and decentralization of the supply chain. Due to the flexibility and secrecy of blockchain, it cannot be effectively regulated, especially in countries with strict market regulations, and such a model cannot be put into practice. This paper considers how such flawed supply chain models can be refactored and optimized in a meta-universe context to improve the scope of application and credibility of decentralized supply chain models.

2. Literature review

Existing research on supply chain transparency has focused on the use of blockchain-related models for its technology. It describes the inadequacy of credit contracts in the traditional decentralized supply chain and the lack of control by companies over the management of the supply chain. The blockchain-optimised supply chain model is also presented in the form of a textual diagram, which demonstrates its superiority. Furthermore, the supply chain model described in the literature is complete, including the raw material chain, the production chain and the distribution chain [2]. However, no specific solutions are given in the literature for either of these problems, and they are not adequately and effectively addressed by using only conceptual terms such as contracts in their supply chain models.

In terms of the metaverse, the researches on metaverse-related concepts, technologies, laws and regulations are not yet mature, but it has taken shape [3]. Moreover, the development of the metaverse is a specific future trend and based on 5G technology and advanced technologies such as brain-computer interface, the emergence of a perfect supply chain system in the metaverse is an inevitable

result of technological development. In the technology system of the metaverse, virtual reality and interactive technology are the key technologies, which lower the threshold of flexible supply chain matching and lay a solid foundation for a flexibly combinable supply chain network. The Internet of Things (IoT), another core technology, highly integrates the metaverse with reality through technologies such as RFID. In fact, on a technical level, the technology behind supply chain management as well as the applications have a high degree of overlap with the meta-universe [4]. They are all deeply connected to artificial intelligence with the help of blockchain as well as IoT technology. Blockchain not only empowers the metaverse but is an important core technology for decentralization, blockchain also empowers decentralized supply chain systems. In a decentralized environment, the use of decentralized technology for the construction of supply chain models is conducive to information transparency and increased supplier credibility. Specific applications are in, for example, the credibility of halal food and the traceability of imported products. The government and enterprises are actively exploring the application of blockchain technology in supply chain management, of which the current theoretical research on supply chain management based on blockchain technology has just started and lacks systematic research [5].

2.1. The status quo of the metaverse

The metaverse, currently a hot topic, is showing a steady momentum based on 5G technology, combined with various development factors in society. Among them, the relevant regulations, as well as the governance of data, are still in the development stage and taking shape [3]. In layman's terms, a metaverse is an intermediate platform that can bring people from all over the world together in one place at the same time to do different things separately. Wearing virtual reality devices, the boundaries between the virtual world and the real world have been blurred infinitely in a laboratory environment, and it is difficult for users to distinguish the difference between the virtual world and the real world [5], while in the virtual world, it is possible to make changes to real-world matter through the Internet of Things technology In the virtual world, it is possible to change the matter of the real world through the Internet of Things technology, realizing a certain sense of collision between mentalism and materialism.

2.2. Challenges of blockchain technology in supply chain management outside the metaverse environment

The flexible nodes of blockchain technology are the strength of blockchain and in some ways a weakness. The exclusivity of the various blockchain traceability platforms and the imperfection of the current technology make blockchain too fragmented. Supply chain performance in this case is deficient, technical credibility is poor and corporate profits are challenged. Different platforms have differentiated governance standards, which discovers the phenomenon that the loss of trust in individual blockchain platforms leads to user suspicion of blockchain technology as a whole [1]. The excessive fragmentation of blockchain technology is detrimental to the transparency of information and overall regulation, and it is even less able to achieve unrestricted cross-platform linkage.

3. Development trend of the supply chain in the metaverse

3.1. Metaverse in supply chain management in the decentralization and decentralization of flexible transition

Due to the pluralistic interoperability of the meta-universe, blockchain technology can flexibly combine as well as separate nodes when faced with supply chain management, presenting a centralized structure in the case of multi-platform and multi-node mergers, giving full play to the advantages of centralization in terms of high efficiency. When there is a lower demand for efficiency, blockchain technology works in the application of supply chain management with multiple nodes separated as usual to give full play to the advantages of decentralization. In this decentralized meta-universe supply chain management model given in this study, each supply chain occupies different

blocks and links up when needed, changing from decentralization to centralization, for example, when supplying specific emergency supplies in large quantities centrally, the need for flexibility as well as traceability etc. diminishes and the demand for efficiency rises sharply, more often than not efficiency is directly related to life, at which point the meta-universe supply chain management system can quickly decentralize The metaverse supply chain management system can quickly decentralize and cater for demand. On the other hand, it still plays host to the metaverse's standardized decentralized supply chain management mechanism, which is flexible, customizable, transparent and reliable. In summary, when the two are combined, the advantages of blockchain technology are fully exploited. Not only can the deployment of emergency supplies be centralized and efficient, but it can also ensure that supply and demand are transparent and resources are dispatched rationally, ensuring that emergency supplies are used promptly for those who need them [6].

3.2. New mode of metaverse enabling supply chain

The metaverse relies on blockchain technology to achieve decentralization [3] and can carry the supply chain management model well, establishing a mesh of decentralized supply chain features, and developing flexible node connection, sharing and interchange in the supply chain under the premise of ensuring transparency. Considering that the diversity and flexibility of the metaverse are born from its reproduction and flexible modification of real-world materials and that it has mature applications in game development, art collection, cultural tourism, etc., the supply chain in the metaverse is highly feasible to build, and can be linked with existing industries to realize the new model of "art collection + supply chain. The new model of "art collection + supply chain" allows for the supply chain management of the art collection in the metaverse, improving its market flow mechanism and strengthening its supervision. All parties in the supply chain can log on to the metaverse from all over the world to achieve a real-time multi-point joint response, achieving a true mesh of real-time interconnection.

3.3. The supply chain management revolution brought about by blockchain technology in the metauniverse

Traditional supply chain management is characterized by obstructed upstream and downstream information transmission and a high risk of information tampering. For example, companies as large as Walmart are unable to coordinate and integrate logistics, capital flow and information flow effectively enough. To solve these problems, most companies choose to use centralized supply chain management platforms.

However, there are problems with such management platforms: a high degree of dependence on the central enterprise, and the security and completeness of the platform depend greatly on the central enterprise's own supervision of information and the level of construction of the platform [1]. The meta-universe itself, as a worldwide blockchain-supported platform, provides an efficient and flexible opportunity for supply chain management, which increases the security of supply chain management and guarantees the transparency of the supply chain.

4. Metaverse Blockchain's unique impact on supply chain managemen

4.1. The need for supply chain transparency brought about by the meta-universe blockchain

The blockchain system built by the metaverse is arguably the most comprehensive and integrated blockchain system in all of humanity. A decentralized block-chain system alone is not capable of building a networked, worldwide supply chain model, so a networked, decentralized supply chain model with flexible node changes can and will only be built and refined in the metaverse. The infinite possibilities and diversity of the metaverse make it no longer limited to one or a few specific age groups or restricted groups of users, as users of the metaverse, ranging from newborn children to the dying elderly, and even primates and dogs and cats can become part of the metaverse through brain-computer interfaces in the future, taking on a small but connected share of computing power. The

future of the meta-universe will be a brain-computer interface, taking on a small but connected share of computing power.

If we mention the advantages of the blockchain alone, especially for products directly related to human health, such as food and drug, the need for transparent management cannot be ignored. Transparency in the supply chain is mainly reflected in traceability and its multi-level visibility[1]. Blockchain technology is needed for the traceability of pharmaceutical products and the official certification of generic drugs.

For cross-border food sales, there is a serious problem of unequal information and opaque prices. Due to the damage caused by counterfeit drugs to patients' bodies, more than 100,000 people lose their lives every year as a result, causing a loss of more than US$18 billion to pharmaceutical companies, seriously discouraging pharmaceutical companies from developing new drugs, and a huge degree of a blow to the whole pharmaceutical industry [7]. For the issue of transparency, the blockchain traceability function exists in Tmall International, which has largely avoided problems such as counterfeit goods, but there is a possibility that its order page does not match the traceability information, and there will be a situation where the product bought is genuine but not of the intended origin, and the regulation, as well as the consistency of information, still needs to be improved.

When this blockchain is put into the meta-universe environment, the purchaser can skip the intermediate nodes, just like on a piece of paper with two points A and B, there are countless small points between these two points, and the normal supply chain link must be advanced from A by the line segment AB, the purchaser skips the intermediate nodes mean that the white paper is folded along the mid-pipeline of AB, so that point A is directly connected with point B, and the consumer directly takes the initiative to trace the source, instead of not through a chain-shaped supply chain in which multiple levels of progressive traceability are involved.

Data from a study in April 2019 showed that in an epidemic-form environment, security is the primary criterion for customers when choosing a fresh food e-commerce provider [8]. Blockchain technology makes the nodes transparent and unchangeable, so merchants will consider the quality of their goods more than the price factor when selling. In terms of security considerations, consumers prefer to trust the results of their traceability rather than the traceability information provided by the end platform. Such a traceability process increases user interaction, reduces the potential cost of traceability for merchants in the region, avoids tampering and loss of information on the way to traceability, increases security and ensures that costs at each point of sale are on the decline.

4.2. A safe, intelligent and ecological supply chain brought about by the meta-universe

Blockchain technology in the meta-universe takes advantage of flexible nodes to self-organize production, reflecting the characteristics of batch customization and avoiding the traditional supply chain challenges of under or over-capacity. At the same time, in the mesh meta-universe supply chain, the user terminal can see the price to be paid for all available options and build a customized supply chain model in comparison to their own needs (as shown in Figure 1). For user A, who is an office worker and carries a paper cup of medium-roasted coffee bean powder to brew daily, demand is for American-style coffee, and he prefers Guatemalan coffee beans.

In this case, User A contacted the manufacturer of the paper cups, ordered 300 custom-made paper cups and connected them to the coffee maker. Next, User A contacted the coffee maker and asked for the number of coffee beans needed for 300 cups of brewed coffee and ordered a quantitative amount of medium-roasted Guatemalan coffee beans from the coffee bean producer to be sent to the coffee maker, who would grind the coffee beans into The coffee beans are then packed into 300 small sachets and packed into customized paper cups, which are then packaged and sent to user A's home, reflecting the advantages of individual batching and the distribution of orders in a network. The linking of the various producer elements can be either the consumer or the targeted platform built in the meta-universe. Intelligent and secure supply chain management is also reflected in the automation of transactions and the advantage that information is available throughout. The paperlessness and efficiency of the entire process make the supply chain environmentally friendly [1].

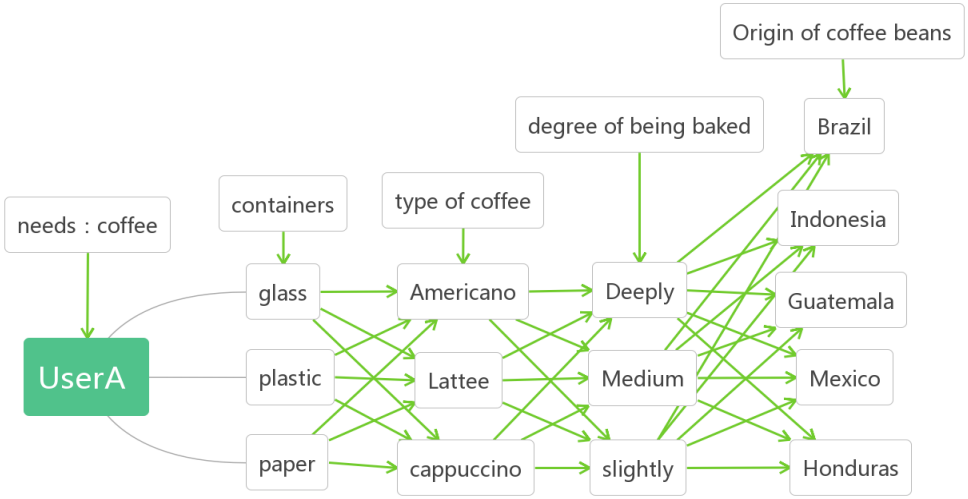


Figure 1. User A is doing mass customization for coffee

5. Application challenges in the metavers

The decentralized distributed storage architecture of the metaverse relying on blockchain technology is only technically transparent and secure. In the real world, this structure will lead to greater centralization and data monopoly [1]. For the supply chain, this monopoly means that although all nodes are open and transparent, the object of openness and transparency is disputed, i. e. the key authority will be centrally controlled, forming a data fault. In this case, supply chain transparency will easily lead to "so-called transparency" in the form of corruption, i. e. the information which can be seen is false, or even the transparent information is fabricated and modified before being typed into a database. This is the challenge that supply chains can face in a meta-universe environment: the corruption that results from the absolute centralization of power due to uncompromising surveillance. In addition, the physically uncomfortable feeling and potential political issues related to the virtual territory should also be taken into consideration [9].

6. Conclusion

This study finds many advantages that supply chain management can play under the carrier of the metaverse, proposes a new mesh supply chain model using the metaverse as a medium, analyses the current situation of the existing blockchain-technology-assisted supply chain management model proposes remedial solutions with the relevant advantageous features of the metaverse, and carries out relevant changes in supply chain management, illustrates the rationality of this model through the case of coffee customization. The limitations of this paper are the identification of metaverse development as a necessary trend for the future, and that the purpose of digital capital development is not taken into account. Some studies have suggested that the real purpose of decentralizing digital capital in a metaverse is to achieve a centralized monopoly, and although the number of people holding this view is not yet significant, it is a reasonable and worthwhile view to examine and add to this study. It also shows an inevitable trend and warns of its potential pitfalls in the future, providing guidance for the future supply chain models built in the metaverse and helping to build a global and efficient supply chain system.

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