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Research on agricultural supply chain system with double chain architecture based on blockchain technology

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Abstract: As an underlying support technology, blockchain is a shared ledger system and a computational paradigm, which is decentralized, and it is highly compatible with the distributed economic system. The distributed scheduling model of agricultural business resources based on the public service platform is a comprehensive solution to the current situation of agricultural industry which is "scattered, small, disorderly and weak", and plays an important role in integrating decentralized resource and making on-demand scheduling. Aiming at some key problems in the current Chinese public service platform, this paper proposes a public blockchain of agricultural supply chain system based on double chain architecture, mainly studying the dual chain structure and its storage mode, resource rent-seeking and matching mechanism and consensus algorithm. The results show that the chain of agricultural supply chain based on double chain structure can take into account the openness and security of transaction information and the privacy of enterprise information, can self-adaptively complete rent-seeking and matching of resources, and greatly enhance the credibility of the public service platform and the overall efficiency of the system.

Keywords: public blockchain, consensus mechanism, agricultural supply chain system, double chain architecture

1. Introduction

Agricultural supply chain is a complex system which responsible for the circulation of agricultural products in the market. As the carrier of the circulation of agricultural products, agricultural commercial resources are important guarantee to meet the demand of agricultural products and to maintain their quality and safety. At present, there are more than 230,000 agricultural business enterprises in China, most of which are small and medium-sized enterprises. Agricultural commercial resources could be characterized as dispersion significantly. Driven by interests, agricultural business resources have high coverage rates in developed regions, and the resource investment is obviously surplus. However, the coverage rate in remote and underdeveloped regions is extremely low, and agricultural business enterprises can hardly spontaneously meet the demands for agricultural products in remote and underdeveloped regions, showing extrusive social contradictions.

With the rapid development of computer technology and distributed computing, public service platform with the targets of “centralized management of decentralized resources and decentralized service of centralized resources” has become the key to solve the contradiction between the demand and supply of agricultural business resources. Public service platform is a non-profit network system based on the third party, which can directly provide high quality and cheap standardization service to the resource demand side in the point-to-point form through virtual aggregation and scheduling of decentralized agricultural business resources. The general process is: Firstly, the supply and demand parties of agricultural business resources provide their information to the public service platform, including ID, resource demand and supply quantity, resource types and rent-seeking conditions. Secondly, the public service platform implements virtual integration of various decentralized agricultural business resources through various cloud-based technologies **[1-2]**, encapsulates these resources **[3]**, and forms standardized service **[4]** to realize the “centralized management of decentralized resources” **[3]**. Thirdly, the public service platform implements dynamic rent-seeking and matching to the demand and supply of agricultural business resources, **[6]** and realizes the “decentralized service of centralized resources” **[5]**. The public service platform is open to both supply and demand parties in the whole process of resource allocation, and can also provide “user-centered” push public service **[7]**, which substantially reduces complexity of specific resource management for the resource supply and demand parties, and provides a wide, personalized and regular resource use environment for both parties **[8]**. Obviously, the public service platform breaks the tight coupling relationship between soft management and hard resources in practice, removes the subordinate relationship between resources and their owners, standardizes the contents and price of resource services, changes the single service mapping relationship between the supply and demand sides in the traditional resource management mode, and coordinates the operation of resources at all levels and links. To sum up, it is a comprehensive solution that can optimize the allocation of decentralized resources at the macro level **[9-11]**.

Although the above literature has thoroughly studied on the public service platform and its scheduling model, there are still some key issues to be resolved.

(1) Adaptive Rent-seeking and matching between resources supply and demand sides

The public service platform is a distributed system. The supply and demand of the public service platform are decentralized and scheduled according to the characteristics of agricultural business resources such as dispersity, magnanimity, randomness, commonweal and heterogeneity. At present, the public service platform has not established the adaptive rent-seeking and matching mechanism of resources, and the utilization ratio of