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Research on the Application of Consortium Blockchain in Electronic Barter Trade

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Abstract: Electronic barter trade has achieved transaction upgrading through the Internet, but it confronted with problems such as lack of trust, opaque processes, and difficulty in value matching, which restrict its large-scale development. Consortium blockchain, featuring both decentralization and controllability, has characteristics including immutability, traceability, and smart contracts. These attributes are highly compatible with electronic barter trade in terms of trust building, process optimization, and value circulation, providing ideas for the industry to break through. Focusing on barter as the core, this paper elaborates on the operation mechanism of electronic barter trade based on consortium blockchain, Taking barter credits as the value medium, it undertakes the functions of value measurement, transaction settlement, and asset certificate. Through the full-process automated operations of issuance, circulation, redemption, and cash withdrawal, standardized transactions are realized. Meanwhile, safeguard measures for the application of consortium blockchain are proposed from three aspects: constructing a multi-party collaborative governance system, strengthening technical security guarantees, and improving industry standards and policy support. The aim is to promote the standardized and large-scale development of electronic barter trade and inject vitality into high-quality economic development.

Keywords: Consortium blockchain; Electronic barter trade; Barter credits

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1. Introduction

With the global development of barter trade and the increasing diversification of global trade forms, this ancient trade method continues to show new vitality through the transformation of global trade forms and presents new changes under the economic conditions of the new era [1]. Compared with conventional trade, barter trade reduces the monetization process, has lower transaction costs, less inventory occupation and can save cash flow. Meanwhile, relying on Internet technology, electronic barter trade breaks the temporal and spatial limitations of traditional barter trade, realizing the expansion of transaction scope and the improvement of transaction efficiency. It has become an important choice for enterprises to reduce product inventory, lower

sales costs, optimize resource allocation, ease financial pressure, and expand market channels [2]. Designed with decentralization as the main principle, consortium blockchain is a mechanism and technology developed on the basis of blockchain, organized and jointly managed by a group of members through various strategies, combining the immutability and traceability of blockchain with other organizational forms [3]. Compared with public blockchain, it effectively controls the deployment and application scope of blockchain. While ensuring the credibility of data and transactions, it can significantly improve transaction efficiency, meet high concurrency needs, effectively protect commercial secrets and sensitive information, unify transaction standards, and enhance collaboration efficiency [4]. Therefore, consortium blockchain can be used as a platform for trade transactions between organizations to integrate resources, effectively solve the traditional problem of data silos, and form consensus [5].

2. Compatibility analysis between consortium blockchain and electronic barter trade

In terms of trust building, the advantages of traceability and immutability of consortium blockchain can serve as a natural trust foundation for electronic barter trade [6]. In a consortium blockchain, once a transaction is recorded on the chain, the entire transaction process is documented and cannot be tampered with. Consortium blockchain adopts a distributed trust system. All parties involved in electronic barter trade on the consortium blockchain, including barter merchants and regulatory authorities, act as nodes to participate in information verification and storage, thereby mutually confirming transactions. No single node can modify information independently, avoiding transactions relying on the credit endorsement of a single institution and largely making up for the lack of trust. By verifying the entities joining the consortium blockchain, the member identity system of consortium blockchain only allows qualified entities such as barter merchants and regulatory authorities to join the chain, thereby maximizing the credibility of transaction entities and enhancing transaction trust [7].

In terms of process optimization, the information transparency and program automation of consortium blockchain can better improve the efficiency of electronic barter trade. Consortium blockchain can store the entire process information of electronic barter trade, such as commodity registration information, commodity valuation information, value negotiation information, and performance settlement information, on the chain. All members of the consortium blockchain can view corresponding information on the chain according to their permissions, realizing the transparency of transaction information and reducing disputes caused by information asymmetry during transactions. Meanwhile, consortium blockchain has programmatic automatic execution capabilities, and the smart contract technology in it can complete the automatic execution of transaction agreements. In electronic barter trade, both parties to the transaction can write transaction commodity requirements, delivery periods, payment methods, etc., into the smart contract program. The contract is automatically executed when the conditions are met, without manual participation, reducing delays and errors in manual operations, and shortening the transaction cycle and costs [8].

In terms of value circulation, consortium blockchain can establish a unified value scale and circulation system for electronic barter trade. Issuing a unified value medium based on consortium blockchain can overcome the dilemma of unmatched values between different commodities in barter transactions and provide a universal value scale for electronic barter trade. The value medium can be linked to commodity values and circulate between entities and scenarios through the consortium blockchain, overcoming the constraints of “point-to-point” transactions, realizing flexible “multi-to-many” transactions, greatly improving the

convenience and speed of commodity exchange, and further supporting the scale expansion of electronic barter trade [9].

3. Core operation mechanism of electronic barter trade based on consortium blockchain: With barter credits as the core

3.1. Positioning and functions of barter credits

In terms of the value measurement function, barter credits provide a unified value scale for different types of barter commodities. Barter merchants participating in electronic barter trade built on the consortium blockchain can convert various held barter commodities into barter credits through a value evaluation process recognized by the consortium blockchain. Even hard-to-convert physical commodities such as raw materials and production equipment, or intangible service commodities such as technical support and logistics services, can be converted into barter commodities for agreed exchange transactions. This effectively solves the problem that different trade targets in traditional barter trade are difficult to measure through a value scale and commodities are hard to match for transactions, and improving the matching rate of transaction matching [10].

Barter trade conducts transaction settlement relying on the smart contracts of the consortium blockchain. Once both parties to the barter reach a barter intention, they only need to transfer barter credits through the consortium blockchain according to the agreed transaction amount. The smart contract will conduct real-time verification of the transfer information and complete the transfer of barter credits when the performance conditions of both parties to the barter are met, with immediate and safe transaction settlement. Transactions is not conducted through a third-party payment institutions, and there is no issue of cash settlement. enhancing transaction settlement efficiency.

As an asset certificate, barter credits can be directly exchanged for the value of products that barter merchants can exchange within the consortium blockchain system. Each circulation of barter credits is recorded on the consortium blockchain and cannot be tampered with. Barter merchants can check the quantity and circulation records of barter credits through the consortium blockchain at any time, and control their own barter asset status. Due to the immutability of the consortium blockchain, barter credit transactions based on it can improve the credibility of the transaction platform and ensure the property safety of barter merchants.

3.2. Full-process operation logic of electronic barter

The execution process of electronic barter mainly includes four stages: issuance (collateral collection), transaction circulation, repurchase and redemption, and cash withdrawal. All execution processes are regulated and automatically executed through the smart contracts of the consortium blockchain [11].

In the issuance stage, barter merchants apply for barter credits using collateralized commodities. Barter merchants first applies for barter credits with collateralized commodities to the consortium blockchain, and submits collateralized commodity information (name, specifications, quantity, quality certificate, etc.) to the chain [12]. The regulatory nodes and professional valuation nodes in the consortium blockchain complete the verification of collateralized commodity information and the valuation of commodity value. If the commodity meets the barter conditions and the value valuation is reasonable, the smart contract automatically completes the issuance of barter credits, issues a specified amount of barter credits to the barter merchant's consortium blockchain account according to the valuation value, and stores the commodity information and collateral records on the consortium blockchain to complete the association and binding between commodities with barter [13].

The circulation process of barter credits is the source of barter value generation. If barter merchants have transaction intentions, they sign electronic transaction contracts through the barter trading platform on the consortium blockchain. The barter transaction agreement is simultaneously written into the smart contract, including the type and quantity of transaction commodities, barter transaction amount, delivery method, etc. After verification, both parties to the transaction initiate transaction requests on the consortium blockchain. The smart contract verifies the barter amount and performance capacity of both parties' accounts. After confirming the transaction agreement, it freezes the buyer's barter credits according to the agreed amount in the agreement. After the seller completes commodity delivery and the buyer signs for receipt, the frozen barter credits are transferred to the seller, completing the circulation of barter credits. The entire process information such as transaction flow, transaction agreement, barter circulation, transaction receipt, transaction freezing, and transaction compensation will be recorded in real-time on the chain, forming a transaction traceability system [14].

The redemption process provides barter merchants with a path to convert barter credits into physical commodities. When a barter merchant wishes to exchange the held barter credits for commodities, they can initiate a redemption application on the consortium blockchain platform, specifying the type and specifications of the desired redemption commodities. The consortium blockchain matches the corresponding commodities through smart contracts and generates a redemption plan for the applicant's confirmation. After the applicant confirms the redemption plan, the smart contract automatically deducts the corresponding amount of barter credits from their account and removes the corresponding commodities, completing the redemption process, and the relevant redemption records are stored on the chain [15].

Cash withdrawal provides barter with the opportunity to exchange for cash, enriching the liquidity of barter. If a barter merchant needs to withdraw cash, they can submit a barter cash withdrawal request on the consortium blockchain and exchange part or all of the barter for cash in accordance with the proportion and steps formulated by the consortium blockchain. The regulatory authority of the consortium blockchain reviews the cash withdrawal request. After verifying the legitimacy of identity and origin of the barter source, the smart contract automatically calculates the cash amount that can be withdrawn and notifies the designated clearing institution to complete the cash transfer. When the cash withdrawal is completed, the corresponding barter credits are destroyed, and the cash withdrawal information is recorded on the chain to maintain the transparency and traceability of capital flow.

4. Safeguard measures for the application of consortium blockchain in electronic barter trade

4.1. Construct a multi-party collaborative consortium governance system

Consortium governance is crucial for the operation of electronic barter trade based on consortium blockchain. The main participants in consortium governance include barter merchants, regulatory organizations, and technology providers. Barter merchants are important subjects of the consortium. They must comply with the transaction order and rules of the consortium blockchain, truthfully register commodity information, complete transaction performance, and participate in the revision of rules within the consortium blockchain and decisions related to the interests of the consortium blockchain. Regulatory organizations supervise transactions, commodity quality, barter issuance, and circulation within the consortium blockchain to avoid false transactions and illegal acts, ensuring the orderly development of the electronic barter trade market. Technology providers

are responsible for the relevant technologies, system maintenance, and information security of the consortium blockchain, ensuring the stable operation of the consortium blockchain and providing technical support for electronic barter trade. By establishing a consortium blockchain governance committee, the rights and responsibilities of relevant subjects can be clarified, forming a social governance model. The governance committee is composed of representatives from all members of the consortium blockchain. Its functions include holding regular governance meetings of the consortium blockchain, solving relevant problems in the operation of the consortium blockchain, optimizing and adjusting transaction rules and barter management mechanisms. Through a multi-party collaborative governance mechanism, it is ensured that electronic barter trade based on consortium blockchain meets the interests of all parties and can achieve effective and sustainable development [16].

4.2. Strengthen technical security guarantees of consortium blockchain

At the data security level, encrypt the storage and transmission of transaction data, commodity data, and other data content in the consortium blockchain to ensure data confidentiality; use data backup and disaster recovery to ensure timely recovery of data in case of accidents such as hardware and software failures and cyber-attacks, ensuring data availability and integrity.

At the node security level, introduce strict node access systems and node management methods, conduct qualification reviews on nodes joining the consortium, periodically monitor the operating status of nodes, and prevent malicious nodes from attacking and damaging the consortium blockchain; introduce node identity authentication methods to ensure the legality and traceability of node operations and prevent potential security risks caused by illegal operations.

At the smart contract security level, after the development of smart contracts, introduce third-party security audit institutions to conduct security analysis on their source code, inspect and fix logical vulnerabilities and security risks; after the contract is deployed and launched, establish a monitoring mechanism to monitor the execution process of the contract, conduct emergency disposal for abnormal transactions and contract vulnerabilities, and suspend contract execution for repairs once discovered, thereby avoiding asset losses caused by smart contract security issues [17].

4.3. Improve industry standards and policy support

The large-scale application and development of consortium blockchain electronic barter trade require industry standards and policy system guarantees [18]. In terms of industry standards, it is necessary to formulate industry standards for consortium blockchain electronic barter trade, such as commodity valuation standards, barter issuance management standards, barter transaction process specifications, and data interface standards, to promote the standardized development of the industry, reduce the collaboration costs of different participants, and realize the large-scale development of consortium blockchain electronic barter trade. In terms of policy system guarantees, the corresponding departments can formulate relevant policies and systems to actively guide enterprises to participate in the pilot promotion of consortium blockchain electronic barter trade, and provide certain policy support for eligible pilot projects; clarify the legal attributes of consortium blockchain electronic barter trade, define the legal responsibilities of transaction subjects, improve the dispute resolution mechanism, provide a clear legal basis for the large-scale application of consortium blockchain electronic barter trade, and create a good policy, system, and legal environment.

5. Conclusion

Consortium blockchain technology can promote the transformation and upgrading of electronic barter trade. Through consortium blockchain technology, problems such as trust, efficiency, and value docking in electronic barter trade can be solved. Using consortium blockchain technology to establish a barter trade trust system, optimize transaction links in the supply chain, innovate value circulation methods, and promote the standardization, automation, and transparency of the operation mechanism centered on barter credits is conducive to realizing the large-scale development of electronic barter trade.

Disclosure statement

The author declares no conflict of interest.

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