

The Application and Prospects of Blockchain Technology in E-commerce

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Abstract: The development of blockchain technology has brought broader prospects to various sectors of society and has also provided innovative applications for the development of e-commerce. Its characteristics of openness, transparency, and reliability have incalculable impacts on the future society. As e-commerce continues to grow in China, it is currently undergoing a crucial transition phase of new innovative development, which also brings about a series of problems. This paper, from the perspective of blockchain technology, analyzes the reasons for applying blockchain technology to the cross-border e-commerce field, discusses three application modes of "Blockchain + E-commerce," and finally proposes the development direction and recommendations for blockchain technology in the cross-border e-commerce field. It explores how blockchain technology can be better applied and its significance for the development of e-commerce in China.

With the continuous development of the domestic economy and the increasing consumer level of the population, consumer demand for products has also gradually increased. With this social background, the e-commerce market continues to expand, and the application of blockchain technology has extended to various fields related to e-commerce, such as the Internet of Things, supply chain management, and digital asset transactions. With the rapid development of cross-border e-commerce and the continuous growth of online shopping, China's e-commerce is currently in a crucial transition phase of new innovative development. At present, the growth rate of Internet users has slowed down, the full integration of online and offline development has not yet been formed, and problems in the cross-border and rural e-commerce markets have not been resolved. Both opportunities and challenges exist in the industry. To address these issues, one of the best ways is to apply blockchain technology to the e-commerce sector. "Blockchain + E-commerce," based on a blockchain-based shared trust system, where all participants on the blockchain share a trust network, and all records are accessible to anyone. Therefore, research on the application of blockchain technology in cross-border e-commerce is of great practical significance.

1. The Fundamental Concept of Blockchain Technology

From a narrow perspective, blockchain technology is a chain-like data structure that stores data in blocks and links them over time. In terms of encryption, data blocks are secured against

tampering and forgery using asymmetric encryption, ensuring data storage security and internal system validation. It is essentially a decentralized distributed ledger database. In a broader sense, blockchain technology involves distributed nodes generating and updating data through consensus algorithms, encrypting and validating data using asymmetric encryption, storing data in chained blocks with timestamps, and utilizing a distributed computing architecture with contract mechanisms for programming and data operations.

Blockchain technology possesses several key characteristics. Firstly, decentralization: In traditional centralized networks, if one central node is compromised, it can potentially disrupt the entire system. In contrast, decentralized networks utilize distributed records, distributed storage, and peer-to-peer communication, where the rights and obligations of any node are equal, and all data is collectively maintained by all nodes. Therefore, attacks on or failures of any individual node do not affect the overall system. Secondly, traceability: Each data block in a blockchain contains a timestamp, allowing the recording of the transaction time within the data block. This gives blockchain its traceability feature. Thirdly, trustworthiness: Blockchain's asymmetric encryption principles and consensus algorithms enable parties in a transaction to complete data transfer and verification. The robust computational power of distributed nodes can resist external intrusions, making blockchain an immutable database, ensuring data security and trustworthiness. Lastly, programmability: Blockchain data blocks incorporate script code, enabling users to create smart contracts and applications using built-in script code[1].

2. Challenges in the Development of E-commerce

2.1 Problems in the Supply Chain System

E-commerce involves various stakeholders in the transaction process, such as distributors, manufacturers, and users. Currently, e-commerce in China is in its early development stages, and the logistics system has not yet reached maturity. However, there is significant demand for logistics speed and system integrity in the trading process. These challenges pose a serious threat, and the issues in the logistics industry must be addressed to avoid constraining the overall development of national e-commerce. The transparency and immutability features of blockchain align well with the deficiencies in the development of e-commerce blockchain, offering space and possibilities for further improvement.

2.2 Issues in the Payment System

During the development of e-commerce, the payment process is complex, and payment costs remain high, which is a primary obstacle hindering industry growth. Due to limited technological capabilities, e-commerce enterprises have struggled to reduce operating costs, resulting in resource wastage and hindering healthy development. Currently, e-commerce transactions in China require third-party platforms to provide security, temporarily holding funds in escrow until the transaction is completed, and then transferring them to the merchant. As a fee for this service, third-party platforms charge 2% to 3% of the turnover. Although it appears to enhance the fairness of transactions, it also adds pressure to the transactions and does not achieve the desired "directness" in transactions [2].

3. Reasons for Applying Blockchain Technology to the Cross-border E-commerce Sector

3.1 Drawbacks of Centralized E-commerce Transactions

Currently, all internet transactions are based on a centralized system, and e-commerce is the most widely applied and largest user base internet business in China. Major tech giants have emerged from or accelerated their involvement in this industry. However, centralized data is vulnerable to attacks, and the more data there is to process, the slower the processing speed becomes. Additionally, cross-border payments often involve commission fees. Furthermore, the current internet can only transmit information; it cannot transfer value. For example, you can copy and share images and videos with others, but you cannot duplicate money and transfer it to another person.

By applying blockchain technology to cross-border e-commerce, all transactions on the blockchain would be recorded on a ledger accessible to all authorized participants. All individuals on the blockchain collectively reach a consensus of trust. There are no intermediaries in transactions; they are all peer-to-peer. If a ledger is modified, all copies synchronize accordingly. Every transaction record is traceable.

3.2 Ideal Alignment of Blockchain Technology with E-commerce Supply Chain Models

The operational models of blockchain technology and supply chains naturally align, with numerous nodes that interact, using value rather than information as the transfer object, and verification and trust as prerequisites for all actions.

Firstly, the characteristics of immutability and the existence of time proof in blockchain technology can effectively resolve disputes among participating entities in the supply chain system, facilitating easy evidence presentation and accountability. Secondly, the transparency of blockchain technology enhances data security, forming a complete and smooth information flow throughout the entire supply chain. Finally, counterfeit and substandard issues can be eradicated through the immutable and traceable nature of transactions.

3.3 Blockchain E-commerce Can Redefine Token Economics

A key element in blockchain technology is TOKEN, most strictly defined as a token. A token is a fuel that operates on a blockchain, distributed, decentralized, and linked by a trust mechanism. Tokens serve as incentives and are the driving force behind blockchain operations. The existing token economy in the e-commerce sector, such as rewards points, aligns well with the incentive-driven nature of blockchain tokens.

From supplier marketing to user shopping, tokens can be used as incentives and discounts. Tokens circulate among supply chain nodes and platform users, releasing the power of traceability and marketing efficiency. This deep integration of blockchain technology and e-commerce business not only activates the token marketing ecosystem of e-commerce platforms but also ignites a new dimension of token economics. It is conceivable that the combination of blockchain and e-commerce will create the most significant impact in token economics, offering new dynamics, new starting points, and a new ecosystem [3].

4. Advantages of Applying Blockchain Technology to E-commerce Development

4.1 Enhanced Security of Network Data

Blockchain technology is a decentralized means of technology that weakens the focus on a central point, allowing the advantages of encryption technology to be utilized. From this perspective, it greatly enhances security and is widely used by major domestic and international companies in finance and networking, providing effective security assurance for company operations. For instance, in the operation of e-commerce, a considerable amount of customer data is often collected for promotional purposes, product planning, and sales. However, e-commerce companies have not fully prioritized the protection of customer information, leading to frequent incidents of customer data breaches. Therefore, e-commerce companies need to transition to a decentralized system, eliminating the need to store the personal and payment data of millions of users. Consumers can store and control their own data in this decentralized system, eliminating the risk of potential data leaks. Blockchain technology aligns well with these characteristics and can be used for storing critical information, playing a crucial role in network data security and user data authentication.

4.2 Effective Control of Payment Costs

Applying blockchain technology to the payment aspect of e-commerce can reduce the complexity of payment procedures, making transaction processes more streamlined and cost-effective. The decentralized nature ensures that all nodes are entirely equal, and they operate independently but remain interconnected. Therefore, any node could potentially serve as the central point for a region. In this payment system model, customers and merchants can directly connect, bypassing intermediaries. This allows transaction funds to enter the merchant's account directly, avoiding issues such as delayed transactions and effectively reducing payment costs. It's worth noting that the payment system based on blockchain itself charges a 1% transaction fee among nodes, which is based on incentive mechanisms and decreases as the number of transactions increases. There are no other costs involved. Thus, blockchain technology can effectively promote the efficiency and rationality of payment processes in e-commerce.

4.3 Effective Assurance of Product Quality

In the process of e-commerce transactions, customers are most concerned about purchasing counterfeit products. Since transactions do not occur face-to-face, many buyers approach transactions with skepticism, which affects their attitude toward e-commerce and product transactions. The application of blockchain technology can effectively address the issue of counterfeit products in current e-commerce. Blockchain technology possesses strong characteristics of security and immutability that other technologies lack. This ensures the origin of products in e-commerce transactions, allowing people to easily trace the source of goods. Blockchain technology can obtain the most data and abundant resources in the shortest time, facilitating efficient resource integration and rational allocation, thereby creating more economic and social value. By applying blockchain technology in e-commerce, it can be used in various segments of the global supply chain system, allowing each segment to be traceable. For example, Alibaba's Tmall Global applies blockchain technology in its cross-border logistics business. Tmall Global officially states that the blockchain system can provide real-time tracking for all imported goods, offering detailed information on each link and aspect, including origin, transportation methods, customs reports, and third-party verification, among others. Alibaba regards this as an advanced internet technology and clearly acknowledges the value of blockchain technology.

4.4 Traceability and Anti-counterfeiting System

Counterfeit products and fake orders have long been persistent issues in the e-commerce industry. The sale of counterfeit brand-name goods online, the substitution of fake products for genuine ones, the difficulty in combating piracy, and the highly centralized nature of traditional e-commerce models have all led to the development of traceability and anti-counterfeiting technologies. The first field where blockchain technology has been applied is traceability and anti-counterfeiting technology. Through a decentralized mechanism and the use of timestamps in blockchain's distributed ledger system, all information on the chain is publicly transparent and immutable.

Blockchain-based anti-counterfeiting and traceability technology can record all of a merchant's transaction history, enabling end-to-end traceability. For example, in the case of fresh products, it may require the original producers to provide environmental certifications, feed ratios, hardware data collection, and even real-time production broadcasts. These pieces of information are then sealed and stored in the blockchain using certain technical methods. Since this data is distributed across various nodes, and each node is interlinked, modifying information within a single node requires modifying all nodes. The cost of such an operation is prohibitively high, making it unlikely for any business to tamper with blockchain data.

Therefore, the application of traceability systems can prevent issues such as theft and allow the tracking of the product's origin, fulfilling the three-party requirements of manufacturers wishing to ensure product arrival at the destination, retailers and wholesalers wanting to ensure product effectiveness and quality, and consumers hoping for increased transparency from providers.

However, in terms of product traceability, although blockchain's anonymity and immutability can ensure the authenticity of data once it is on the chain, authenticity before the data is put on the chain still requires the involvement of third-party centralized institutions.

4.5 Payment System

The use of blockchain technology can address the shortcomings of traditional cross-border remittances. Traditional wire transfers, while capable of directly reaching the recipient's account, come with high costs. These costs primarily include two components: transaction fees related to the remittance amount and telecommunication fees related to the number of remittances. In addition, during remittances, there are intermediary fees that cannot be predicted.

By applying blockchain technology to cross-border remittances and eliminating the involvement of third-party financial institutions, users can complete cross-border transfers more quickly and at a lower cost. This approach can essentially achieve real-time settlement, similar to local transfers, resulting in savings in terms of cost and time, while ensuring security, transparency, and openness. This contributes to increased efficiency and reduced financial risk.

4.6 Enhancing Transaction Transparency

The diversity and rapid development of e-commerce have brought convenience to people's transactions. However, it has also led to speculation and manipulation in transactions, harming the interests of others. This issue primarily arises from the lack of transparency in the transaction process. Consumers mainly rely on factors such as the seller's credit rating to make judgments when purchasing products, but this information may not always be accurate. As a result, consumers are in a passive position when making choices. However, the application of blockchain technology ensures that all transaction records are presented in a shared distributed ledger, guaranteeing the high security and transparency of information. Consumers can intuitively learn all information about the seller, eliminating the possibility of manipulation. This promotes healthy competition on

e-commerce platforms, increases transaction transparency, and safeguards consumer rights [4].

5. Conclusion

In summary, the application of blockchain technology has played a significant role in the development of e-commerce in China, offering numerous advantages for e-commerce platforms while also safeguarding consumer rights. Many enterprises have already embraced the use of blockchain technology in their operations, aiming to transform e-commerce platforms into fast and secure channels for people to purchase products and services with confidence. It is believed that in the near future, blockchain technology will transform e-commerce platforms into the safest, most reputable, most convenient, and most scalable trading platforms.

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