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Construction of Cross-Border E-Commerce Supply Chain of Agricultural Food Products based on Blockchain Technology

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Abstract

The European Union has for several years been a critical export market and a significant source of imports for us, and the US has, in general, kept closed domestic players vis-à-vis the EU. However, given the variety of alternative market conditions and EU forms, the attractiveness of cross-border electronic commerce (CBEC) between China and the EU has fallen far short, and there is an urgency to create a harmonious and uniform environmental environment for the exchange of information to facilitate the convenience of cross border electronic commerce. This study examines the CBEC of agricultural goods and its cooperative management technique inside the logistical supply chain. It details the complete transaction model and fundamental components and presents a theoretical framework for the CBEC distribution network. The Block Chain can effectively bridge the obstacles to CBEC in Chinese and European countries by providing a valuable source of benefits from decentralization, trust, anti-counterfeiting, consensus, innovative procurement, and extraordinary techniques, which will provide the basis for building an Embedded Provider Platform for Electronic Commerce, Risk Management System for Deposit Risk Management, Supply Chain (SC) Management System, Cross Border Logistic System, Customs Supervisory Computer, etc. The paper examines how blockchain science can assemble CBEC SC computing devices for agricultural goods between global places in Central Europe. Firstly, it expounds on the theory and characteristics of the blockchain. Then, the paper introduces the troubles that arise in the CBEC supply chain. Then, the thesis proposes a blockchain-

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based CBEC SC structure, analyzes the aspects and relations among each other, and provides a framework for developing a China-European blockchain cross-border electronic Commerce. The test findings indicate that the system satisfies the criteria for tracking agricultural items and enhances fresh farm commodities' quality and security.

Keywords:

China, the european union, cross-border e-commerce, blockchain, agriculture.

Article history:

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Introduction

Cross-border e-commerce (CBEC) companies face each manufacturer and consumer, and the intermediate hyperlinks contain logistics, customs, customs declaration, tariffs, accepted agents, distributors, wholesalers, and retailers. The middle links of the enterprise supply chain (SC) are very complicated. To optimize the supply chain, enterprises must continuously reduce inefficient intermediate links to improve sales efficiency (Cross-border, 2020). Enterprises need to always think about where to purchase goods, whether they can ensure that the goods are genuine, who will transport the goods after the purchase, how to ensure the safety of the goods, ensure that the goods will not be exchanged, and where to store the warehouse for storage, how to ensure that they are not wet, and whose logistics are used when shipping (Zheng et al., 2018). How do you ensure that the goods are still in shelf life when they reach the hands of consumers? Other intermediate links are prone to a variety of problems. Therefore, in the furnish chain optimization of CBEC enterprises, interest must be paid to every link, and every hyperlink performs a necessary function in enhancing efficiency (Monrat et al., 2019). The optimization of CBEC grants chain capacity that organizations beef up aid trading, integration, and records sharing with exterior markets, continuously combine interior benefits such as technology, understanding, and information, and eventually set up their core competitiveness, and constantly keep shut relationships with suppliers, sub-suppliers, and clients (Belotti et al., 2019).

The conventional traceability system for agricultural goods supply chains depends on a centrally located server, and information will be irretrievably lost if the server malfunctions. The dissemination of the agricultural goods manufacturing chain is hindered by untimely and cumbersome data exchange, leading to a lag in the updating rate of traceability findings relative to the pace of information inquiries. The conventional agricultural item traceability network must explore innovative technology solutions to address the issues above.

Blockchain is the core technological know-how of the digital cryptocurrency gadget represented by Bitcoin (Wüst & Gervais, 2018). The core gain of blockchain science is decentralization, which can recognize peer-to-peer transactions, coordination, and collaboration based totally on a decentralized credit score in an allotted gadget (Bashir, 2017). The place nodes no longer want to have faith daily through facts encryption, time stamps, dispensed consensus, and financial incentives. It presents an answer to clear up the issues of high cost, low effectiveness, and insecure statistics storage in centralized organizations for agricultural goods (Iansiti & Lakhani, 2017).

This paper examines how blockchain technological know-how can be used to construct a CBEC grant chain device between nations in Central Europe. First, the paper elaborates on the principles and qualities of blockchain technology. Then, the paper introduces modern troubles in the CBEC furnishing chain. Then, the paper designs a blockchain-based CBEC chain architecture and explains the factors and interrelationships of its components, which offers a reference for placing up a blockchain-based CBEC furnish chain between China and Europe.

Related Works

Li et al. aimed to enhance the effectiveness of agricultural goods by integrating theories pertinent to CBEC and developing a novel operational model using a large-scale Internet data system (Wen et al., 2021). They introduced a novel idea of CBEC advertising for agricultural goods and explored a new advertising paradigm for exporting agricultural goods. Owing to the existence of the CBEC setting, there is a risk associated with quality requirements across many nations. Song et al. employed a text mining technique and fuzzy rule inferred risk evaluation approach to enhance the product exporting rate and mitigate the associated risks (Mu, 2022).

Initially, fuzzy risk criteria are established to identify the attributes associated with CBEC for commodity exports and to classify the products. The products are assessed, and their export risk is analyzed using the fuzzy risk evaluation approach. The risk likelihood and repercussions of the commodity-exporting CBEC are evaluated based on previous risk variables associated with the commodity (Wang et al., 2021).

A semantic web-based monitoring technique is presented for the CBEC selling method of commodities-exporting to monitor logistics at the target post-export and to establish a commodity security and quality monitoring network by integrating the tracking method with semantic route design (Sun & Gu, 2021). A CBEC traceability paradigm is suggested to be built on the semantics of the web tracking method, and its performance is evaluated through simulated tests. The results from the study indicate that the inter-node route hops are singular, the method for tracking efficiently identifies the items' origin, and the system's latency range of [0, 0.05] satisfies real-time requirements.

Blockchain Technology Overview

Overview of Bitcoin and Blockchain

Table 1 illustrates the evolution of blockchain technology (Yli-Huumo et al., 2016). The inaugural block of the Bitcoin blockchain, referred to as the Genesis block, was created on January 4, 2009, by its inventor, Satoshi Nakamoto. One week later, Satoshi Nakamoto transmitted ten bitcoins to Halfney, a cryptography specialist, constituting the inaugural transaction in Bitcoin history. In 2010, a programmer in Florida exchanged 10,000 BTC for a $25 pizza voucher, marking the inception of the first legitimate transaction fee for Bitcoin. Since that time, the value of Bitcoin has surged dramatically, to a peak of $1,242 per bitcoin in November 2013, above the price of gold at $1,241.98 per ounce during the same timeframe. CoinDesk estimates indicate that over 60,000 businesses globally accept Bitcoin transactions, with China emerging as the fastest-growing market for such purchases. Blockchain science has solved two vital troubles that the Bitcoin device has long faced in digital cryptocurrencies: the double price and widespread Byzantine hassle (Xu et al., 2019).

Table 1. The development of blockchain

time	Key events
2008	**White Paper Release
2009	**Online launch
2014	Ethereum White Paper Release
2015	Ethereum's leading network launched
2017	Exploration and application acceleration of blockchain technology in the enterprise field
2019	Global institutions are beginning to pay attention to and explore blockchain applications
2020	The Rise of Central Bank Digital Currency (CBDC)
2021	The nontrading NFT (nonfungible token) market is thriving
2022	Breakthroughs in Cross-Chain Technology
2023	The rapid development of decentralized finance (DeFi)
next	Technological breakthroughs in privacy protection and scalability

With its first-mover advantage, Bitcoin has now dominated a whole ecosystem and corporate chain, including issuing, circulating, and money derivatives markets (as demonstrated by Figure 1), and this is the main reason that it has held most of the market share for an extended period. The open-source nature of Bitcoin has attracted many developers who generally contribute their existing technologies and mechanisms (Gorkhali et al., 2020). Each Bitcoin nearby node (miner) provides computational power to ensure that Bitcoin is compatible and secure for agricultural goods. In contrast, the majority of its computational power is generated through the capability of the Working of Device Manufacturers (PWPs) (Abadi & Brunnermeier, 2018). The Bitcoin Quarter pays the miners the incentive to release a small number of bitcoins per discovery, and miners can work together to create revenue-sharing mining pools so that they can pool their computational energy to increase their chances of getting Bitcoin. After the issuance and release of Bitcoin, the owner can pay Bitcoins for purchases of devices or options via a specific software application (e.g., Bitcoin Wallet) that displays the financial properties of Bitcoin. Simultaneously, because of the upsides and downs of Bitcoins, it has all the features of currency derivatives, thus creating a trading platform for Bitcoin that allows foreigners to invest or invest in Bitcoin (Efanov & Roschin, 2018). Inside circulation and in currency markets, every Bitcoin transaction is confirmed and credited to the blockchain using all miners in the Bitcoin community.

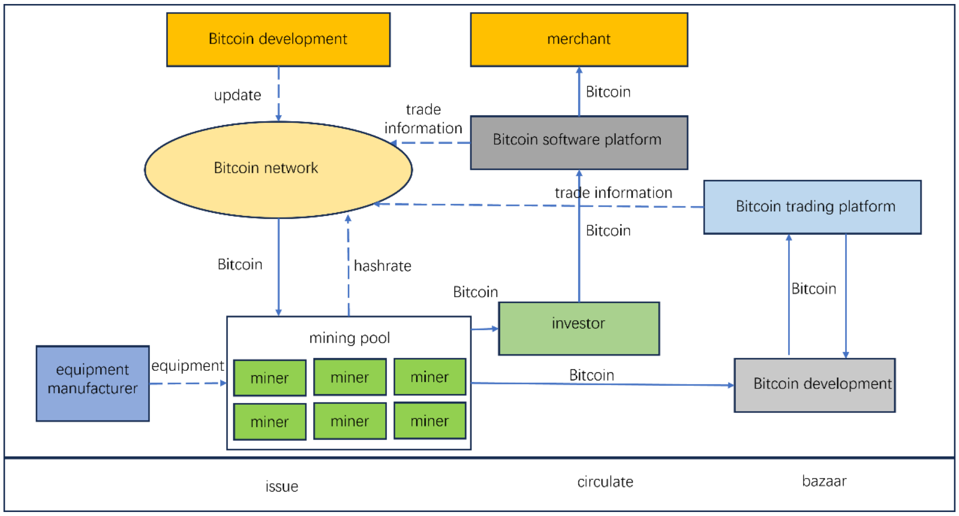

Figure 1. Bitcoin Ecosystem

The Basic Model and Critical Technology of Blockchain

The infrastructure model of the blockchain is shown in Figure 2. Generally, a blockchain facility comprises a truth level, a community level, a client level, an incentive level, a contractual level, and a soft wave relayer. The facts layer encapsulates the underlying facts block and associated information encryption and time stamp technology. The community layer comprises a networking mechanism, a facts propagation mechanism, and an information verification mechanism (Ammous, 2016). The consensus layer then encapsulates a range of consensus algorithms of community nodes. The initiator incorporates currency components in the technology evaluation system of the blockchain, usually in conjunction with an issue mechanism and an economic stimulus allocation mechanism; the contractual layer often encapsulates all types of scenarios, algorithms, and reasonable agreements that form the basis for the programmability of the blockchain for agricultural goods. The most critical innovative elements in blockchain technology are time-stamped chain-block architecture, (Zheng et al., 2017) the agreement between distributed nodes, a currency stimulus based primarily on consensus computation of electric power, and a flexible and programmable good agreement (Chen et al., 2019).

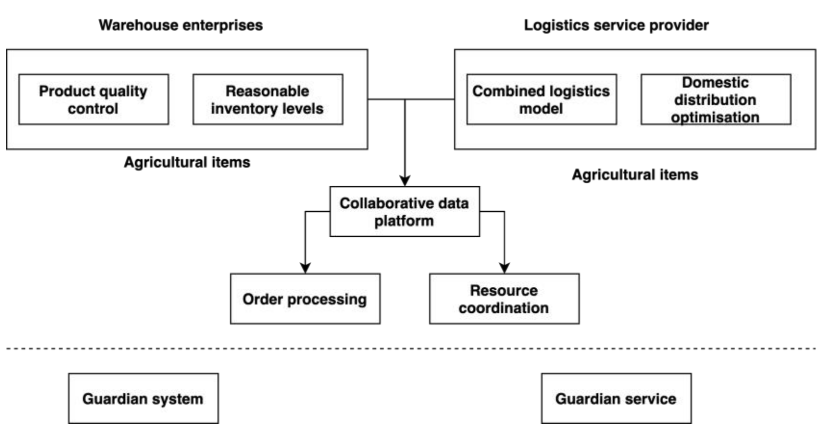

Figure 2. Agricultural-based CBEC management model

The hierarchy of significance among the contributing variables in CBEC collaboration oversight for agricultural supplies is as follows: data collaborative capability, logistics collaboration capability, and partnerships. The recommended implementation approach is provided in conjunction with the current challenges and issues of collaborative leadership in the CBEC distribution network for agricultural goods. Figure 3 depicts the theoretical structure of collaborative leadership inside the CBEC distribution network of farming supplies.

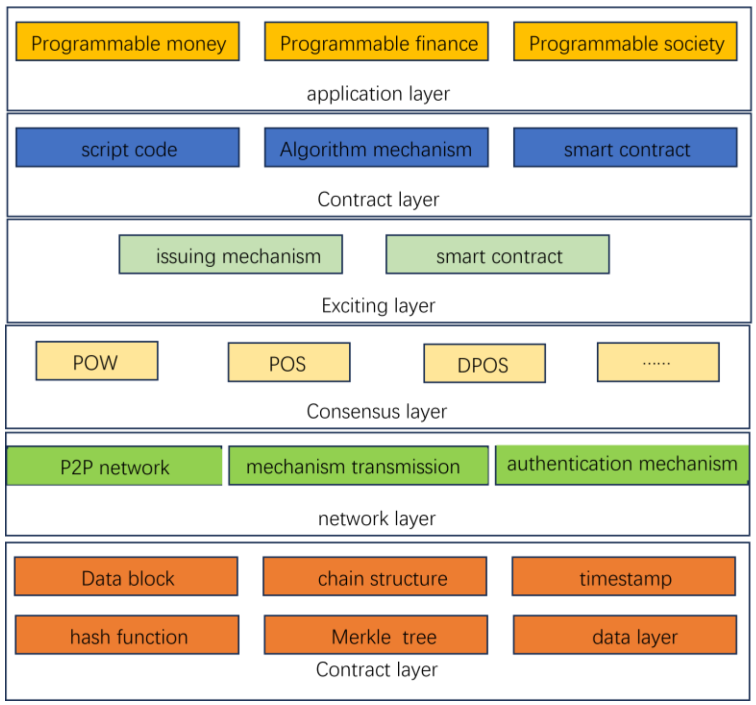

Figure 3. Blockchain infrastructure model

Data Layer

In a strict sense, blockchain is an open record disseminated via the capabilities of nodes inside a SC. Every distributed node can utilize a specialized hash method and Merkle tree data structure to store transaction details and code acquired over an eternity into a time-stamped data block, linking it to the present longest essential blockchain to identify the present-day block. This methodology encompasses blockchain technology, hashing, Merkle Trees, and timestamps. Data Segment: Figure 4 illustrates how every statistical block is generally comprised of two elements: the block header and the block content. The block heading encapsulates information like the Version Big Change (Version), Dynamic Hash Value (Bits) of the current Block Address, Random Range (Nonce) of a Modern Block Protocol, Merkle root, and Timestamp (Lu, 2019) Chain structure: The person who obtains accounting rights adds the contemporary block to the preceding block, forming the today's block name chain. Every block is interconnected so that it creates the most significant chain between the Genesis block and the cutting edge, which in turn registers the entire block's data records, provides traceability and location functions for the blockchain data, and makes it possible to track and track all the records through this chain for agricultural goods. Time Stamp: The blockchain technology requires a node with an appropriate current account to stamp a timestamp on a current log block heading, showing when it was previously written (Nofer et al., 2017).

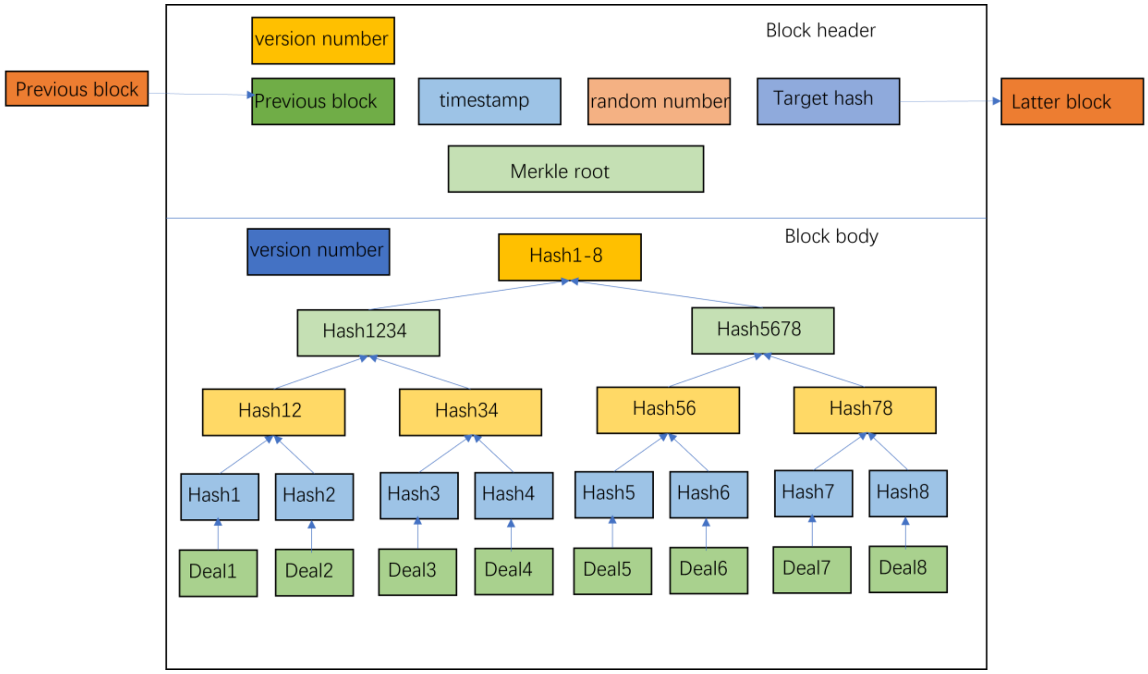

Figure 4. Block Structure

Network Layer

The neighborhood layer is used to encapsulate the critical components of the blockchain, including the network operation pattern, the message transmission agreement, and the information verification mechanism. In combination with the actual needs of the software program, through the construction of accurate transmission protocols and validation mechanisms, each node in the blockchain participates in a stage in the validation and billing process of the block data. If the block information has been validated through the majority of the nodes of the complex system, it is registered in the blockchain (Koens & Poll, 2018). Web Model: Because the nodes of a block are generally distributed, self-organized, open-access, and free-access, Peer Peer-To-Peer Network (P2P) is frequently used to connect nodes that perform tasks such as authentication and accounting around the globe. Each node in a P2P neighborhood is peer and associated and interacts with every one of a kind in a flat topology structure for agricultural goods. There is no centralized one-form node or hierarchy structure, and every node is responsible for the neighborhood routing, the verification of the block data, the expansion of the block data, the discovery of the new node, and the extraordinary function. Data Transmission Protocol: Once a block has been created, it will be sent to all the exclusive nodes in the neighborhood for verification via the node that generated the truth. Based on Nakamoto's design, the transaction statistic propagation protocol of the Bitcoin gadget consists of the following steps (Zhang et al., 2019): See Table 2.

Table 2. Transaction Data Propagation Protocol Steps of the Bitcoin System

step	describe
Step 1	The initiator of the transaction creates and signs the transaction, broadcasting it to nodes in the network.
Step 2	After receiving the transaction, the node verifies it, including verifying the validity of the transaction and the identity of the initiator.
Step 3	Verified transactions are included in the pending transaction pool (mempool) by the node.
Step 4	Miner nodes in the network select some transactions from the pending transaction pool to form a new block.
Step 5	The miner node starts calculating Proof of Work for the new block
Step 6	Other nodes verify the validity of the new block after receiving it, ensuring its validity.
Step 7	The verified block is added to the tail of the blockchain, becoming the latest block.
Step 8	Nodes in the network broadcast the latest blocks to other nodes for full network synchronization.

Consensus Layer

Early Bitcoin blockchains utilized Token of Work (POW), which heavily depended on a vacuum to ensure that the Bitcoin account was consistent. As technology advances in blockchain technology and the appearance of more than a handful of competitive coins, researchers have proposed various mechanisms that no longer count number quantity when calculating electricity. They can attain consensus, such as the Proof of Peace for agricultural goods through Peercoin. POSS Consensus (Zhang et al., 2019) and Delegation Evidence of Bets (DPOS) were pioneered by Bitcoin (Zeng et al., 2020). The blockchain consensus layer encapsulates these consensus mechanisms. POINT CONSENSUS: In his Bitcoin Foundation document, Satoshi Nakamoto proposed the POW Consensus Mechanism, the main challenge of achieving a positive balance of data and consensus by introducing paid nodes' computational power. Generally speaking, the method of finding a random volume for a PoW consensus is as follows (see Figure 5 for a block shape), as proven in Table 3.

Table 3. Random Number Search Process of PoW Consensus

Steps	content
Step 1	Gather non-confirmed transactions from an entire neighborhood at a certain date, and then add a Coin Base transaction to create a Bitcoins Bonus to form a Modern Block Entity Transaction Pool.
Step 2	Compute the Merkle Root of a Block Physical Transaction Set, report it in Block Head, and add only Block Head Metadata, where Random Variation Nonce will be set to 0.
Step 3	Add 1 to Nonce Random-Area; Compute the SHA256 Hashed Hashed for the day. If this is significantly lower than the intended hash, then efficiently find an appropriate random range and extract the counting privileges of the block. Otherwise, continue in Step 3 until each node finds a perfect random number;
Step 4	If this fails, modify the time stamp and unvalidated transaction set, recalculate Merkle's root, and continue.

Exciting Layer

The blockchain consensus approach realizes the file verification and bookkeeping of the shared blockchain ledger with the resource of aggregating the computing energy properties of large-scale consensus nodes, so it is a challenge to the crowdsourcing approach amongst consensus nodes. Consensus nodes in distributed structures have self-interest, and their involvement in recording and accounting primarily aims to maximize their benefits. Therefore, it is necessary to design an actual searching crowdsourcing mechanism that is nicely suitable with incentives so that the persona rational habits of consensus nodes to maximize their blessings are consistent with the common reason of making the security and effectiveness of decentralized blockchain systems positive for agricultural goods. By designing exceptional economic stimulus and incorporating it into a consensual process, the Block Chain Mechanism brings together large nodes to make an unbreakable agreement about the block's data (Gao et al., 2018).

Contract Layer

The contract layer encapsulates the complex, wide variety of script codes, algorithms, and bigger, complex, intelligent contracts created through the operation of the blockchain. Where the three levels of data, local and agreement, the primary "virtual machines" in the blockchain, perform the tasks of representing records, disseminating records, and verifying documents, the contractual level is a daily run and algorithm built on a block-based digital computer. It provides a basis for implementing flexible programming and operational archives in a blockchain. Digital cryptography, comprising Bitcoins, typically uses a generic script for a software program and handles a transaction procedure, which is a prototype for smart contracts. Thanks to technological advances, Turing-complex languages like Ethereum can now apply accelerated and flexible smart contracts, allowing the blockchain to take on many aspects of macro and social structures (Zheng et al., 2017).

Current Situation and Challenges of CBEC SC

The Operation Mode of Domestic E-commerce

As shown in Table 4, B2C e-commerce is one of the most important approaches for China's enterprises to behave abroad. Substantial varieties of B2C e-commerce trends include online stores and purchase and sale platforms. Based on the B2C electronic commerce mode, the range of import and exportation of certain processed products in China is extended, publication and advertisement of processed products under their identification by electronic commerce is extended; the online clearance procedure allows for seamless exportation of goods to cross sea trade markets by international shipping for agricultural goods. In B2C electronic commerce mode, most of China's agents can exchange products with foreign clients, and the most significant revenue range is non-public customer products. From this, the functioning of B2C electronic commerce can help to improve the quality of foreign exports in a particular sector of goods in China.

Table 4. How e-commerce operates in China

Operation mode	definition
B2C	Enterprises selling goods or services to consumers
C2C	Consumers buy and sell with each other, and the platform provides transaction-matching services
O2O	Combining offline physical storefronts with online platforms
B2B	The e-commerce model for transactions between enterprises
P2P	Personal lending, investment and financing transactions
O2C	Introducing traditional offline industries into the field of e-commerce
F2C	Factory direct supply to end consumers
G2C	**Provide online services to individuals

Current Development Status of Domestic, CBEC

As confirmed in Table 5, CBEC has been considerably used in dome used transportation for logistics transportation gadgets in China are performed through the utilization of cross-border logistics transportation, which is convenient, flexible, and safe, so that the fundamental form of the transaction can be unexpectedly matched with transnational logistics traffic for agricultural goods. At present, the freight records of gadgets and the freight data of electrical power suppliers can be shared in authentic time through China's e-commerce platform, and the producers of export merchandise in China can omit the import and export statistics of merchandise to multinational e-commerce businesses in an adequately timed manner. The records of China's gadgets' import and export alternatives can be counted through this platform. On this basis, the transnational logistics route can be rationally planned, which appreciably improves the work effectivity of global logistics transportation (Ma et al., 2018).

Table 5. Development status of CBEC in China

Development indicators	status
CBEC transaction scale	In 2020, the complete retail import and export extent of China's CBEC reached RMB 1.69 trillion, a year-on-year enlarge of 31.1%
Main trading partners	The CBEC alternate interplay between China and international locations and areas such as the European Union, * *, and ASEAN is extraordinarily active.
Policy support	China has brought a collection of CBEC insurance policies and measures, which include decreasing tariff rates, supplying preferential policies, and simplifying customs clearance processes.
Development of CBEC platforms	China has some popular CBEC platforms, such as Alibaba's 1688 global version, JD Global, Pinduoduo Global, etc.
Logistics and Distribution	China has made fantastic development in cross-border logistics and distribution, such as the promotion of cross-border direct mail, bonded warehouses, and different models, which have accelerated the import and export of goods.
CBEC Industry Association	Industry Association There is more than one CBEC enterprise association in China, such as the China Cross Border E-commerce Association, which supplies aid and education for enterprise development.
E-commerce talent cultivation	Chinese universities and coaching establishments have set up majors and publications associated with CBEC, strengthening the cultivation of e-commerce talents.
Payment and Settlement	CBEC repayments and settlements contain currencies and fee structures from one-of-a-kind international locations and regions, and Chinese price establishments grant handy and impervious cross-border price services.
Cross border E-commerce Comprehensive Pilot Zone	Comprehensive Pilot Zone China has installed some complete pilot zones for CBEC, such as Hangzhou, Ningbo, Shanghai, etc., to discover progressive improvement fashions for CBEC.

1) The challenges facing the evolution of cross-border electronic commerce. As shown in Table 6, cross-border electronic commerce (CBEC) is typically applied domestically and abroad. The current state of affairs shows that the attractiveness of CBEC is facing specific problems. There are still gaps in CBEC in logistics and transport, price policies, and coordination mechanisms. With the development of logistics and transport, as well as the fascination of international trade, the vast number of remote customers is constantly growing, more and more Chinese export orders are growing, and the transport distance between items is becoming more and more isolated, causing tremendous pressure and challenges for the cross-border electronic business logistics. Regarding billing methodologies, CBEC takes place online, and fees are paid online; however, there are better ways to do so for agricultural goods. Therefore, regular operation is always met with problems like neighborhood safety and blocking online digital currency circulation. The early emergence of such issues has raised demands on aspects of cross-border electronic commerce (Xue et al., 2016).

Table 6. Challenges in the development of CBEC

challenge	describe
Cross-border policies and laws	Policies and legal guidelines in unique international locations and areas have variations in CBEC, consisting of rules on tariff policies, mental property protection, client rights protection, etc., which want to be observed and tailored to the necessities of distinctive countries.
Electronic Payment and Settlement	In the procedure of CBEC fee and settlement, exclusive currencies and fee structures from special international locations and areas are involved, and the inconsistency of the charge surroundings additionally make bigger transaction charges and risks.
Cross-border logistics and distribution	The long-distance, multi-link, and various traits of the global logistics transportation chain lead to challenges in transportation, warehousing, and complete services, such as timeliness, traceability, and value control.
Trust and security issues	Due to the transnational nature of the transaction subject, there can be language and cultural variations between consumers and sellers, and the institution and safety of confidence and protection are essential challenges in CBEC.
Taxation and Customs Supervision	CBEC includes tariff insurance policies and tax rules from more than one country, and the complexity of customs supervision additionally poses challenges for enterprises, which have commodity declaration, compliance requirements, etc.
Product quality and after-sales service	P In CBEC, a verbal exchange between shoppers and agents is fairly difficult, and assembly product satisfactory problems and after-sales provider desires amplify the chance of alternate disputes and complaints.
Competition on CBEC platforms	The opposition between CBEC systems is fierce, such as massive structures such as Alibaba and Amazon, as properly as nearby systems in a number of countries, which want to cope with the rate stress and market share opposition delivered about by way of competition.
Cultural and linguistic differences	CBEC entails cultural and linguistic variations between exceptional international locations and regions, along with differences in market demand, advertising methods, personal experience, etc., and requires bendy responses.

2) CBEC development area. Given the current fascination with cross-border electronic commerce, there is once more scope to attract alternative national importation and exportation through cross-border electronic commerce. While an alternative CBEC offers more advantages than an alternative daily mode, the area in which it improves is mainly based on the form of cross-border electronic commerce. Thus, a combination of an alternative form of CBEC and a more advanced alternative means of electronic commerce in a daily alternative mode is the predominant way for today's alternative mode of electronic commerce. Against this background, CBEC companies will continue to explore the commercial characteristics of the traditional business model that has been applied in the past CBEC and conclude a first-class management system to improve the efficiency of the electronic commerce management system.
3) Payment method. In the past, the charge technique used in global transactions was once more cumbersome and time-consuming, and the present-day fee manner has been notably simplified. Nonetheless, there are many issues with CBEC in terms of charge methods. For example, it can't efficaciously shield the safety of the charge system for agricultural goods. Each purchaser and vendor will use the third-party charge platform or online bank in the transaction. In the case of large-scale CBEC, the online financial institution will be used for payment, and there will be a positive distinction in the time of charge and receipt of goods, resulting in the loss of items or funds. Adopting a third-party trading platform, via which real-time supervision can be conducted, improves the equity and protection of trading. However, if it is a giant transaction, there will be a considerable risk, which requires extra effort to hold the safety of the network. Currently, there is no entire community data safety machine in the world, so more excellent necessities are put ahead for protecting community records (Wang et al., 2017).

Results and discussion

Construction of China-Eu CBEC Foreign Exchange Trading Ecosystem

This time, Block Chain Science is applied to build a Sino-European CBEC ecosystem, and the usual form is shown in Figure 5. The diagram shows a unidirectional interchange of environmental data for cross-border electronic commerce between China and Europe. In contrast, the double-arrow shows a bi-directional alternative environmental record for Chinese and European cross-border electronic commerce. The Commission, the Government, China, and Europe have been selected as the main body of the ecological system for agricultural goods. They are interconnected through an environmental system consisting of a Sino-European cross-border electronic business issue platform that is considered a vital component of this ecosystem, and cross-border trade between China and Europe is achieved through the Embedded Provider Platform for CBEC (Liu et al., 2021). By arranging China-Europe's cross-border electronic commerce, the China-Europe cross-border electronic business environment, and the China-Europe CBEC management system, the research has built an entire China-Europe cross-border trade ecosystem that mainly relies on blockchain technology.

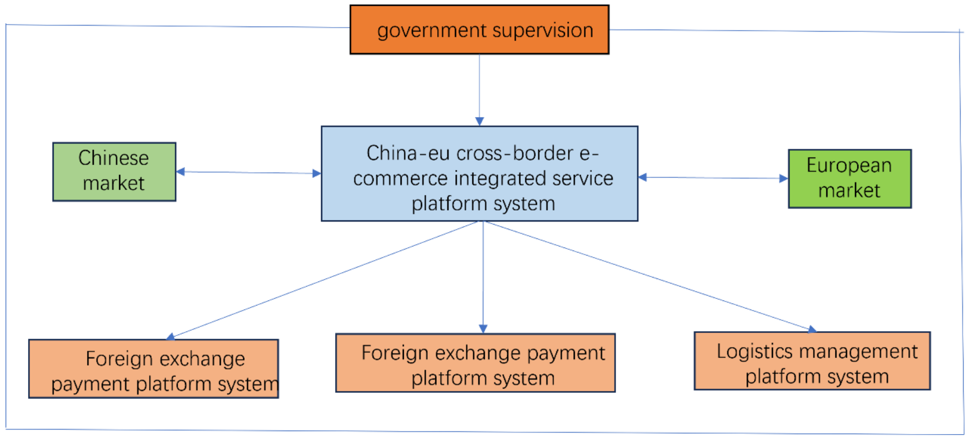

Figure 5. Architecture diagram of CBEC between China and Europe based on blockchain technology

Blockchain technology is used to build the Sino-European CBEC foreign exchange trading ecosystem to improve the efficiency and security of foreign exchange trading for agricultural goods. Through this system, foreign exchange payments can be made directly without the involvement of other intermediaries. The schematic diagram of the system is shown in Figure 6. The process of using blockchain technology to achieve forex trading is as follows: First, the set of all nodes in the ecosystem is formed into a block; each copy of the block is represented by an integer from 1 to F-1, and the ideal number of nodes in the block is:

$$F = 5f + 1 \qquad (1)$$

Formula (1) represents the number of nodes in the block and the maximum number of failed nodes (Liu et al., 2015). The block includes the primary node and the secondary node, and the following formula determines the selection of the primary node:

$$h = lmodF \qquad (2)$$

In formula (2), h is the leading book number, and l is the view number. When the controller node in the block fails, the view change is started, and the controller node is re-determined by formula (2). When there is a transaction, the request message a is sent to the controller node, and the controller node will assign a number A to the payment message and then broadcast the foreign exchange payment message to all nodes in the system. The format of the node broadcast message is as follows:

$$k =< l, \alpha, g, a > \qquad (3)$$

In formula (3), k represents the payment message format, and g is the summary of the request message a. According to this format, compare whether block Data1 and block Data2 are the same; if they differ, the payment transaction service will be rejected. If they are the same, proceed to the next step. Then, compare whether block Data1 information is the same as block Data3; if it is different, the payment transaction service will be rejected. If they are the same, proceed to the next step. Finally, all block information is compared with block Data4 information. If different, it indicates that the foreign exchange transaction information has been maliciously tampered with, and the transaction is terminated. If the same, all the information in the transaction process is consistent, and the payment can be made for agricultural goods. Through block information verification, all nodes can reach a consensus on the newly generated block and ensure that the foreign exchange payment message between the buyer and the seller cannot be destroyed or tampered with during the transmission process of CBEC transactions between China and Europe. Suppose the foreign exchange trading information of the buyer and seller is entirely consistent. In that case, the seller will be notified to deliver the goods, and the buyer will finally confirm the receipt, thus completing the construction of the foreign exchange trading ecosystem.

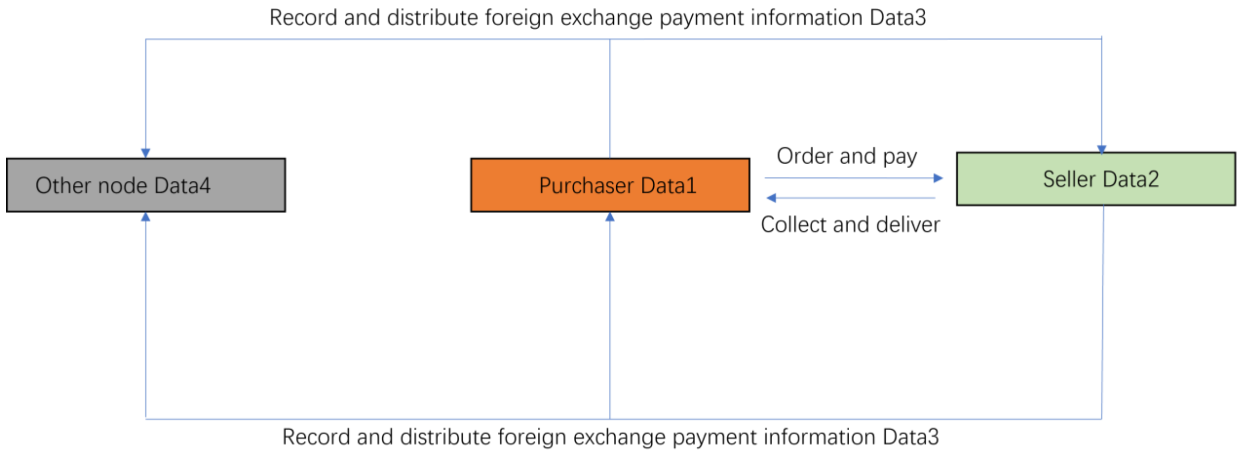

Figure 6. Schematic diagram of China-Eu CBEC foreign exchange trading system based on blockchain technology

China-Eu CBEC Construction

The China-Europe Cross Border Electronic Commerce SCis built on the capabilities of a wide range of actors, including international logistics, customs authorities, control companies, and households, making it a highly quality trade consistent with the characteristics of multiple links in the blockchain, thus building up a Sino-European cross border electronic commerce supply chain. Build up a Chinese and European electronic commerce logistic database with blockchain technology. Code all the properties and structures of Chinese and European CBEC logistics statistics while entering them into the blockchain for agricultural goods. The data characteristics and format for the EBTP are set out in Table 7 (Qi et al., 2020). Once logistical data is entered into the Blockchain database, it will have a timestamp so that no logistical data can be exchanged between the two parties, which is currently no longer able to guarantee the safety of China-Europe CBEC logistic information, nor is it possible to ensure the real-time and accuracy of the information retrieved from the Web site in China and Europe. Thus, an integrated China-Europe Logistics Ecological System is established.

Table 7. Blockchain database data attributes and data structure

data attribute	explain	data structure
Delivery factory	shipper	string
Domestic logistics	domestic logistics	uint36
Delivery time	delivery time	uint48
Delivery Location	point of departure	uint36
Delivery list abroad	Foreign delivery list	string
Cargo weight	cargo weight	uint48
Item type	type of goods	string
Shipping amount	Shipping amount	uint36

Construction of China-Eu CBEC Credit Risk Management System

The FDIC is a critical field in the China-Europe CBEC ecosystem, and the crisis in the European Union's CBEC is a problem for agricultural goods. The research first wants to build a Blockchain Savings Data Warehouse Storing Platform and accumulate data on Electronic Commerce Organisations with a Blockchain Consensus Mechanism. Then, the research Builds a Smart Contractual Savings Account Valuation Index Based entirely on the chain Technique, Considering the Savings of Cross Border Electronic Commerce in China and Europe according to the collected data and making Employee Policy and Product Very High-Quality Requirements recognized by each Chinese and European Source in Code Guidelines. Lastly, the organization of a Sino-European Cross Border Electronic Trading Society Centre, which is listed on each element's savings list at all times, is a guarantee for CBEC between China and the EU to improve the Sino-European CBEC management system, in particular based on blockchain science (Yu, 2018).

Agriculture Model Verification

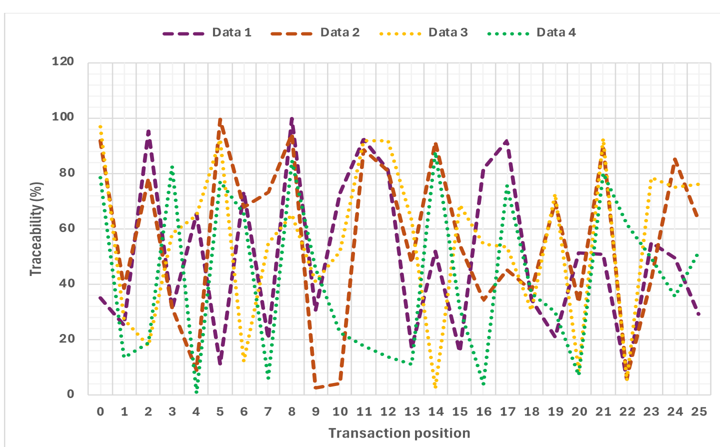

Figure 7. Traceability analysis

The module depicted in Figure 7 does an auditing query on the publicly stored blockchain data by entering the transaction identifier. Data on the quantity of blockchain transactions is categorized into four data areas. Data groups one and two are contrasted, while data sets three and four are compared. The illustration is rendered using virtual polylines. As the agriculturally suitable identifier serves as the main entry point of its respective database, it will be queried based on its dynamically produced index, returning the results to the tracing component. Raw agricultural item numbered components span from 0 to 25, while product index components vary from 0 to 1, with related traceability outcomes reaching a maximum value of 20. Based on the validation findings, the auditing component will execute "double validation" based on the outcomes and select whether to implement straight recursion accountability or recursion accountability post-traversal.

Conclusion

This study introduces the idea of co-management of CBEC activities and operations supply chains for agricultural exports, examines the components of the CBEC supply chain, and delineates the theoretical framework of the CBEC distribution network. The present state of collaborative leadership in the CBEC transportation SC for agricultural goods highlights the issues within logistics administration. This paper discusses how blockchain technology can be applied to set up CBEC and supply chains worldwide in Central Europe. In this article, the theory and features of the blockchain are explained, the problems existing in the cross-border supply are proposed, and the structure of the cross-borders is proposed. The features and interactions of more than 100 parts, which are the basis for developing a CBEC supply chain, are described. This is mainly built on the technical understanding of blockchain in China and Europe for agricultural goods. Due to the restrained time and non-public functionality of research, some things could be improved even though the excellent search for results has been completed in this aspect. The EESC hopes this issue will be addressed to encourage rapid and healthy growth of Chinese and European CBEC organizations and provide a solid theoretical basis for the harmonious society and finance of the internet age for agricultural goods.

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Author Contributions

All Authors contributed equally.

Conflict of Interest

The authors declared that no conflict of interest.

References

Abadi, J., & Brunnermeier, M. (2018). Blockchain economics (No. w25407). *National Bureau of Economic Research*. https://doi.org/10.3386/w25407

Ammous, S. (2016). Blockchain technology: What is it good for? https://doi.org/10.2139/ssrn.2832751

Bashir, I. (2017). *Mastering blockchain*. Packt Publishing Ltd.

Belotti, M., Božić, N., Pujolle, G., & Secci, S. (2019). A vademecum on blockchain technologies: When, which, and how. *IEEE Communications Surveys & Tutorials,* 21(4), 3796-3838. https://doi.org/10.1109/COMST.2019.2928173

Chen, J., Huang, Y., Xia, P., Zhang, Y., & Zhong, Y. (2019). Design and implement a real-time traceability monitoring system for agricultural products supply chain under Internet of Things architecture. *Concurrency and Computation: Practice and Experience,* 31(10), e4766. https://doi.org/10.1002/cpe.4766

Cross-border, E. (2020). *Cross-border e-commerce*.

Efanov, D., & Roschin, P. (2018). The all-pervasiveness of the blockchain technology. *Procedia Computer Science,* 123, 116-121. https://doi.org/10.1016/j.procs.2018.01.019

Gao, W., Hatcher, W. G., & Yu, W. (2018). A survey of blockchain: Techniques, applications, and challenges. *In IEEE 27th International Conference on Computer Communication and Networks (ICCCN)* 1-11. https://doi.org/10.1109/ICCCN.2018.8487348

Gorkhali, A., Li, L., & Shrestha, A. (2020). Blockchain: A literature review. *Journal of Management Analytics,* 7(3), 321-343. https://doi.org/10.1080/23270012.2020.1804035

Iansiti, M., & Lakhani, K. R. (2017). The truth about blockchain. *Harvard Business Review,* 95(1), 118-127.

Koens, T., & Poll, E. (2018). What blockchain alternative do you need? *In Data Privacy Management, Cryptocurrencies and Blockchain Technology: ESORICS 2018 International Workshops, DPM 2018 and CBT 2018, Barcelona, Spain, Proceedings* 13, *113*-129. Springer International Publishing. https://doi.org/10.1007/978-3-030-11395-7_9

Liu, A., Osewe, M., Shi, Y., Zhen, X., & Wu, Y. (2021). Cross-border e-commerce development and challenges in China: A systematic literature review. *Journal of Theoretical and Applied Electronic Commerce Research,* 17(1), 69-88. https://doi.org/10.3390/jtaer17010005

Liu, X., Chen, D., & Cai, J. (2015). The operation of the cross-border e-commerce logistics in China. *International Journal of Intelligent Information System*s, 4(2), 15-18.

Lu, Y. (2019). The blockchain: State-of-the-art and research challenges. *Journal of Industrial Information Integration,* 15, 80-90. https://doi.org/10.1016/j.jii.2019.04.002

Ma, S., Chai, Y., & Zhang, H. (2018). Rise of cross-border e-commerce exports in China. *China & World Economy,* 26(3), 63-87. https://doi.org/10.1111/cwe.12237

Monrat, A. A., Schelén, O., & Andersson, K. (2019). A blockchain survey from the perspectives of applications, challenges, and opportunities. *IEEE Access,* 7, 117134-117151. https://doi.org/10.1109/ACCESS.2019.2936094

Mu, W. (2022). Analysis and warning model of logistics risks of cross-border e-commerce. *Discrete Dynamics in Nature and Society,* 2022, 5140939. https://doi.org/10.1155/2022/5140939

Nofer, M., Gomber, P., Hinz, O., & Schiereck, D. (2017). Blockchain. *Business & Information Systems Engineering,* 59, 183-187. https://doi.org/10.1007/s12599-017-0467-3

Qi, X., Chan, J. H., Hu, J., & Li, Y. (2020). Motivations for selecting cross-border e-commerce as a foreign market entry mode. *Industrial Marketing Management, 89*, 50-60. https://doi.org/10.1016/j.indmarman.2020.02.017

Sun, P., & Gu, L. (2021). Optimization of cross-border e-commerce logistics supervision system based on Internet of Things technology. *Complexity,* 2021(1), 4582838. https://doi.org/10.1155/2021/4582838

Wang, X., Xie, J., & Fan, Z. P. (2021). B2C cross-border e-commerce logistics mode selection considering product returns. *International Journal of Production Research,* 59(13), 3841-3860.

Wang, Y., Wang, Y., & Lee, S. H. (2017). The effect of cross-border e-commerce on China's international trade: An empirical study based on transaction cost analysis. *Sustainability,* 9(11), 2028. https://doi.org/10.3390/su9112028

Wen, Y., Kong, L., & Liu, G. (2021). Big data analysis of e-commerce efficiency and its influencing factors on agricultural products in China. *Mobile Information Systems,* 2021, 5708829. https://doi.org/10.1155/2021/5708829

Wüst, K., & Gervais, A. (2018). Do you need a blockchain? *In IEEE Crypto Valley* Conference *on Blockchain Technology (CVCBT)* 45-54. https://doi.org/10.1109/CVCBT.2018.00011

Xu, M., Chen, X., & Kou, G. (2019). A systematic review of blockchain. *Financial Innovation,* 5(1), 1-14. https://doi.org/10.1186/s40854-019-0147-z

Xue, W., Li, D., & Pei, Y. (2016). The development and current of cross-border e-commerce. *China & World Economy,* 24(6), 1-8.

Yli-Huumo, J., Ko, D., Choi, S., Park, S., & Smolander, K. (2016). Where is current research on blockchain technology?—A systematic review. *PLOS One,* 11(10), e0163477. https://doi.org/10.1371/journal.pone.0163477

Yu, T. (2018). A case study of B2C cross-border e-commerce challenges in China from Customs to consumers. *World Customs Journal,* 12(2), 3-13.

Zeng, S. Q., Huo, R., Huang, T., Liu, J., Wang, S., & Feng, W. (2020). Survey of blockchain: Principle, progress, and application. *Journal on Communications,* 41(1), 134-151.

Zhang, R., Xue, R., & Liu, L. (2019). Security and privacy on the blockchain. *ACM Computing Surveys (CSUR),* 52(3), 1-34. https://doi.org/10.1145/3316481

Zheng, Z., Xie, S., Dai, H. N., Chen, X., & Wang, H. (2017). An overview of blockchain technology: Architecture, consensus, and future trends. *In IEEE International Congress on Big Data (BigData Congress),* 557-564. https://doi.org/10.1109/BigDataCongress.2017.85

Zheng, Z., Xie, S., Dai, H. N., Chen, X., & Wang, H. (2018). Blockchain challenges and opportunities: A survey. *International Journal of Web and Grid Services,* 14(4), 352-375. https://doi.org/10.1504/IJWGS.2018.095647