

Application of Block Chain Technology in Logistics Industry

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Abstract—In recent years, block chain technology has emerged rapidly all over the world and is regarded as an important engine of the fourth Industrial Revolution, in which logistics industry is considered to be the field with the highest application value except for the financial industry. This paper introduces the basic concept and characteristics of block chain technology and analyzes the principle of block chain. It is concluded that block chain technology can be applied to logistics industry very well by applying block chain technology to the business scene of landing in logistics industry. Under the background of information age, the strong rise of “block chain technology logistics” will promote the transformation and development of logistics industry, and will also reconstruct the mode of logistics economic operation and rapidly innovate the logistics mode. And this paper also provides a lot of technical assistance to the current problems of the logistics industry.

Keywords—Block chain; Logistics industry; Innovative application; Transformation and development

I. INTRODUCTION

In recent years, the logistics industry develops rapidly and has a bright future. On a global scale, the annual compound growth rate of the logistics market is expected to be 3.48 percent between 2016 and 2022, and will reach \$12.256 trillion in 2022, according to data. Especially in China, where demand for consumption and people's livelihood is strong, the logistics market is even larger, with nearly 40% of the world's share, ranking first in the world for the third year in a row. While, at a high rate of growth, the logistics industry is still relatively backward in terms of technology and operation. This is because the decentralized nature of the industry leads to low transparency of the whole logistics process, and no one party is responsible for many important responsibilities. The block chain technology provides a train of thought for the standardization and digitization of the logistics industry, and how to locate and apply it in the logistics field is worth further pondering [1]. In recent years, with the development of electronic commerce, the process of freight transportation has become extremely rapid, which is simpler in theory than ever before. With a complete logistics infrastructure, the next step in logistics industry reform should be digitization. With the increasing of global merchandise trade, many participants are involved, and the development of logistics industry will be accompanied by the development of global trade, which will have an important impact on the future technological innovation and industrial transformation of logistics industry.

II. PRINCIPLE AND CHARACTERISTICS OF BLOCK CHAIN TECHNOLOGY

Block chain technology is a reliable database technology maintained collectively. This technology participates in any number of nodes in the system and calculates all the data of the system in a certain time by using cryptographic algorithm and records it into the data block. The fingerprint of the data block is used to connect the next data block and check, and all the participating nodes of the system can work together to determine if the record is true [2]. Block chain Technology and Industry Development White Paper prepared by China Block chain Technology and Industrial Development Forum defines block chain as: distributed data storage, point-to-point transmission, and consensus mechanism. A new application pattern of computer technology, such as encryption algorithms [3]. From a data point of view, it's almost impossible for block chain to be changed in distributed database, in which "distributed" is not only the distributed storage of data, but also the distributed record of data. From a technical perspective, block chain is not a single technology, but a combination of multiple technologies. It is generally believed that block chain technology integrates P2P network technology, distributed technology, asymmetric encryption technology books, consensus mechanism technology and intelligent technology contract. These technologies are combined with new structures to form a new way to record, store, and publish data.

Compared with the traditional database technology, block chain technology has four main characteristics: first, open and consensus; anybody can take part in a block-chain network, each of which can act as a node, each of which allows a full copy of the database. Nodes maintain the whole block chain through competitive computation based on a set of consensus mechanism. If one of nodes loses effectiveness, the rest of the nodes can play a very good role as usual. Second, go to the center and to trust; block chain is an end-to-end network composed of many nodes, and there is no centralized facility and regulatory agency. The data exchange between nodes is verified by digital signature technology, so there is no need to trust each other. As long as the data exchange between nodes is carried out according to the established rules of the system, the nodes can neither deceive nor deceive other nodes [4]. Thirdly, the transaction is transparent and the two sides are anonymous; block chain operation rules are open and transparent, all data information is open, so that each transaction is visible to all nodes. The identity between the nodes is not required due to the distrust between the nodes, and each participating node is anonymous. Fourth, the modification of the database by one or more nodes cannot affect the database of other nodes, unless it

can control more than 51% of the nodes to modify simultaneously in the whole network, which is almost impossible to happen. Each transaction in a block chain is concatenated with two adjacent blocks by means of cryptography, so it can be traced back to any previous life of a transaction.

III. APPLICATION OF BLOCK CHAIN TECHNOLOGY IN LOGISTICS INDUSTRY

In May 2018, the 2018 China Block chain (non-Financial) Application Market Survey, jointly released by PricewaterhouseCoopers and VeChain, said that the logistics industry is considered by industry sources to be the industry with the highest value of innovative applications other than the financial sector. It can be called the logistics block chain. In fact, the logistics ecosystem is a community of interests composed of multiple participants. There is a concept of flow in the industry, starting from the initial business flow, gradually giving birth to logistics, as well as the corresponding capital flow and the support of information flow. The generation of various flows, behind which there is a key issue, is the transfer of ownership of a commodity. Many of the problems solved by block chain technology are related to trust friction in the process of asset ownership transfer. Therefore, the conclusion can be drawn that the multi-flow business scene involved in the logistics industry is very suitable for the block chain technology to play its value and effect. The application of block chain technology in logistics industry mainly includes the following aspects:

A. *To ensure the safety of the goods and to avoid the loss of packages in the warehouse of express delivery.*

In the traditional logistics, it is difficult to trace the source of the goods, the information in the logistics process is difficult to control and track immediately, the delivery confirmation at the time of delivery, the issuance of bills and so on are difficult to carry out. After the introduction of block chain logistics, every link in the logistics process is a node. Whenever the goods arrive at a link, the node automatically uploads the quantity, status, destination and other information of the goods to the block chain and backs up the whole chain immediately. When the destination is reached, the destination node uploads the delivery information, sends the invoice, and backs up the whole chain. Because of the non-usurpable modification of the block chain, we can supervise and inspect any batch of goods, make the whole supply process more transparent, and prevent the goods from being rescheduled.

Block chain technology can also be used in logistics transportation to achieve intelligent transportation. With the help of modern logistics information technology, the information of goods is intelligentized, the goods are classified automatically by block chain technology, the transportation routes and schedules are arranged, and the whole flow blocks are chained from before, during and after transportation [5]. When the cargo data in the block chain system changes, each of the systems records and stores the change data of the cargo information, which not only ensures the openness and transparency of the cargo transportation process, It can also improve the traceability of goods transport information and funds. When there are problems in freight transportation, both logistics operators and customers can trace back the information

of goods through block chain system, so as to solve these problems and improve the efficiency of transportation. Block chain technology can record all links of goods in logistics. Through the establishment of consensus network, it can directly locate the problems in the intermediate link of express delivery, and it also ensures the traceability of information, so as to avoid the occurrence of problems such as popping up and dropping packets and misreceiving the wrong collar of express delivery. Express delivery requires both private key signature, each courier or delivery point has its own private key, whether or not to sign or delivery only need to check the block chain. End users do not receive couriers without signing, couriers can not forge signatures. In this way, couriers can avoid examination by falsifying signatures, reduce usersundefined complaints, and promote the implementation of logistics real-name system. And the enterprise also can master the logistics direction of the product through the block chain, prevent the goods from being spoofed, be advantageous to fight the fake, guarantee the benefit of the off-line dealers at all levels.

B. *Optimization of cargo transport routes and schedules*

With the development of information technology, the information level of container transportation industry and the visualization requirement of container logistics service are gradually improved. But the container transportation industry lacks the unified information identification standard, the high trust cost still exists. The container transportation market has the characteristics of multi-trust subject, multi-party cooperation, intermediate frequency transaction and so on, which accords with the application conditions of block chain technology. At present, block chain technology has been applied in the process of intelligent container transportation abroad. The container related information is stored in the public "account book", that is, the database, and then the intelligent contract technology in the block chain system can proactively plan the container transportation route and schedule, and can also analyze the past container transportation process by analyzing the previous container transportation process. Continuously optimize the transportation route and schedule design, constantly improve transport efficiency. Smart contract technology is based on trusted and untampered data, which can automate the execution of some pre-defined rules and clauses. In addition, since every node in the block chain stores all the information, it is very convenient to obtain the information, and the information is more transparent and credible [6]. As a result, the shipping company can contact the docker directly and further simplify the container transportation process. At the same time, the consignee can not only track the whole container logistics information, but also modify and optimize the container transportation schedule at any time. As long as the transport process or supply chain participants enter the same network, the full potential of the block chain can be realized.

C. *Solving the problem of financing difficulties for small and medium-sized micro-enterprises in logistics supply chain*

In recent years, with the rapid development of logistics finance in our country, the block chain is used to construct the closed loop of goods storage, transaction, financing and sale, and to manage the assets digitally so as to realize the accurate matching of enterprise operation information and asset information and the control of the whole process. Thus ensuring

the authenticity, transparency and non-usurpable modification of asset information^[5]. For example, project information and asset information can be accurately quantified within a block chain, or pre-defined relationship functions can be converted into electronic asset vouchers. Because the use and circulation of electronic assets and vouchers are limited to the closed trading platform provided by banks for the company undefined supply chain finance, the whole circulation process of electronic assets and vouchers is regulated by the platform. Block chain application technology ensures that the certificate cannot be copied without authorization or traded or transferred in any way without the platform in other environments. However, the enterprises in the logistics supply chain mostly are small and medium-sized, and their credit ratings are universally low, many enterprises have no credit ratings, and it is difficult for them to acquire financing services from Banks or financial institutions. The application of block chain technology in the logistics industry makes the logistics goods have the characteristics of capitalization, which is helpful to solve the above-mentioned problems. Block chain technology can value and capitalize the information-based goods, mainly because the assets recorded in block chain technology can not be changed or forged. The sole ownership of fixed goods can make all goods in logistics chain traceable, falsified, and not tampered with, realize the capitalization of logistics goods, and provide assets guarantee for enterprises that own their ownership in logistics supply chain. The use of block chain platform can make capital access to logistics industry efficiently and quickly, thus improving the business environment of small and medium-sized enterprises in the supply chain.

Logistics supply chain finance introduces the digital information of logistics enterprise into the bank credit structure, and changes the traditional two-party model of bank ~ financing enterprise into the three-party model of bank ~ logistics enterprise ~ financing enterprise. Logistics enterprises have a good understanding of the logistics situation of trusted enterprises and their daily production and operation activities, especially for trusted enterprises that outsource logistics, logistics enterprises are even more deeply involved in their purchase and marketing activities, which is conducive to effective supervision of pledged movable property. Reduce the loan risk, optimize the information asymmetry between the credit and trusted enterprises, so as to promote the completion of credit transactions. Through the logistics enterprise data to create the supply chain financial industry belt of the new financial model.

It is a difficult problem for the whole logistics industry that how to "prove its trust" and how to use Internet technology to complete the credit verification mechanism in the logistics chain. And block chain can record and transfer capital flow, logistics and information flow truthfully and reliably. Through cooperation with the supply chain core enterprises to complete the targeted payment, joint defense control, embedded in the logistics ecosystem, control the use of loans and repayment; A real-time monitoring model based on supply chain, Internet and traditional financial data is established based on the field survey of core enterprise network resources. For example, when accounts receivable are stored in block chains in the form of digital assets, accounts receivable between core enterprises and

first-tier suppliers are actually split, transferable and traceable digital assets. Once accounts receivable can be circulated and paid, the problem of payment between enterprises in the supply chain will be solved, and this kind of digital assets can be used to pay, no longer need to carry on the pledge financing. For small and medium-sized suppliers, the digital assets corresponding to accounts receivable that hold the credit of core enterprises can also be more easily obtained from banks, factoring, etc., if they need to be paid to enterprises outside the supply chain. Thoroughly solve the problem of financing difficulties in the past.

D. Retroactive anti-counterfeiting

The block chain can not be tampered with and the data can be traced back, which can effectively solve the problem of traceability and anti-counterfeiting [7]. For example, block chain technology can be used to authenticate diamonds, record the attributes of each diamond, and store them in the block chain. As long as there is illegal trading, or fraud, it will be detected. In addition to diamonds, block chain technology can also be traced to drugs, art, collections, luxury goods and other sources of anti-counterfeiting. By using block chains, food companies can trace back more quickly to the source of food problems. This can not only help reduce consumer risk, provide security, but also reduce financial losses through targeted calls. Food companies affix labels connected to the Internet of things to the goods, with each shipment assigned a unique identification number. These identification codes can record the source of the product, processing information, storage temperature shelf-life and other information. At each stage of the supply chain, employees can simply "register" products using their identification codes, that is, write information into blocks, and block chains securely track products across checkpoints. Employees can also enter identification codes to obtain real-time data on the product and its history. Traceability of block chain technology can make up for the traditional traceability liability, tamper with books, accountability, private loopholes and the loss of information. In a practical case, in May 2017, JingDong teamed up with Horqin cattle Industry to create the worldundefineds first block chain traceability. JingDong block chain anti-counterfeiting tracing platform is connected with tracing information of breeding, production, processing and other products of Horqin cattle Group, combined with JingDong storage-in-storage, order, logistics and other information, the whole quality traceability information will be displayed to consumers. And create exclusive pages, consumers scan the code or enter the order center can be one-click query. The information of raw material process, production process, circulation process and marketing process is integrated and written into the block chain, so that the whole process of real product tracing from one thing to one code can be realized.

IV. BUSINESS SCENARIO OF BLOCK CHAIN TECHNOLOGY IN LOGISTICS INDUSTRY

A. The insured price of express delivery

Around the price-insured scene, express delivery companies to transport goods, insurance companies to provide insurance prices, businesses to provide sales of goods, sellers to purchase

price-insured services, the government to regulate the industry. Then several key points, goods logistics details, accounts, identities, claims, other reference data and other information needed to be recorded on the block chain. Insurance price is the concept of contract. When the customer signs the package normally, it automatically triggers the account settlement, the contract ends normally and the premium closes automatically. If a problem or loss occurs, the insurance company claims process is triggered.

B. Public courier

For public welfare activities, such as "one cent" activities, one cent of the cost of each package is taken out of the account donated to the public welfare organization. In this scenario, express delivery companies still undertake commodity transport, public welfare organizations to provide public welfare activities, pro-poor businesses to provide pro-poor goods sales and so on. Then, what is recorded in the block chain is the logistics details of the goods. After the package is signed and received, it will be recorded on the block chain, automatically triggering the transfer from the logistics company undefineds public welfare account to the public welfare organization undefineds account. When the public welfare activities are over, the whole process is open and transparent, avoiding the public distrust of the social welfare activities.

C. Industry blacklist sharing

Express delivery practitioners of the blacklist, or offline mode is the main. We hope that through block chain technology, each company will be able to blacklist employees onto the block chain, other companies can also query, and the data can not be modified, And can trace back to the company in which the person did what kind of inappropriate behavior and other information.

D. Supervision of security incidents in postal delivery channels

Many couriers install security machines, and the government wants to know if every logistics company has a transport safety risk. Through the mode of distributed bookkeeping, each express company can record the effective information of the security event on the block chain when the security event occurs, so that the supervisor can monitor and control the security event in real time and can not be tampered with.

V. CONCLUSION

As a new type of logistics information technology, block chain technology plays an important role in the collection and recording of logistics information, verification and storage, processing and sharing, analysis and feedback, and has an important impact on the future industrial transformation of logistics industry. Block chain technology is considered to be a disruptive innovation after steam engine, power, and the Internet. The advantages of "direction visible" and "zero trust cost" have truly completed the credit construction under an anonymous society, and brought new opportunities to the logistics industry. As a result, it is possible to make all kinds of innovative applications possible. In the past, most logistics companies used to achieve economic growth by increasing the size of enterprises, but the future should be to management, technology to benefit. In the context of the rapid development of block chain

technology, the logistics industry is undergoing a new round of changes and shuffling, integrating big data, cloud computing and the Internet of things and other block chain technology intelligent logistics is rapidly developing, for enterprises, It is necessary to lay out the block chain technology as early as possible, increase the application of block chain technology in the logistics process, and improve the logistics efficiency, so as to improve the logistics service.

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