

Green supply chain financial governance and technology application based on block chain and AI technology

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Abstract. Global warming and environmental protection will be the common challenges facing mankind in the 21st century. The sudden outbreak of COVID-19 in 2020 also makes us more deeply aware that all sectors of the world must strengthen their attention to the environment, society, and governance (ESG) to promote global sustainable development. The renewal of the green supply chain finance system assisted by science and technology will be a hot topic for new research or breakthrough for future. The author studied the application of green supply chain finance based on the method of combining blockchain and AI technology and proposed the idea of a green supply chain finance platform driven by blockchain technology and the Wide&Deep algorithm. It is found that the combination of blockchain technology and the WIDE&DEEP algorithm can better solve the lack of unified green standards and effective information disclosure and information sharing mechanisms in green supply chain finance. Small and medium-sized institutions financing difficulties, financing expensive, high cost, low turnover, ecological supply chain information flow, business flow, logistics, capital, etc in the "four circulations" a series of problems such as poor communication problems, blockchain algorithm combined with technology and AI can provide a decent future for supply chain finance development direction, how to practice is the direction of future research to its success.

Keywords: Blockchain; Green finance; Supply chain finance; AI algorithms; Distributed ledger.

1. Introduction

At present, experts often thought the foundation of green supply chain finance has two aspects, The first is inclusive finance, and The second one is green finance, industry chain has a great influence on the environment is the consensus of the present social and scientific conclusion, therefore, depends on the industrial chain effect on the improvement of the environment is also the biggest, supply chain finance through green financial products to create a win-win environment, It is in line with the world's development path to combine economic and social benefits [1-3]. The author believes that the combination of blockchain technology and AI technology is the third cornerstone of green supply chain finance [4].

First of all, blockchain technology and AI technology can better link inclusive finance and green finance. The decentralized characteristics of blockchain technology perfectly meet the requirements of inclusive finance for supply chain finance [5-6]. Intelligent public transparency and trade financing parties have consistent books, save reconciliation link, the data flow through trade, promote efficiency, realize the upstream and downstream enterprises in green finance trade in the chain the timely resolution, transfer of funds, solve the financing problems of small and medium-sized firms, financing problems, realize the ecological supply chain information stream, business flow, and cash stream, Secondly, the blockchain technology provides the data source of AI technology with the guarantee of learning and adaptability of AI technology, which makes up for the form solidification of blockchain technology, and assists blockchain technology to manage the green supply chain finance system [7-8]. Based on previous studies on supply chain finance, they have put forward the solution for intelligent contract, complete blockchain technology is used by the People's Bank of China digital paper trading platform to run the test, and established the institute of digital currency continue to blockchain technology research and development of the related project, test run, and perfect follow-up work, hundreds of independent research and development of cloud financial level SaaS cloud-native platform, It provides a more agile path for financial institutions to achieve digital

transformation, reduces resource and energy consumption in financial business processes, and strives to promote internal energy and environmental management to reduce the possible environmental impact of operations [9]. P Treleaven and B Batrinca proposed Automating Financial Compliance Monitoring and Regulation by combining blockchain technology with AI technology, but AI and blockchain technology in green supply chain finance system has little relevant progress that has been made [10].

The author combines AI algorithm and blockchain, working together to solve the green supply chain of small and medium-sized financial institutions financing difficulties, financing expensive, high cost, low turnover, ecological supply chain information flow, business flow, logistics, capital, etc in the "four circulations" poor communication problems, put forward the chain drive and pick up AI algorithms green the blockchain financial platform design train of thought, And compared with the traditional supply chain finance system.

2. Application of blockchain technology in green supply chain finance

2.1 Relevant concepts

The objects of green supply chain finance is refers to the industrial chain of green manufacturing and utilization of clean energy products, green manufacturing is to point to in under the precondition of quality, high efficiency and energy saving and cannot cause harm to human body in life ,in addition,the surrounding environment in scrap can be recycled after daily use products, such as washing machines, air conditioning, color TV, Or the use of clean energy, recycling resources to produce products and the production process by using new energy equipment and related equipment, such as wind turbines, solar panels, hydrogen energy cells, new energy vehicles, charging pile, etc., in clean energy, such as distributed photovoltaic power generation equipment, the energy storage equipment research, development and utilization, etc., as a result, Block chain technology in green equipment and application perspective of the green supply chain finance which refers to how to use the transparent block chain, as well as information sharing, tamper-resistant, traceability features, build unified green of the vertebral and transparent information sharing, multilateral development work of the new green supply chain in the financial system of technology innovation, To solve the green manufacturing and new clean energy related financing difficulties, expensive financing, high cost, low turnover rate, supply chain ecology in the "four flow" information communication is not smooth

2.2 Application design

The supply chain involves the collaborative operation of suppliers, middlemen, third-party services, and customers. To develop green supply chain finance based on blockchain technology, the deployment of blockchain technology in the green supply chain should be done well first.

In traditional green supply chain, such as raw materials, production process, technical standard vertebral information data, often a lack of transparency of information disclosure, and whether the green environmental protection material source, whether the production process of low carbon low hazard is an important standard to measure the green degree vertebral, in this kind of information flow, business flow, logistics, capital, etc. "four circulations" poor communication of ecological supply chain, It leads to the continuous occurrence of trust crisis in commercial activities and restrains the development of green finance. Therefore, how to do a good job of relevant information disclosure in a safe, efficient, open, and transparent way is very crucial. The supply chain of green manufacturing includes green raw materials and three links procurement, manufacturing, and sales. In these three links, the relevant data can be kept as a record on the blockchain. (Record the material information of raw material suppliers and the source of recycled materials in the raw material chain, record the production information of manufacturers in the production chain, and record the sales information of distributors in the sales chain)

In the fabricating process, the input must be the output of the procurement part. If there are all kinds of raw materials, each raw material is taken as the input, and the manufacturer, manufacturing time stamp, and other information are recorded, and the output must be the product.

In the sales process, only labels come into being for each green product, which can be linked to the source of materials used in the product, the production process, the annual carbon dioxide emission reduction data, and other information through the way of two-dimensional code, near field wireless communication technology and radio frequency identification tag. So that buyers can clearly understand that green products are made of clean energy, environmental protection materials, and how low carbon and low harm manufacturing.

In terms of SME financing based on the above, (1) In view of the problems of SME financing difficulty, expensive financing, high cost and low turnover rate, blockchain technology can be used to make both sides have consistent accounts, eliminating the reconciliation link, opening up trade data flow and improving efficiency; (2) in view of ecological supply chain information flow, business flow, logistics, capital, etc in the "four circulations" poor communication, lead to enterprise credit can't transfer, process procedures, such as complex problems, can be based on the above raw materials chain, chain, sales chain, set up information sharing, do not tamper with the online platform, the traceability of the green supply chain finance and help enterprises to transfer enterprise credit and green product information, In this way, it promotes the rapid progress of financing services and procedures, deep enterprises cooperation, helps regulators and third-party institutions to conduct audit and evaluation, and helps consumers with product traceability, etc. (see Fig1). (3) finance security, can be combined with the Internet of things technology, data from the sensors on the chain, reducing artificial operation risk because the chain data do not tamper with the sex, so that Banks can more convenient verify data authenticity, identity, and information validation and comparison, effectively reduce the risk of fraud, avoid duplication of financing and financing scam. (4) In view of the lack of a unified green standard, the author cites the following green rating standard, which can be used as a reference standard for third-party institutions and banking institutions to evaluate financial services, so as to help domestic small, medium, and micro enterprises with potential development to obtain green financing effectively and cheaply.

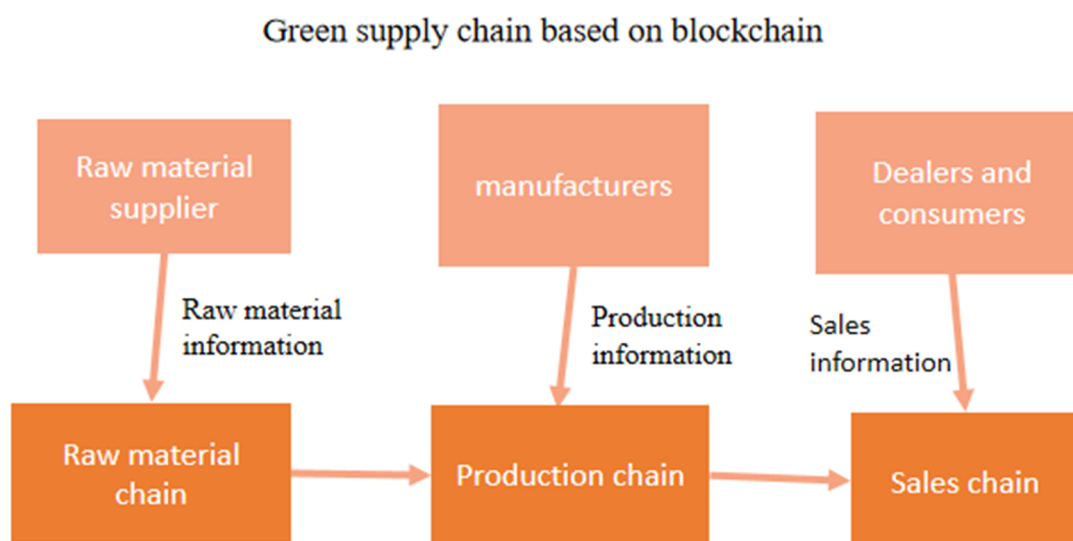


Fig 1. Green supply chain blockchain platform services

3. Design of green supply chain finance platform based on blockchain and equipped with an AI algorithm

3.1 Green supply chain finance platform services

Mentioned in the second chapter in the design of the application of chain of raw materials, manufacturing chain, sales chain as the core data, establish a green supply chain financial platform, as shown, the service object involves the seven, is divided into three layers, the first layer of suppliers, manufacturers, distributors, enterprises, Banks, the platform will apply for the user to provide financing, financing for verification, business cooperation, and other functions, The second layer is third-party institutions and regulatory agencies, which are responsible for the supervision and evaluation of the first layer. The third layer is consumers, for whom the platform will provide traceability services for green products (fig 2).

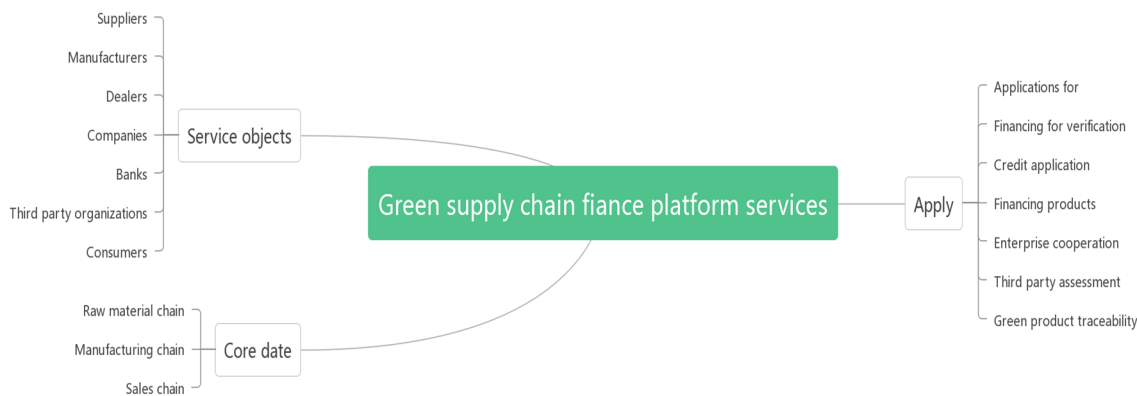


Fig 2. Green supply chain finance blockchain platform services

3.2 Enterprise greenness rating algorithm and model based on Wide&Deep model

3.2.1 Relevant concepts

It is a recommendation model originated from Google Play and an AI deep learning model, which is divided into wide and deep parts. The wide part is the part of realizing the feature conversion function of a linear model, which can input the environmental penalty data and environmental resource investment volume mentioned above. Trained as the embedding in low dimensions, the embedding is input into the deep part, that is, into the neural network. The embedding vector is used to calculate the weight of cross features, and then the green rating can be calculated.

A common challenge for recommendatory systems and similar general-purpose search ranking problems is the ability to both memorize and generalize (to achieve both accuracy and scalability of recommendation results). The ability to remember can be explained by learning features that often co-occur and exploiting co-occurrence in past data. Generalization ability, besides, it is based on migration correlation to explore new feature combinations that have hardly appeared before. Memory-based recommendation systems usually prefer to learn historical data samples, which are directly related to the actions already taken by users. Generalization ability tends to improve the diversity of recommendation content more than memory ability. Recommended content is accurate content, user interest convergence, no novelty, and not conducive to long-term user retention; The recommended content is too general, and the precise interests of users cannot be satisfied, which leads to a great risk of user loss. Compared with the accuracy of the recommendation, the scalability tendency, and the diversity of the improved recommendation system. The type is summarized in Table 1.

Table 1 Experiment data type setting

The data type	Date
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Basic information	Enterprise type, enterprise registration time
Environmental indicators	Environmental investment resources, environmental penalty data, green patent acquisition, green development data
Corporate behavior	Environmental investment resources, environmental penalty data, green patent acquisition, green development data

3.2.2 Model building

The traditional linear model requires the independence of the input data. If the independence is not satisfied, the traditional model cannot make the optimal fitting. The wide&Deep network model was first used in the GooglePlay recommendation system. The wide part of the model is built by a series of linear models through the single-layer neural network, and the Deep part is composed of the nonlinear model through a multi-layer neural network. The whole network structure is shown in Figure 1. The basic information, environmental indicators, and enterprise behavior data after normalized preprocessing are simultaneously input into Deep input and Wide input. Hide contains three fully connected layer networks with Relu output. During the training, the Deep part and the Wide part are jointly trained, and the final Loss and Gradient are calculated by combining the outputs of the two parts. Then it is backpropagated to the Deep part and the Wide part respectively for gradient calculation and parameter update.

3.2.3 The experimental results

In this paper, 1137 groups of data from 132 industrial enterprises from January 2021 to July 2021 are selected as samples, 90% of which are used as the training set and 10% of which are used as the validation set. The closer the model output is to 1, the higher the probability of green default risk of the industrial enterprise in the next month, and the closer the model output is to 0, the smaller the probability of green default risk of the industrial enterprise in the next month. When the sample Label is 0, the model output & LT; 0.4 is considered correct. When the sample Label is 1 if the model output & GT; 0.6 is correct. Figure 2 shows the convergence of model accuracy after 350,000 iterations of training. After doing this experiment, it shows that the accuracy of 92.88% can be achieved by the Wide&Deep model for green default risk by the experimental result. In this paper, according to the probability of green default risk, the enterprise greenness level is divided into 5 levels (A is the best, E is the worst). This risk level can be used as the main starting point of green financing credit, and can also be used as the basis for insurance companies' participation premium rating (fig 3 and table 2).



Fig 3 Training accuracy

Table 2 Credit Rating of Green financing

Level	Score
A	[0, 0.1)
B	[0.1, 0.3)
C	[0.3, 0.7)
D	[0.7, 0.9)

E	[0.9, 1.0)
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4. The combination of Wide&Deep algorithms and blockchain

4.1 Blockchain and AI assist role

Blockchain technology is powerful, but it is subject to many technical limitations. AI and blockchain technology seem to be two extremes, but they can also complement each other

AI is a centralized technology, while blockchain is a decentralized technology. However, if blockchain technology is used as the underlying training data source of AI, the two technologies can be well combined. Data collection and data sources are often the most difficult parts of artificial intelligence projects. The non-tampering and transparency of distributed accounting of blockchain provide a strong guarantee for data collection.

Blockchain's huge power losses have long been a pain point, and AI can effectively optimize power losses.

Bitcoin is steadily rising at a rate of 1MB every 10 minutes, at present, Satoshi Nakamoto proposed "blockchain pruning" (i.e. removing unnecessary data about fully consumed transactions) as a possible solution initially, but AI is able to introduce new decentralized learning systems or introduce fresh data sharding techniques to make the system more advanced.

Network safety protection has always been a key research topic of a blockchain platform. Even though blockchains are hard to hack, the deeper layers and applications of blockchain are not so reliable (such as DAO, Mt Gox, Bitfinex, etc.). The great advances in machine learning over the past few years make AI an excellent ally of blockchain for secure application deployment, especially given the robustness of the system's architecture.

In terms of efficiency, Deloitte (2016) estimates that the total operating cost of blockchain verification and shared transactions are about \$600 million every year. An intelligent system might eventually calculate in real-time the likelihood that a particular node will perform a particular task for the first time, by giving other miners the option to forgo efforts for that particular transaction, thereby cutting total costs. Moreover, even with some structural constraints, better efficiency and lower energy consumption may reduce network delays, making transactions faster.

4.2 Operation process of Wide&Deep algorithm combined with blockchain

When an account is registered on the platform, the platform will require the registered party to provide relevant data from the State Environmental Protection Bureau and the Bureau of Statistics, and then the platform will record them to the block, and then open the data to the Wide&Deep algorithm AI through the API port and DPEs protocol. The embedding of the wide linear model is trained as the low-dimensional embedding and then input into the deep part, that is, into the neural network. The embedding vector is used to calculate the weight of cross features. Finally, the green rating can be calculated based on this, and the rating data will be uploaded to the cloud server of the website. This risk level can be used as the main starting point of green financing credit, and can also be used as the basis for insurance companies to participate in premium rating (fig 4).

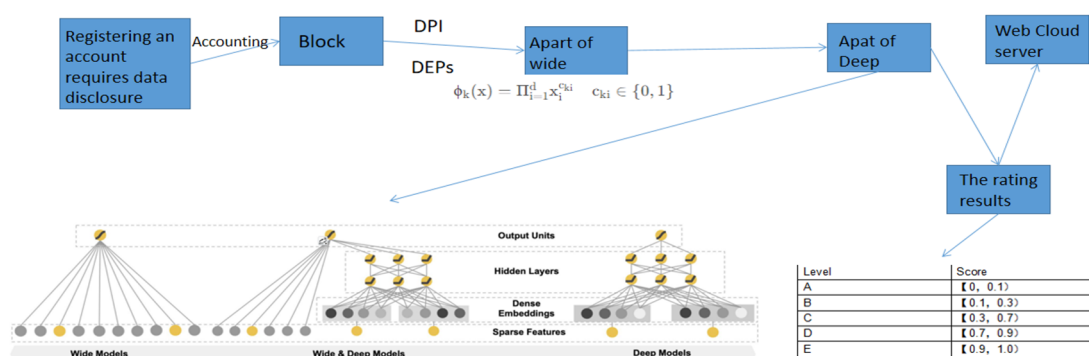


Fig 4. The combination of Wide&Deep algorithms and blockchain

4.3 Comparison of green supply chain finance based on the combination of blockchain technology and AI technology and traditional green supply chain finance

1) Traditional green supply chain finance lacks risk management methods, while artificial intelligence technology training to provide data to the blockchain as the underlying block can greatly reduce the risk of supply chain finance, and blockchain technology is tamper-proof and traceable, becoming the second insurance method of green supply chain finance;

2) traditional green supply chain financial lacks of unified standard job, leading to economic policy and related behavior being difficult to implement, this new type of green supply chain finance has a unified green standard job, able to run under a unified green label vertebral, making economic policy and related behavior would be able to implement, enables the third party to evaluate enterprise;

3) Traditional green supply chain finance is too centralized, green credit is mainly concentrated in core enterprises, and it is difficult for middle and downstream enterprises to obtain green credit. However, the decentralized characteristics of blockchain can alleviate this trend of centralization and enable the balanced development of green supply chain finance.

4) Small and medium-sized enterprises in traditional green supply chain finance have difficulty in the financing, high financing cost, and low efficiency, while the combination of blockchain technology and AI technology reduces the financing cost, which can alleviate the financing difficulty of small and medium-sized enterprises to a certain extent and improve efficiency;

5) Traditional green supply chain finance lacks the reward mechanism, while the bitcoin-like mechanism of blockchain technology provides a relatively mature reward mechanism, which improves the autonomy of the supply chain.

5. Conclusion

The author combines AI algorithm and blockchain, working together to solve the green supply chain of small and medium-sized financial institutions financing difficulties, financing expensive, high cost, low turnover, ecological supply chain information flow, business flow, logistics, capital, etc in the "four circulations" poor communication problems, put forward the chain drive and pick up AI algorithms green the blockchain financial platform design train of thought.

Due to the author's lack of ability, the proposed design idea lacks practical verification. Secondly, the author believes that better AI algorithms can cooperate with blockchain to realize AI-assisted blockchain to realize server protection and other functions, which can be used as a future research direction.

Green is the balance between current survival and long-term future survival and is the sustainable demand of human development. Back to the essence of reality, in the era of the epidemic, enterprises need to survive, countries need to survive, and humans need to survive. If we do not develop a low-carbon revolution and let the fate of mankind turn the corner, then where will survival and civilization go? The author believes that considerable breakthroughs will be made by combining AI technology and blockchain technology into green supply chain finance and constantly researching and practicing it.

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