Ecological Economic Development Based on Supply Chain in the Era of Big Data

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Abstract: Under the background of the active development of ecological economy in China, the transition from traditional supply chain to ecological supply chain has become a new topic of supply chain management. The use of big data technology is not only an inevitable choice for supply chain, but also an important guarantee for the development and innovation of supply chain. The purpose of this paper is to study the ecological economic development based on supply chain in the era of big data. This paper firstly analyzes and studies the development problems of enterprises in the supply chain, and expounds the significance of applying big data technology to ecological supply chain. Then it introduces the connotation and composition of ecological supply chain. Then, based on the gradient promotion decision tree algorithm, a cost sensitive xgboost algorithm, called cs-xgboost algorithm, is proposed in this paper. The experimental results show that it is of practical significance to apply the decision tree algorithm proposed in this paper to the risk prediction of ecological supply chain. In this paper, AUC and ACC are used as performance indicators to test the cs-xgboost algorithm, and the value of AUC of the algorithm is 0.9.

Keywords: Big Data, Supply Chain, Ecological Economy, Development Research

1. Introduction
The increasing prominence of ecological issues and the attention of the whole society will drive the rise and development of new industries, which will also have a great impact on existing enterprises and supply chains [1-2]. All enterprises in the supply chain are faced with the innovation and improvement of ecological technology, which requires a large amount of capital investment. Currently, the most difficult enterprises to achieve emission reduction targets are precisely small and medium-sized enterprises with backward technology and lack of capital [3-4]. These enterprises have been active in China's economic development in the past and have made many contributions. However, under the policy pressure of ecological standards, their backward technology and management will hinder the improvement of ecological benefits of the whole supply chain, and they
cannot afford the cost of technology development and renewal by themselves, so the survival of these enterprises is in danger [5].

Ecosystem of relevant national measures also gradually began to pilot, in the face of these government restrictions or encourage support policy, the original supply chain each enterprise all need to re-examine their own business and production process, whether to exceed bid, whether meet the support conditions, the ecological policy impact on supply chain and chain enterprises growing [6-7]. These not only provide opportunities for the original supply chain to improve ecological benefits, but also increase the risk of being penalized for non-compliance [8]. This paper aims to integrate all the resources of enterprises on the chain to carry out ecological innovation and mobilize the enthusiasm of enterprises so as to achieve the purpose of adapting to the government's ecological policies. In addition, through the cooperation of enterprises in the supply chain, communication between enterprises can be strengthened, trust can be enhanced, and management methods can be provided to realize the transformation and sustainable development of the supply chain[9-10].

This paper firstly analyzes and studies the development problems of enterprises in the supply chain, and puts forward the significance of applying big data technology to ecological supply chain. Then it introduces the connotation and composition of ecological supply chain. Then, based on the gradient promotion decision tree algorithm, a cost sensitive xgboost algorithm, called cs-xgboost algorithm, is proposed in this paper. The experimental results show that it is of practical significance to apply the decision tree algorithm proposed in this paper to the risk prediction of ecological supply chain.

2.Method

2.1 Ecological Supply Chain

Ecological supply chain is to optimize the whole supply chain system into a holistic and systematic view, to improve the natural ecological environment and the sustainable development of human beings, to use ecological thinking to ensure the process of economic activities, and to strengthen the impact of economic actions on the environment in the design stage. The material and energy flow of the supply chain has no harm to the environment. It takes into account the economic, social and ecological interests comprehensively, and finally realizes the harmonious coexistence between man and nature and sustainable social development.

The composition of ecological supply chain is generally divided into two parts: on the one hand, it is composed of six parts, namely, ecological design, ecological procurement, ecological manufacturing, ecological marketing, ecological logistics and ecological disposal of waste. On the other hand, from the perspective of system and whole, six elements are coupled to form the whole system of ecological supply chain through the main chain in vertical series and the secondary chain in horizontal symbiosis.

2.2 Gradient Elevation Decision Tree Algorithm

Gradient lift decision tree (GBD for short). The gradient lift is abbreviated to GB. This is used for regression or classification algorithm, belongs to the promotion algorithm, also belongs to the research category of integrated learning. Boosting is a learning algorithm that can upgrade a weak classifier to a strong classifier. Gradient promotion decision tree is an iterative decision tree algorithm. The algorithm is composed of multiple regression trees, and the results of all trees are added to the final algorithm results. The specific idea is as follows: each model created is in the direction of gradient descent of the loss function of the model created in the previous round. The traditional idea of ascension is to weight the right sample against the wrong sample. At the end of the repeated steps, the weight of the error point increases and the weight of the point decreases.

Each time xgboost generates a tree, it generates C(1,0) and C(0,1). The new loss function is defined as:
\[ L = \frac{C^{t-1}(1,0)}{C^{t-1}(1,0) + C^{t-1}(0,1)} (y^{t-1} - y_i)^2 \]  

(1)

Where \( C^{t-1}(1,0) \) and \( C^{t-1}(0,1) \) is the element in the cost matrix \( C^{t-1} \) of the spanning tree in the t-1st iteration. In the case of the new loss function \( L \), there is:

\[ g_i = 2(y^{t-1} - y_i) \frac{C^{t-1}(1,0)}{C^{t-1}(1,0) + C^{t-1}(0,1)} \]

\[ h_i = \frac{2C^{t-1}(1,0)}{C^{t-1}(1,0) + C^{t-1}(0,1)} \]  

(2)

The cost sensitive xgboost algorithm, called cs-xgboost algorithm, can be obtained by introducing \( g_i, h_i \) into the calculation process of xgboost algorithm.

3. Experiment

3.1 Data Collection

In this paper, the performance of the improved xgboost algorithm is validated using data from datahackathon3.x AV using a public unbalanced data set. In general, on an unbalanced data set, a category with a large number of samples is called a positive class, while a category with a small number of samples is called a negative class. The statistical format of open data set samples and characteristic quantities is shown in Table 1.

| Table 1. Data set properties |
|------------------------------|
| Total number of samples | Total number of features | Is sample | Negative sample |
| 19335 | 35 | 19022 | 313 |

3.2 Evaluation Criteria

The ACC. ACC is called accuracy, which can well reflect the overall performance of the classifier.

AUC and ROC. ROC(Receiver Operating Characteristic) evaluation index: for a curve drawn on a two-dimensional plane (ROC curve). For the classifier, a TPR and FPR point pair can be obtained according to its performance on the test sample. Thus, the classifier can be mapped to a point on the ROC plane. By adjusting the threshold value used by the classifier, we can get a curve that goes through (0,0) and (1,1), which is the ROC curve of the classifier.

4. Discussion

4.1 Experimental Results and Discussion

The experiment used a public unbalanced data set, and then compared the logistic regression classification algorithm (LR) with the cost sensitive gradient promotion decision tree algorithm (cs-xgboost). Each algorithm was classified on the same unbalanced classification data set, and then ACC value, AUC value and ROC curve were used as performance evaluation indexes to measure the classification model of the two algorithms learning on the unbalanced classification data set. The results of the logistic regression classification prediction algorithm and the improved cs-xgboost classification prediction algorithm are shown in Table 2 and Figure 1.

| Table 2. Experimental results |
As can be seen from Table 2 and Figure 1, the traditional logistic regression classification algorithm is not much different from cs-xgboost algorithm in accuracy for the experimental results of classification on unbalanced data sets, but the performance of cs-xgboost algorithm is much better than that of LR algorithm in AUC.

4.2 Thinking on Promoting the Optimization of Ecological Economic Environment Based on Supply Chain

(1) Build a complete supply chain credit system as the core point, constantly optimize the cultural ecological environment of the supply chain

A good credit environment is an important guarantee to construct an ecological environment of supply chain and promote the healthy development of industrial economy. First, a systematic and effective supply chain credit information system is established. The so-called effective supply chain system refers to the establishment and improvement of supply chain information credit system based on the inherent requirements and characteristics of supply chain management, the information flow characteristics of the whole society, the information demand of the market and the perfection of credit. Improve the financing efficiency of the entire supply chain through cultural and economic skills. Second, build a credit firewall in the supply chain. The weak link in supply chain management often occurs in smes. Small and medium-sized enterprises are in a weak position in the supply chain due to their small scale and large number. However, their status has a significant impact on the speed and level of ecological environment construction in the supply chain. Therefore, it is necessary to improve the ability of preventing sme management risks and maintaining balanced supply chain ecology.

(2) Constantly strengthening the ecological legal environment of the supply chain with a view to improving the legal system

The important work of optimizing the ecological environment of supply chain is to continuously improve the legal composition of supply chain, maintain and develop the ecological environment of supply chain, expand the development space of supply chain ecology and improve the competitiveness according to the inherent legalization requirements of market economy. First, improve the legal provisions, eliminate legal conflicts, establish a complete and systematic legal system of supply chain, and integrate the legal basis of supply chain ecological environment. Second, protect legal authority and establish and improve legal incentive and disciplinary mechanisms. The basic purpose of establishing and improving the legal system of supply chain is to improve the market competition
mechanism of enterprises and improve the development of ecological environment. We should create a noble social atmosphere that emphasizes trust and integrity, strengthen the control of untrustworthy behaviors, maintain the authority of the law, maximize the use of legal means, and make the concept and awareness of the law truly popular.

(3) Take the fair business environment as a springboard to promote the healthy and sustainable development of supply chain

The key to building a just business environment is to reduce inappropriate administrative intervention and provide an important external guarantee for promoting the marketization of supply chain. First, law-based administration is an important part of building a legitimate China. To actively publicize administration in accordance with the law, improve the credibility of the government and eliminate undue administrative interference is an important means for China to maintain a fair business environment and to realize a good supply chain environment. Second, improve the regional investment environment, protect the overall situation of economic development, improve work style, improve work efficiency, and further optimize the business environment. Third, the government should constantly improve the level of service, strengthen the construction of credit action standards. The government is the subject of social responsibility and has the responsibility to improve the level of social integrity. Improve the credit management system of government business, improve the level of social services to enterprises, as an industrial support supply chain, correctly handle the interests of all aspects of the whole society, and eliminate the incidents that damage the ecological environment of the supply chain. The fourth is to establish a set of management system with clear responsibilities, division of labor, coordination and coordination, starting from the fundamental problems of the system and mechanism, so as to provide a practical guarantee for improving the ecological environment of the supply chain.

(4) Based on the main market development of the supply chain, actively improve the internal ecological environment of the supply chain

The specialized supply chain enterprise is the main organization of supply chain market. Whether the subject is developed or not is related to the scale and level of supply chain development, which is a fundamental problem. First, the supply chain environment is the background of the market economy and the operation system of the market economy. The healthy and sustainable development of the market economy is the soil and water for the development of the supply chain. At the same time, only the healthy and sustainable development of the supply chain market can enable more social funds to enter the supply chain, improve the flow and use efficiency of social funds, and promote the prosperity and development of the market economy. The second is to actively guide and encourage differentiated credit policies that are different from the characteristics of supply chain development, stimulate the market demand of supply chain, and improve the supply capacity of supply chain credit market. We will cultivate and continuously develop professional supply chain institutions, specify the minimum proportion of supply chain credit investment, actively develop the supply chain market, focus on solving the financial problems of small and medium-sized enterprises, and constantly expand the financial channels for small and medium-sized enterprises.

5. Conclusion

Nowadays, ecological economy and low-carbon economy have become the main direction of world economic development. Countries are constantly introducing strict environmental protection laws and regulations and management rules for various industries. China is also actively engaged in the establishment of ecological economy and low-carbon society, and ecological economy is the main way to realize the sustainable development of China's economy. China has begun to formulate and promulgate various laws and policies on environmental protection and industrial pollution control and management. In the ecological voice, the traditional supply chain management needs to be transformed, and the transformation to the ecological supply chain has become the inevitable choice for development. Environmental protection and ecological improvement have not only affected the quality and reputation of the supply chain, but also affected the smooth operation and development of
the supply chain. After all, the supply chain is not the government. What the enterprises care most about is the profit. The cost of ecological improvement is high and the risks are high, and most of the enterprises in need of improvement are the small and medium-sized enterprises at the source.

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