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Green Financial Data Security and Legal Guarantee System under the Background of Sustainable Development

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Abstract: Financial sustainable development is based on the theory of sustainable development, which is an extension and expansion in the financial field. The article started from the theoretical basis of financial data security and explained the definition of financial data security system. Three subsystems were determined, and a fuzzy method was used to comprehensively evaluate the security of financial data and build a model. From the four levels of the financial institution's internal stability subsystem, macroeconomic stability subsystem, market risk subsystem, and the entire financial system, it comprehensively evaluated the level of financial data security and found deficiencies. Finally, the results of the empirical analysis were used to make policy recommendations to improve financial security and prevent financial risks at these four levels. According to the scoring of a single subsystem from 2005 to 2014, the score of China's financial security evaluation in 2005-2010 was between 60 and 80, which was in the basic security zone [50,80]; the 2011-2014 scores were between 80 and 90, which was in the safe zone [80, 100].

1. Introduction

The introduction of green finance means not only the social responsibility of financial institutions, but also huge economic benefits. Some areas of low-carbon economy, such as new energy, new materials, etc., can not only reduce carbon emissions after the technology is mature, but also can significantly reduce costs and increase profits. In addition, coupled with government policies, low-carbon industries can bring good economic benefits in the long run. Financial institutions would be able to enjoy their benefits over the long term due to their investments in their respective industries. Of course, there is still a long way to go to develop ecological finance. How to promote the development of green finance at the institutional level, how the financial industry can cooperate with related low-carbon industries to achieve economic and social win-win for financial institutions, and how to innovate models are all issues worth exploring.

With the continuous development of society and the continuous advancement of technology, financial data security has become a major issue. Goda G S used a set of administrative tax data on individuals who may benefit financially from delayed Social Security claims to explore the relationship between Social Security claims and allocations to tax-advantaged retirement savings accounts [1]. Goettenauer C analyzed the regulatory and legal norms related to data protection in the financial system. He also identified the actors who contribute to the regulatory environment and their respective regulatory roles in conjunction with the cybersecurity policies published by financial institutions [2]. Lyons A C used data from the 2014 World Bank Global and Macroeconomic Indicators of Old Age Security to investigate household financial security in developed (OECD) and developing (non-OECD) countries with varying degrees of population ageing [3]. Arshad A empirically studied the impact of financial inclusion on food security. In order to overcome the endogeneity problem, this study used a fixed-effects model, two-stage least squares and systematic generalized moment estimation techniques [4]. Choi D mainly surveyed financial fraud methods using machine learning and deep learning methods from 2016 to 2018, and proposed an accurate fraud detection process based on the strengths and limitations of each study [5]. However, these studies have not been analyzed from the perspective of sustainable development, and have not incorporated the relevant concepts of green finance.

Nowadays, there are more and more methods for judging data, and there are also many studies on fuzzy comprehensive evaluation. Zhou R proposed a comprehensive performance data and subjective evaluation method considering the inherent uncertainty in the product usability evaluation process [6]. Liu Y selected nine indicators to evaluate the risk of traffic accidents, and used the fuzzy comprehensive evaluation method to calculate the risk. The research results are of great significance to the calculation and management of regional traffic accident risk [7]. The purpose of Li X K was to propose a method for evaluating the performance of lean construction management of engineering projects using an analytical network process-fuzzy comprehensive evaluation model. This study is helpful to researchers, project managers and decision makers engaged in project lean construction [8]. Zuo Z constructed the AHP-Fuzzy (Analytic Hierarchy Process-Fuzzy) comprehensive evaluation method, the results showed that the AHP-Fuzzy comprehensive evaluation method can objectively evaluate the effect of ISO9001 implementation effect [9]. Li Q comprehensively considered the current technology level and technology improvement cost, and proposed a process optimization priority number analysis method. Then, the optimization priority of all technical parameters was evaluated and ranked based on the fuzzy comprehensive evaluation method of Analytic Hierarchy Process [10]. These algorithms have achieved good results to a certain extent, but the integrity of the data needs to be further supplemented.

The qualitative analysis and quantitative comprehensive evaluation results of China's financial data security proposed in this paper were basically consistent with China's current financial security situation. Facts have proved that the comprehensive evaluation index system introduced in this paper and the fuzzy comprehensive evaluation method used can more accurately reflect the current financial data security situation in China, and have certain theoretical value and practical significance for the future comprehensive evaluation of financial security. The innovation of this paper is the combination of financial data confidentiality and fuzzy comprehensive evaluation method. The model creation process was introduced in detail, and the economic benefits of green finance development were analyzed from multiple perspectives.

2. Fuzzy Comprehensive Evaluation Method of Financial Data Security

2.1 Design of Data Security Exchange and Transmission Structure

The Secure Sockets Layer (SSL) and Virtual Private Network (VPN) technologies are used to encrypt and decrypt interactive data transfers. The SSL security gateway adopts SSL technology, which is used for the front-end of the entire platform to perform secure data exchange and accepts access requests from user clients. It calls the corresponding authentication service to complete connection verification and performs encryption and decryption functions on all packets [11-12].

The terminal network encryption device is combined with the security gateway to jointly realize secure transmission in enterprise applications. Its application structure is shown in Figure 1.

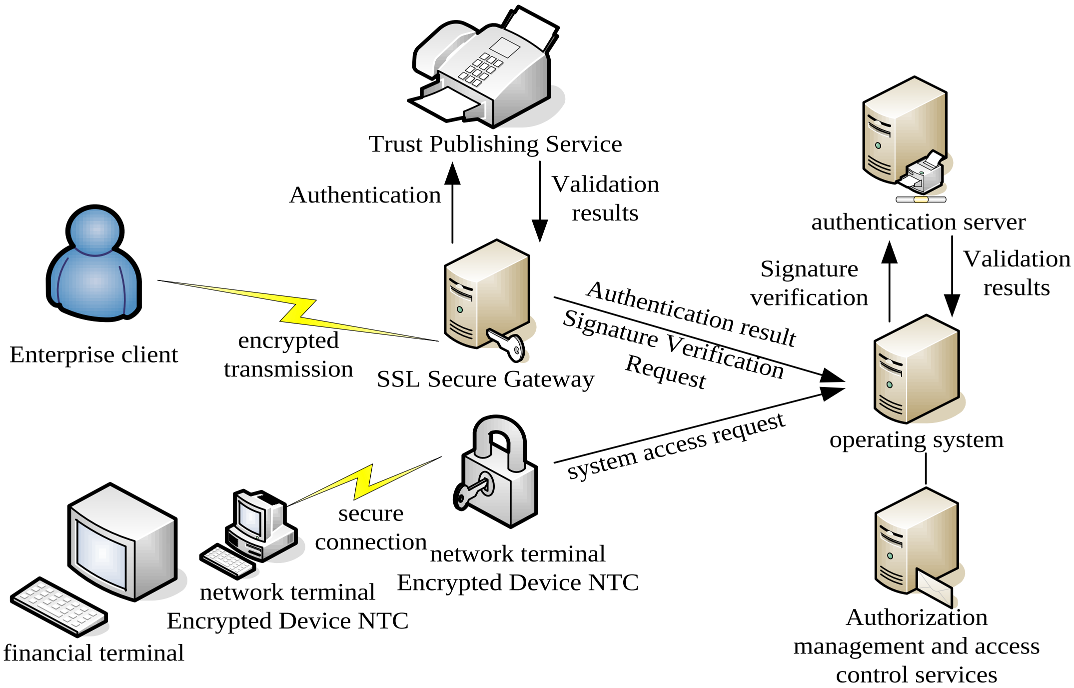


Figure 1. Application structure design of data security transmission system

The SSL security gateway is mainly used to ensure the secure transmission between business application customers and the unified connection of the pedestrian business network system. It is a secure application program suitable for designing end-to-end services. The network terminal encryption device is mainly used to establish a secure channel between the bank and the bank branch, and the device is used to ensure the security of the business interaction between the bank branch and the bank. In addition, the multi-party data security interaction system ensures the information exchange and sharing between enterprise systems from the application level [13-14].

(1) Security structure design of data exchange between points

For the data exchange between business system application partners, SSL technology is adopted. By creating a secure SSL channel between the bank and the company user, the security of the data exchange between the bank and the company user is guaranteed. The structure is shown in Figure 2.

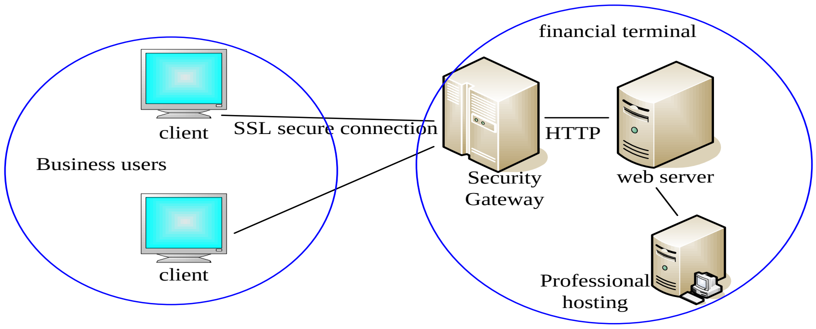


Figure 2. Application structure for secure data exchange between peers

In Figure 2, the customer creates a secure SSL channel through the bank gateway. Client-initiated requests would be securely transmitted to the bank, then updated and sent to the WEB server. Through this process, enterprise users can securely access the bank's back-end WEB servers and application systems, and users can use secure local remote services [15].

The multi-party data transmission security system adopts digital certificate and IPSec encryption technology to realize the security encryption system to ensure the security of data transmission between banks.

(2) Security structure design of data transmission between terminals

For the security requirements of inter-bank transmission in the security application of the inter-bank transaction system, IPSec (Internet Protocol Security) technology is used to add network encryption equipment at the unified output end of the bank and the bank to create an IP security channel [16]. In order to ensure the security of transaction data exchange between banks, its structure is shown in Figure 3.

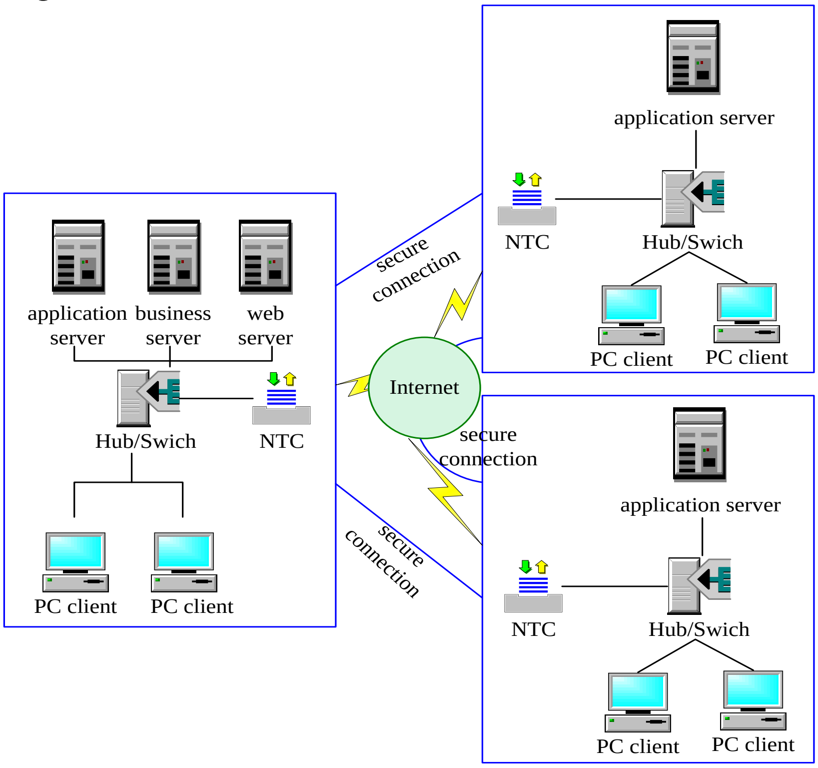


Figure 3. Schematic diagram of the application structure of network terminal encryption equipment

(3) Security structure of the system

As long as there is communication and interaction, there would be information exchange. Information exchange is an important means of communication and interaction between people and institutions. It exists on a large scale in business fields such as finance and e-government, and has an open, secure and standardized foundation.

The security information exchange service system should provide unified, general and standardized security and data exchange services for various specific business applications of the bank [17]. The logical structure design is shown in Figure 4.

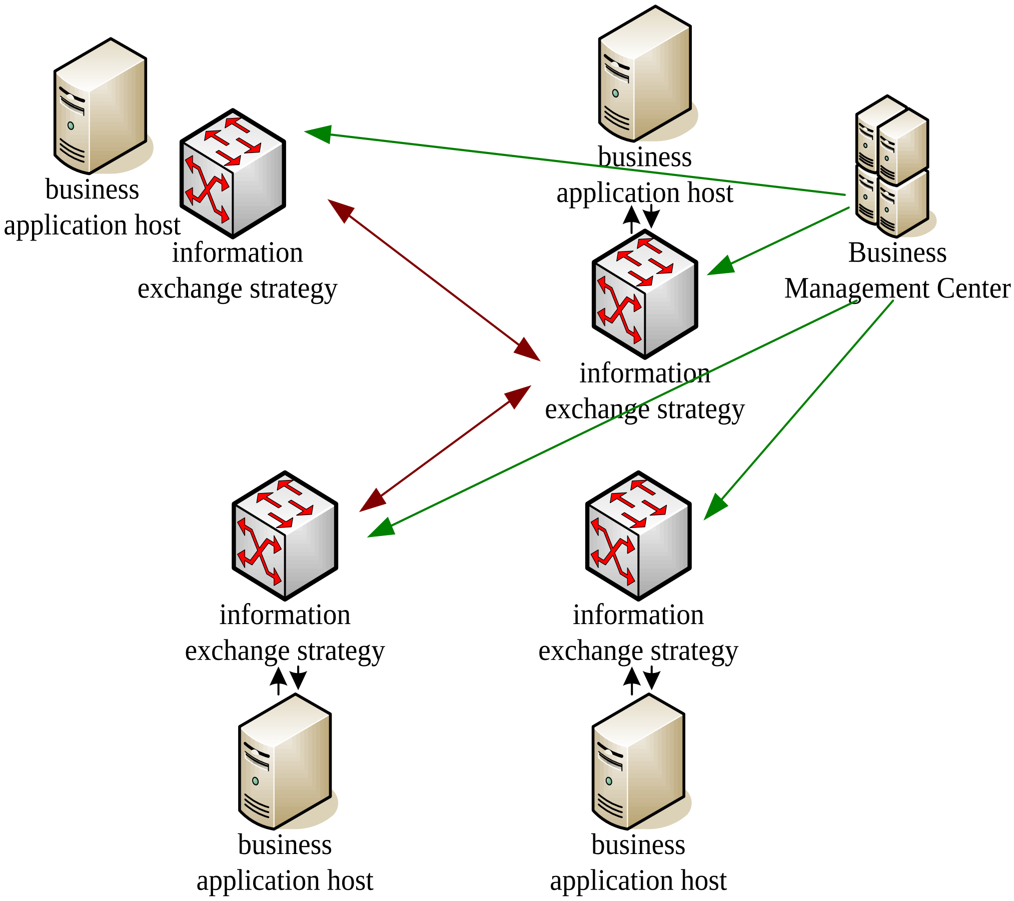


Figure 4. Information security exchange service system structure

It can be seen from the structure diagram in Figure 4 that this security architecture mainly consists of two components: a unified enterprise resource management center, and an information exchange policy service system distributed among all participants in the enterprise.

The business resource management center is the focal point of the construction of the security information exchange service system. It formulates and publishes all the procedures of business interaction. Each strategic information exchange service system is the executor of the security strategic business interaction. Under the guidance of a unified business interaction strategy, the security information exchange policy service system performs corresponding processing on the standard format data transmitted from the back-end business system, and sends the data from the back end to the security exchange service system to process the standard format data. Finally end the business system and send it to the partner until the final process of business interaction is over [18-19].

2.2 Model Establishment

In the comprehensive assessment of financial data security, the classification of a single security level is not clear and is not absolute. Therefore, it is difficult to judge the security status of financial data with the precise mathematical concept of "yes" or "no". If the security of financial data is examined from a classical mathematical perspective, the assessment results are too absolute and cannot reflect the degree of risk. Therefore, it is more scientific and reasonable to use the fuzzy comprehensive evaluation method to study the security of financial data [20]. The fuzzy comprehensive evaluation method is used to empirically analyze the security of China's financial data. The model building process is divided into several aspects as shown in Figure 5.

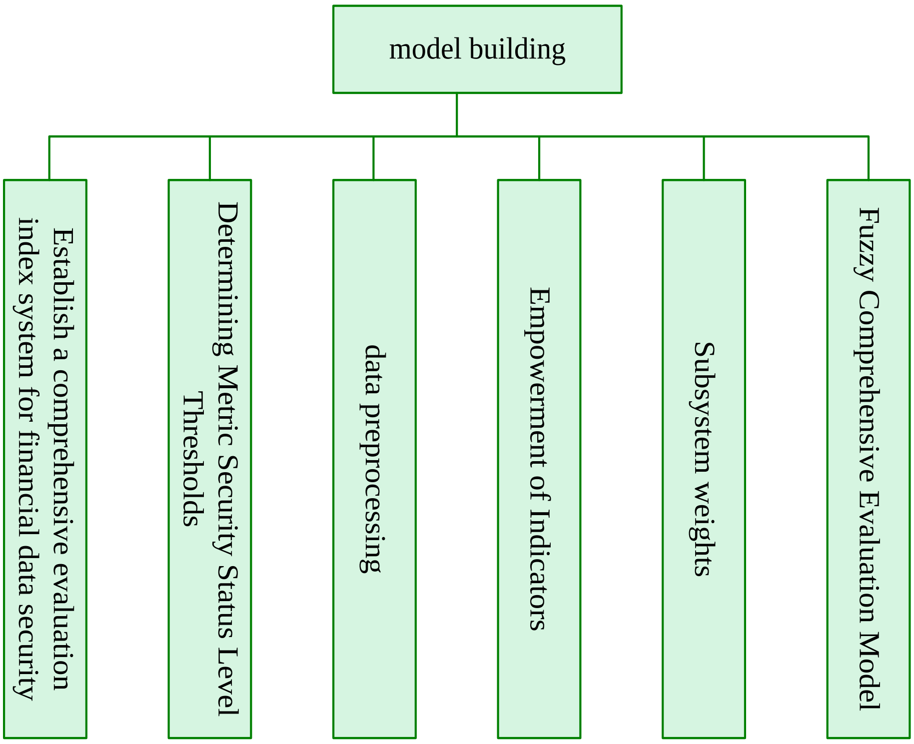


Figure 5. The specific process of model establishment

In the established comprehensive financial data security evaluation index system, and according to the economic importance of each index and the status quo of China's economic development, the indicators are divided into positive indicators and negative indicators.

According to international standards, historical data and relevant research results, the threshold levels of the safety status of each indicator are determined.

In the selected index system, there are n years, m indicators $c_{ok}(o=1,2,...,n;k=1,2,...,m)$, and u subsystems, which constitute the original data matrix $C=(c_{ok})_{n\times m}$ of the indicators. In order to ensure data comparability and validity, data should be dimensionless.

Positive indicators:

$$u_m=\frac{c_m-\min(c_m,...,c_n)}{\max(c_m,...,c_n)-\min(c_m,...,c_n)} \tag{1}$$

Negative indicators:

$$u_m = \frac{\max(c_m,...,c_n) - c_m}{\max(c_m,...,c_n) - \min(c_m,...,c_n)} \tag{2}$$

There are many ways to assign indicators, which are divided into subjective and objective. The subjective assignment method relies heavily on subjective perception and empirical judgment, while the objective assignment method is more objective. The entropy method is one of the target assignment methods. The entropy method is suitable for the situation where the data is relatively complete, and avoids the situation of negative weights when using principal component analysis to calculate the weights [21-22]. Therefore, the entropy method is used to determine the weights.

The first step is to translate the dimensionless data.

All dimensionless data u_m are in the interval [0,1], but the value of the pointer value 0 cannot be directly taken logarithm. Therefore, it is necessary to translate the dimensionless data u_m, then there are:

$$u'_m = u_m + 1 (o = 1,2,...,n; k = 1,2,...,m) \tag{3}$$

The second step is to calculate the weight.

The weight of the indicator value of indicator k in indicator o is calculated:

$$a_{ok} = \frac{u_{ok}}{\sum_{o=1}^{n} u_{ok}} (o = 1,2,...,n; k = 1,2,...,m) \tag{4}$$

The descendant value of the k-th indicator is calculated:

$$r_k = -(1/\ln n)\sum_{o=1}^{n} a_{ok} \ln a_{ok} \tag{5}$$

The coefficient of variation h_k for the k-th indicator is calculated:

$$h_k = 1 - r_k \tag{6}$$

The weight of the k-th indicator is defined as s_k:

$$s_k = h_k / \sum_{k=1}^{m} h_k \tag{7}$$

The evaluation total value b_k of the k-th index is calculated:

$$b_k = \sum_{o=1}^{n} s_k a_{ok} (o = 1,2,...,n; k = 1,2,...,.m) \tag{8}$$

The total score for each indicator in each subsystem is summed to obtain the total score for subsystem B_l, which is then normalized to obtain the weight of each indicator and the weight of each indicator of S_l.

$$S_l = B_l / \sum_{k=1}^{m} B_l \tag{9}$$

The determination of the domain of judgment factors: a set of subject evaluation factors of $I = \{i_1, i_2, ..., i_m\}$ are established. The theoretical field that takes the fuzzy index system of the comprehensive evaluation of financial data security as the evaluation factor. The subsystem level is recorded as $C=\{C_1,C_2,C_3\}$, and the indicator levels are recorded as $C_1=\{C_{11},C_{12},C_{13},C_{14},C_{15},C_{16},C_{17},C_{18}\}$ and $C_2=\{C_{21},C_{22},C_{23},C_{24},C_{25},C_{26},C_{27},C_{28},C_{29}\}$.

The determination of the evaluation set: an evaluation set is a collection of different evaluations of an object being evaluated. It is supposed that the evaluation set is T, and $T=\{T_1,T_2,T_3,T_4\}$. According to the general classification of financial data security levels in China, the security status is divided into four levels: safe, potentially unsafe, manifestly unsafe, and unsafe, which are recorded as T_1,T_2,T_3,T_4, respectively.

The determination of a set of evaluation factor weights: according to the allocation of indicators, it is assumed that S is the weight set of the complex system of financial security evaluation indicators. S_l respectively represent the weights occupied by the internal stability, macroeconomic stability and market risk subsystems of financial institutions, and weight s_{lk} is the value of each indicator, then there are:

$$S=(S_1,S_2,S_3)and\sum_{l=1}^{3}S_l=1,S_l\geq 0 \tag{10}$$

$$S_1=(s_{11},s_{12},s_{13},s_{14},s_{15},s_{16},s_{17},s_{18})and\sum_{l=1}^{8}s_{1l}=1,s_{1l}\geq 0 \tag{11}$$

$$S_2=(s_{21},s_{22},s_{23},s_{24},s_{25},s_{26},s_{27},s_{28})and\sum_{l=1}^{8}s_{2l}=1,s_{2l}\geq 0 \tag{12}$$

$$S_3=(s_{31},s_{32},s_{33})and\sum_{l=1}^{3}s_{3l}=1,s_{3l}\geq 0 \tag{13}$$

Judgment by a single indicator: the evaluation of a single metric is the process of determining how well that metric correlates with each security level. First, the critical value for each security level is determined. Then, through the security level of each index of the membership function, the affiliation of the index of each security level is calculated, so as to determine the degree of affiliation of the knowledge domain.

According to the above principles, a common membership function (the distribution diagram is a trapezoidal membership function) is used to calculate the membership function value of an indicator.

The membership calculation formulas for the positive indicators of safety, potential insecurity, apparent insecurity and insecurity are:

$$q_{lk}(T_1)\begin{cases}0 & t_0\leq c\leq t_2\\ \dfrac{c-t_2}{t_3-t_2} & t_2\leq c\leq t_3\\ 1 & t_3\leq c\leq t_4\end{cases} \tag{14}$$

$$q_{lk}(T_2)\begin{cases}0 & t_0\leq c\leq t_2\\ \dfrac{t_2-c}{t_3-t_2} & t_2\leq c\leq t_3\\ 1 & t_3\leq c\leq t_4\end{cases} \tag{15}$$

$$q_{lk}(T_3)\begin{cases} 0 & t_0 \le c \le t_1 \\ \dfrac{c-t_1}{t_2-t_1} & t_1 \le c \le t_2 \\ 1 & t_2 \le c \le t_4 \end{cases} \tag{16}$$

$$q_{lk}(T_4)\begin{cases} 1 & t_0 \le c \le t_1 \\ \dfrac{t_2-c}{t_2-t_1} & t_1 \le c \le t_2 \\ 0 & t_2 \le c \le t_4 \end{cases} \tag{17}$$

The calculation formulas for the membership degrees of negative indicators of safety, potential insecurity, apparent insecurity and insecurity are:

$$q_{lk}(T_1)\begin{cases} 1 & t_0 \le c \le t_1 \\ \dfrac{t_2-c}{t_2-t_1} & t_1 \le c \le t_2 \\ 0 & t_2 \le c \le t_4 \end{cases} \tag{18}$$

$$q_{lk}(T_2)\begin{cases} 0 & t_0 \le c \le t_1 \\ \dfrac{c-t_1}{t_2-t_1} & t_1 \le c \le t_2 \\ 0 & t_2 \le c \le t_4 \end{cases} \tag{19}$$

$$q_{lk}(T_3)\begin{cases} 0 & t_0 \le c \le t_2 \\ \dfrac{t_3-c}{t_3-t_2} & t_2 \le c \le t_3 \\ 0 & t_3 \le c \le t_4 \end{cases} \tag{20}$$

$$q_{lk}(T_4)\begin{cases} 1 & t_0 \le c \le t_2 \\ \dfrac{c-t_2}{t_3-t_2} & t_2 \le c \le t_3 \\ 0 & t_3 \le c \le t_4 \end{cases} \tag{21}$$

$q_{lk}(T_t)$ means C_{lk}, which belongs to the degree of security degree T_t (where $t=1,2,3,4$). q_t is the critical value of each safety level, and $q_0 \le q_1 \le q_2 \le q_3 \le q_4$. The membership alignments for this article are as:

$$Q=(Q_1,Q_2,Q_3)^Y \tag{22}$$

$$Q_1=(q_{11},q_{12},q_{13},q_{14},q_{15},q_{16},q_{17},q_{18},q_{19})^Y \tag{23}$$

$$Q_2=(q_{21},q_{22},q_{23},q_{24},q_{25},q_{26},q_{27},q_{28},q_{29})^Y \tag{24}$$

$$Q_3=(q_{31},q_{32},q_{33})^Y \tag{25}$$

Among them, $q_{lk}=\{q_{lk}(T_1),q_{lk}(T_2),q_{lk}(T_3),q_{lk}(T_4)\}$.

A comprehensive financial data security assessment model: in this paper, the weighted average fuzzy comprehensive evaluation model is used. When using this model to comprehensively analyze the financial data security situation, the impact of various indicators on financial data security would be fully considered. At the same time, the contribution of indicators with smaller weights is not ignored, so as to more objectively and truly reflect the financial data security situation and play a scientific management role in financial data security management. On the basis of the above analysis, a comprehensive evaluation model of financial data security based on weighted average fuzzy comprehensive evaluation is established. The model is based on the relational fuzzy matrix composed of the weights of each index calculated above and the evaluation results, and the model is calculated as follows.

$$D = SQ = (S_1, S_2, S_3)(Q_1, Q_2, Q_3)^Y = (s_1, s_2, s_3, s_4) \tag{26}$$

$$\begin{aligned} D_1 &= (s_{11}, s_{12}, s_{13}, s_{14}, s_{15}, s_{16}, s_{17}, s_{18}, s_{19})(q_{11}, q_{12}, q_{13}, q_{14}, q_{15}, q_{16}, q_{17}, q_{18}, q_{19})^Y \\ &= (s_{11}, s_{12}, s_{13}, s_{14}, s_{15}, s_{16}, s_{17}, s_{18}, s_{19}) \begin{bmatrix} q_{11}(T_1) & q_{11}(T_2) & q_{11}(T_3) & q_{11}(T_4) \\ q_{12}(T_1) & q_{12}(T_2) & q_{12}(T_3) & q_{12}(T_4) \\ q_{13}(T_1) & q_{13}(T_2) & q_{13}(T_3) & q_{13}(T_4) \\ q_{14}(T_1) & q_{14}(T_2) & q_{14}(T_3) & q_{14}(T_4) \\ q_{15}(T_1) & q_{15}(T_2) & q_{15}(T_3) & q_{15}(T_4) \\ q_{16}(T_1) & q_{16}(T_2) & q_{16}(T_3) & q_{16}(T_4) \\ q_{17}(T_1) & q_{17}(T_2) & q_{17}(T_3) & q_{17}(T_4) \\ q_{18}(T_1) & q_{18}(T_2) & q_{18}(T_3) & q_{18}(T_4) \\ q_{19}(T_1) & q_{19}(T_2) & q_{19}(T_3) & q_{19}(T_4) \end{bmatrix} \\ &= (d_{11}, d_{12}, d_{13}, d_{14}) \end{aligned} \tag{27}$$

$$\begin{aligned} D_2 &= (s_{21}, s_{22}, s_{23}, s_{24}, s_{25}, s_{26}, s_{27}, s_{28}, s_{29})(q_{21}, q_{22}, q_{23}, q_{24}, q_{25}, q_{26}, q_{27}, q_{28}, q_{29})^Y \\ &= (s_{21}, s_{22}, s_{23}, s_{24}, s_{25}, s_{26}, s_{27}, s_{28}, s_{29}) \begin{bmatrix} q_{21}(T_1) & q_{21}(T_2) & q_{21}(T_3) & q_{21}(T_4) \\ q_{22}(T_1) & q_{22}(T_2) & q_{22}(T_3) & q_{22}(T_4) \\ q_{23}(T_1) & q_{23}(T_2) & q_{23}(T_3) & q_{23}(T_4) \\ q_{24}(T_1) & q_{24}(T_2) & q_{24}(T_3) & q_{24}(T_4) \\ q_{25}(T_1) & q_{25}(T_2) & q_{25}(T_3) & q_{25}(T_4) \\ q_{26}(T_1) & q_{26}(T_2) & q_{26}(T_3) & q_{26}(T_4) \\ q_{27}(T_1) & q_{27}(T_2) & q_{27}(T_3) & q_{27}(T_4) \\ q_{28}(T_1) & q_{28}(T_2) & q_{28}(T_3) & q_{28}(T_4) \\ q_{29}(T_1) & q_{29}(T_2) & q_{29}(T_3) & q_{29}(T_4) \end{bmatrix} \\ &= (d_{21}, d_{22}, d_{23}, d_{24}) \end{aligned} \tag{28}$$

$$\begin{aligned} D_3 &= (s_{31}, s_{32}, s_{33})(q_{31}, q_{32}, q_{33})^Y \\ &= (s_{31}, s_{32}, s_{33}) \begin{bmatrix} q_{31}(T_1) & q_{31}(T_2) & q_{31}(T_3) & q_{31}(T_4) \\ q_{32}(T_1) & q_{32}(T_2) & q_{32}(T_3) & q_{32}(T_4) \\ q_{33}(T_1) & q_{33}(T_2) & q_{33}(T_3) & q_{33}(T_4) \end{bmatrix} \\ &= (d_{31}, d_{32}, d_{33}, d_{34}) \end{aligned} \tag{29}$$

Among them, $d_{lt} = \sum (s_{lk} q_{lk}(T_t)), d_l = \sum (S_l D_l)$.

For the convenience of comparison, it is normalized as:

$$D' = (\frac{d_1}{n}, \frac{d_2}{n}, \frac{d_3}{n}, \frac{d_4}{n}) = (d_1', d_2', d_3', d_4') \quad (30)$$

Among them, $n = \sum_{t=1}^{4} d_t and \sum_{t=1}^{4} d_t' = 1$.

The determination of security status: based on the results of the comprehensive evaluation model calculated above, this paper determines the security status of China's financial data and the security level of the three subsystems based on the eigenvalue method.

3. Experiment of Green Financial Data Security and Legal Guarantee System

3.1 Economic Benefits of Green Finance Development

(1) Green finance and economic growth

Production and life bring a lot of carbon emissions and a lot of environmental pollution, which has become the main obstacle to the further development of China's economy. The government as a provider of public goods is directly responsible for public goods such as resources and the environment. As the government attaches more importance to environmental protection, the investment in environmental protection is also increasing. It can be seen from Table 1 that the total investment in pollution control in China in 2009 reached 452.55 billion yuan, which far exceeded the GDP growth rate in the same period; the proportion of pollution control investment in GDP rose steadily from 1.023% in 2000 to 1.330% in 2009. It can be seen from Figure 6 that the direct economic loss of pollution reached a peak of 434 million yuan in 2009, and the compensation for pollution accidents also reached a peak of 84 million yuan in 2006.

Table 1. Statistics on China's pollution control indicators over the years

years	GDP (100 million yuan)	Investment in pollution control (100 million yuan)	Investment in pollution control as a percentage of GDP (%)
2000	99214.8	1015.0	1.023
2001	109655.4	1106.8	1.009
2002	120332.9	1267.4	1.053
2003	135823.0	1627.9	1.199
2004	159878.5	1010.0	0.632
2005	184937.6	2388.2	1.291
2006	217314.6	2566.1	1.181
2007	265810.5	3387.8	1.275
2008	314045.6	4490.5	1.430
2009	340507.1	4525.5	1.330

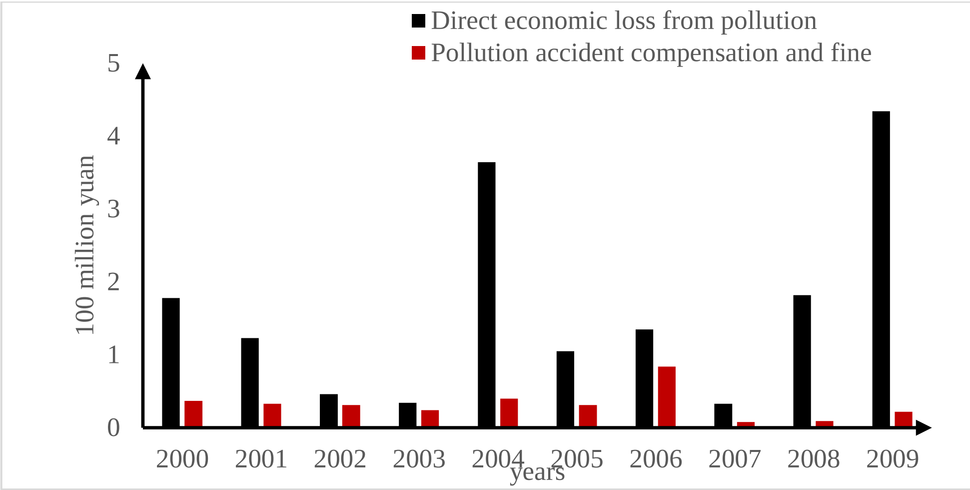
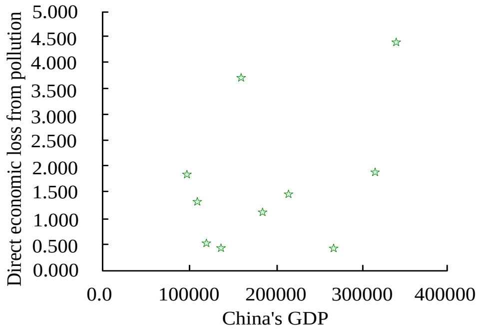


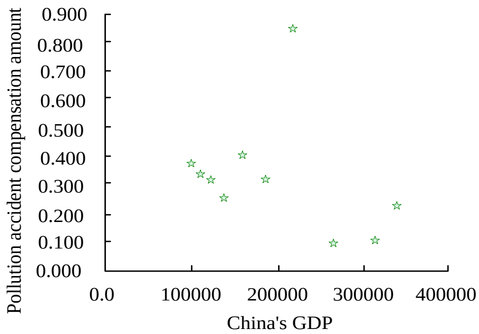
Figure 6. Investment in direct economic losses from pollution and compensation for pollution accidents (100 million yuan)

Of course, to protect the environment and support the development of low-carbon and environmentally friendly industries, only the efforts of the government are not enough. It also requires the support of financial institutions and other industries, as well as the response and cooperation of the entire society. The government is very supportive of promoting green financing. First of all, environmental financing can be used for the government to participate in some environmental protection projects, which reduces the government's financial burden to a certain extent and is in line with the government's development goals.

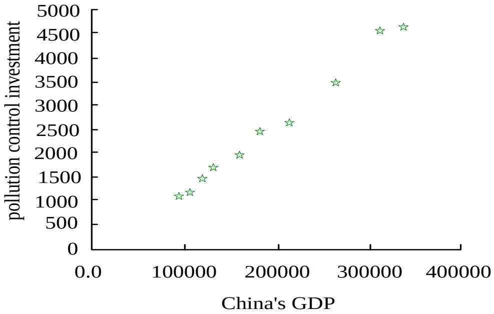
From the scatter plot distributions in Figure 7, it was obvious that the distribution of China's GDP and environmental pollution control investment was linear (Figure 7(c)), while the other two groups were irregularly distributed (Figure 7(a), Figure 7(b)).



(a) Scatter plot of pollution direct economic loss and GDP



(b) Scatter plot of compensation and fines for pollution accidents and gross domestic product



(c) Scatter plot of pollution control investment and GDP

Figure 7. Scatter plot of pollution control indicators

(2) Low-carbon economy

Conventional theory holds that a stock is considered overvalued and riskier if its P/E ratio is high. Of course, it has also been assumed that a high P/E ratio means that the market predicts faster earnings growth in the future and a higher level of future earnings per share, and the P/E ratio is an early reflection of this trend. It needs to be considered that the price-earnings ratio is a dynamic indicator, so the annual average stock price in 2021 was selected as the numerator to calculate the annual average price-earnings ratio. From Table 2, it can be seen that the average price-earnings ratios of the low-carbon economy and environmental protection industries were 50.702 and 53.557, respectively, which indicated that the stocks of the low-carbon economy and environmental protection sectors were sought after by the market, but the risks were also greater.

Table 2. List of indicators for fundamental analysis

	Average earnings per share (yuan)	Average price-earnings ratio	average price-to-book ratio
Low-carbon economy	0.541	50.702	5.111
Environmental protection industry	0.594	53.557	3.585
cement industry	0.640	24.158	3.431
coal industry	0.784	31.435	4.513
Textile industry	0.220	49.429	2.804
Food Industry	0.451	47.913	4.117
Machinery Industry	0.515	52.554	4.079
digital information	0.243	43.851	4.323

Profit growth rate refers to the growth rate of net profit, which is an important indicator to measure the company's current profitability and potential growth forecast. The total industry net profit growth rate from 2019 to 2021 was calculated and took 2021 as the base period. The results showed that the total profit growth rate of the low-carbon economy sector and the environmental protection sector was 93.51% and 70.46%, ranking first and third respectively, which indicated that the industry's profitability is relatively high. Table 3 showed that among the eight major industries, only low-carbon and environmental protection industries, cement and machinery were the industries that can achieve two consecutive years of profit growth in 2020 and 2021. The profitability of the low-carbon industry in 2021 increased by more than 70 percentage points compared with 2020, which indicated that the coal industry not only had better profitability, but also had greater growth potential.

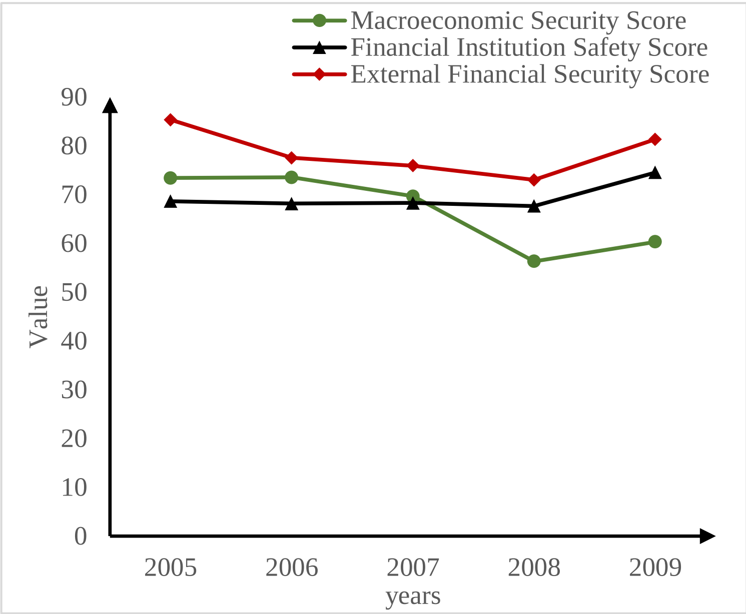
Table 3. Industry Profit Growth Rate

	Overall profit growth rate (%)	Profit growth rate in 2020 (%)	Profit growth rate in 2021 (%)
Low-carbon economy	93.51	9.44	77.18
Environmental protection industry	70.46	21.91	40.11
cement industry	82.88	19.35	53.53
coal industry	32.11	57.88	-16.13
Textile industry	-35.66	-47.38	22.56
Food Industry	32.29	-18.03	61.75
Machinery Industry	40.44	37.88	2.07
digital information	-20.77	-31.51	15.94
low carbon economy ranking	1		
Environmental protection industry ranking	3		

3.2 Financial Data Security Evaluation

According to the weight calculation of the financial data security assessment system, the financial institution security subsystem had the highest proportion among the three subsystems, at 54%; the second largest share was external financial security, at 33%; the lowest percentage was macroeconomic security at 13%.

The security status of China's financial security rating subsystem from 2005 to 2014 was analyzed in detail. After the summary, the score table of each subsystem is obtained as shown in Figure 8.



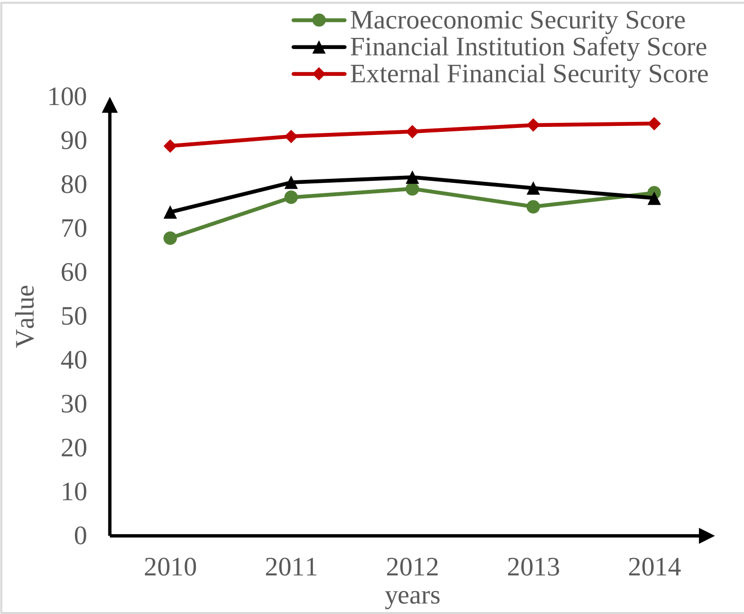


Figure 8. Scoring of each subsystem

From Figure 8, it can be seen that during the ten years from 2005 to 2014, the three main subsystems of China's financial data security all belonged to the basic security scope. Overall, the safety scores of the three showed a specific pattern: from 2005 to 2008, the ratings of the three subsystems decreased; from 2009 to 2012, the three subsystems all rebounded, and from 2013 to 2014, the scores of the three subsystems decreased again (external financial security is on an upward trend). Specifically, the macroeconomic security subsystem was in a worse position than the other two subsystems, which may be due to the unoptimistic development of China's real economy and the slowdown in GDP growth in recent years; on the other hand, external financial security was in a relatively good position, with scores above 80 being in the security zone for seven of the ten years. This was because China's exchange rate has been fluctuating in the safe zone in recent years under the policy of stabilizing and strengthening foreign exchange. China's opening to the outside world has driven the rapid development of China's foreign trade and the rising trend of current account balances, and the concept of "Made in China" has been recognized worldwide. In addition, financial institution safety scores showed an upward trend between 2005 and 2012. This paper argued that this was due to China's policy of stabilizing the safety of financial institutions in recent years and the positive development of Chinese financial institutions. In contrast, financial security scores showed a downward trend between 2013-2014. This was largely related to the rapid development of Internet finance in China in recent years. This has had a huge impact on traditional financial institutions, especially in the past two years, which forced them to accelerate the pace of transformation and reform.

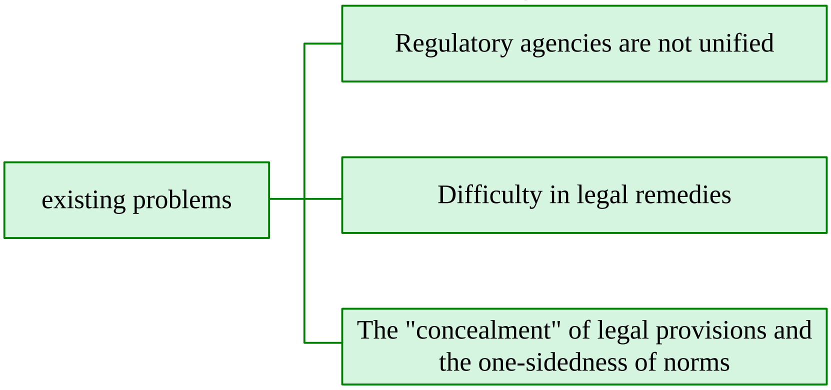
During the period from 2005 to 2010, the overall financial security situation in China was basically safe, with a score between 60 and 80, and the scope of the basic security zone was [50,80]; During the period from 2011 to 2014, China's financial security situation was generally safe, with a score between 80 and 90, and the safety zone range was [80, 100]. From the overall trend, China's financial security showed a downward trend from 2005 to 2008, but an upward trend from 2008 to 2014. China's financial security score in 2008 was the lowest in the past ten years. Although China was not affected by external factors due to its low degree of financial openness at that time, the outbreak of the economic crisis also posed a certain threat to China's economic security. The main reason why China's financial security score in 2006 was lower than in 2005 was mainly because

China opened up many financial services in response to its WTO commitments, thereby increasing the potential uncertainty, which was also reflected in the score to a certain extent. With the continuous advancement of economic globalization, China would inevitably be affected. The overall financial security environment has deteriorated, which has led to a decline in the level of financial security. The aggravation of the financial crisis made the subprime mortgage crisis in 2008 have a very serious impact on the financial development environment of countries and regions in the world, and the overall economic development was hindered to a certain extent. At the end of 2008, under the impetus of the Chinese government's US$4 trillion investment plan, the macro economy recovered. In 2009, China's financial security rating showed a positive recovery. Since then, from 2010 to 2013, China's financial security score has steadily improved. This paper believed that this is mainly due to the effectiveness of China's financial system reform in recent years, the efficient operation of the financial system, the healthy development of the economy, and the government's policies to stabilize financial security and financial security. The favorable macroeconomic and microeconomic development environment has also contributed to China's financial security in recent years. The government's policies aimed at stabilizing financial security and a favorable macroeconomic and microeconomic environment have also contributed to China's positive financial security posture in recent years.

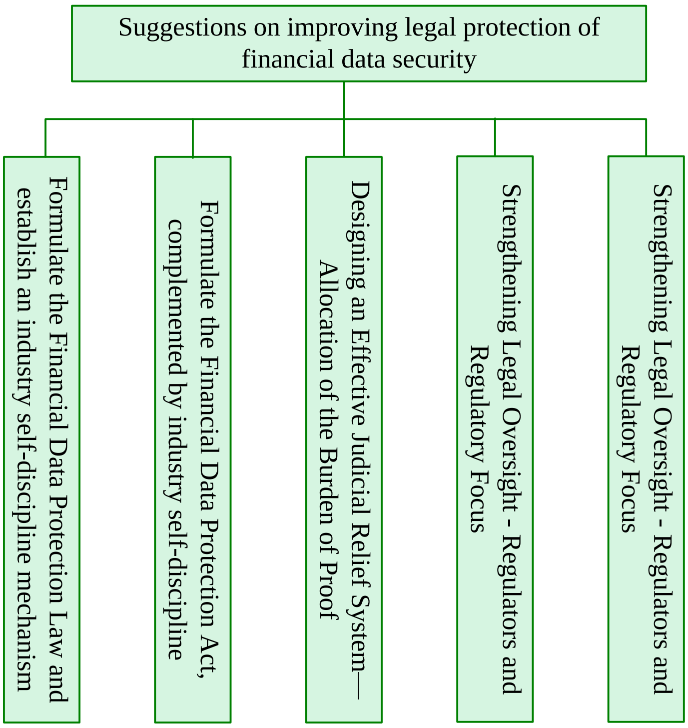
3.3 Legal Protection System

The law is authoritative and stable, and once it is implemented, it would have a profound impact on the country and its citizens. For the state, the law is the basis for the management of state and social affairs, and the guarantee for the normal operation of the country; for the citizen, the law is the guarantee for the protection of their rights. The formulation and modification of laws are related to the authority and stability of laws, and are important issues that need attention. Therefore, in response to changing social realities and new problems, the existing legal system should be exhausted to find solutions instead of rushing to formulate new laws. After all, the entire legal system is coordinated, and one issue concerns the entire institution. The passage of new laws necessarily affects existing laws.

For all the problems posed by financial data security, it is important to first thoroughly examine whether existing legislation is sufficient to address them. If all efforts have been exhausted and nothing can be done, consideration should be given to amending the law and passing new legislation. However, there are still some serious problems with the existing law as shown in Figure 9(a), and some suggestions for improvement are shown in Figure 9(b).



(a) Existing problems



(b) Recommendations

Figure 9. Existing problems and recommendations for financial data laws

In summary, it can be concluded that although the current law has played a role in protecting the security of financial data, and this protection is not perfect due to the limitation of the scope and method of legal adjustment in traditional departments. While modifications can be made to address specific issues in individual sectoral laws, this approach can only address temporary difficulties. The essence of the problem lies in the serious imbalance of power between individuals as financial data subjects and state agencies and commercial institutions that mainly collect, process and use financial data, and the subject's financial data is naturally in a weak position. In this case, the interests of individuals, the protection of financial data, the interests of state agencies and commercial organizations, and the use of financial data are inevitably violated, which would further exacerbate financial data security issues. A more balanced situation can only be achieved by introducing systematic rules for the use of financial data to regulate the collection, processing and use of personal data by state agencies and commercial organizations, and to give individuals direct rights to protect their own interests. In this way, the use of financial data can also effectively protect the security of personal data.

4. Conclusions

In the context of the wide application of big data, the potential value of financial data has become increasingly prominent. In order to capitalize on this potential value, commercial organizations and governments are experimenting with the development and use of personal data. With the rapid development of financial markets, potential risk factors also emerge. From the perspective of financial data security, it is an inevitable trend in China to build a long-term mechanism for financial data risk prevention that takes into account the needs of the times. The development of a low-carbon economy and the support of low-carbon industries require a large amount of capital to be invested in R&D and equipment production. In terms of financing, part of the burden should be borne by governments, especially guidance and demonstration; most of the rest must come from the financial sector. Therefore, the development of ecological finance has far-reaching significance.

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