

## Research Article

# Legal Modeling Approach of Big Data Transaction Management in the Perspective of Digital Economy

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The rapid development of digital economy puts forward theoretical and practical requirements for the construction of legal model of big data transaction management (BDTM). The new problems of ambiguous data ownership, privacy leakage, chaotic digital transaction order, and low nationalization in the context of big data transactions have largely restricted the role of China's big data transaction market and related laws and regulations and are not conducive to promoting the scientific and standardized development of China's digital economy. In this paper, we firstly analyze the connotation, importance, and necessity of the construction of legal model of big data transaction in the era of digital economy from the basic connotation of legal model. Then, we analyze the need to adhere to the principles of systematization, security, and openness in the construction of legal model of big data transaction management and focus on four methods of contract law, market behavior, replication behavior, and dispute resolution in the construction of legal model of big data transaction management. Finally, we summarized the conclusions of this paper. The conclusions of this paper are important for promoting the transformation of digital resources into effective data elements and advancing the scientific and standardized development of China's digital economy.

## 1. Introduction

With the rapid development of the digital economy, the digital resources, such as big data, are gradually becoming a new type of production factor, which, unlike traditional factors such as labor, capital, and technology, has a comprehensive and unstoppable impact on the social economy. Therefore, it has a huge impact on social production and life. 2020 "Opinions of the State Council of the Central Committee of the Communist Party of China on Building a More Perfect Institutional Mechanism for Market-Based Allocation of Factors Data" is regarded as an important factor of production, and the development of "big data" trading center [1] business model is emphasized to optimize the rational allocation of factors in the market. This indicates that in the rapid development of the digital economy, big data has become an important and indispensable part of China. From its connotation, the digital economy platform is a new type of economic organization in the era of digital economy with

data elements as its core, which has an important role in the rational use of technology and voluntary integration and deployment. However, there are pros and cons of all the opposite things. Although the momentum of big data transactions in China is relatively strong, there are still some problems involving legal aspects. For example, the data attribution right is unclear, the digital trading market is in disorder, the data circulation mechanism is poor, and the internationalization of digital trade is not high; these problems restrict the benign development of China's big data trading market, and the problems behind them can only be effectively solved by integrating legal issues. Therefore, how to build a reasonable legal model approach to the management of big data transactions according to the background and realistic requirements of the era of digital economy becomes a more important issue. This is because only by establishing a reasonable legal model of big data transaction management can we scientifically realize the protection of big data rights and interests, isolate the reasonable use of data

according to law, guarantee the free flow of data in an orderly manner according to law, and promote the healthy and benign development of data element market [2]. In fact, only by analyzing the process of big data transaction from the dual dimensions of legal dimension and technical dimension and dealing with the problems arising from the process of big data transaction can we ensure the security and free flow of big data transaction [3, 4]. And for when the data transaction problem, we should and must unify the legal regulation and big data technical requirements into a systematic analysis framework and adopt a reasonable legal model approach to its rigorous legal and technical analysis in order to be able to investigate and deal with illegal as well as gray area data transactions from the level of big data transaction content and to release the development space of big data transactions. In summary, the technical route of the research content of this paper is shown in Figure 1.

## 2. Connotation and Significance of the Construction of Legal Model of Big Data Transaction Management

*2.1. Basic Concept and Connotation.* Broadly speaking, the legal model of big data transaction management is a model that applies legal models to the process of managing big data transactions, which itself does not have a strict academic definition. It is mainly involved in e-commerce, digital copyright transactions, and commercial banks' participation in securities investment funds aspect, and so the model can be regarded as an important application of legal model in the field of big data transactions. However, the model is not a simple application of the legal model, but has its own special characteristics.

The legal model of big data transaction management is an old concept which based on the "legal model" proposed by Yoshitaro Kitagawa (1987) [5]. First of all, a legal model is a model formed by contractuality, which is a common feature of laws and legal systems all over the world. To provide top-level design reference and practical reference for legal theory and practice is the main important role of legal models. In the early days, the legal model did not form a strict unified understanding, and scholars at that time believed that the important feature of the legal model was contractuality. With the development of the times and the formation and maturity of several major legal systems, some new legal models have gradually emerged in the economic society that are difficult to explain, for example, technology and ethics, the rapid transformation of society and legal theory lagging behind social practice [6], the failure of legal regulation, and other important realities. This also meant that the legal texts of the time were difficult to effectively solve social for, so scholars of the time tried to seek a universal legal model that could solve social problems [7]. Based on the contractuality and universality of the legal model, Saburo Raisu tried to construct a legal model to explain legal theories and emphasized the weight of universality and difference; that is, social reality should be analyzed according to the legal sources, and the same legal norms should be used as a criterion, and by seeking the

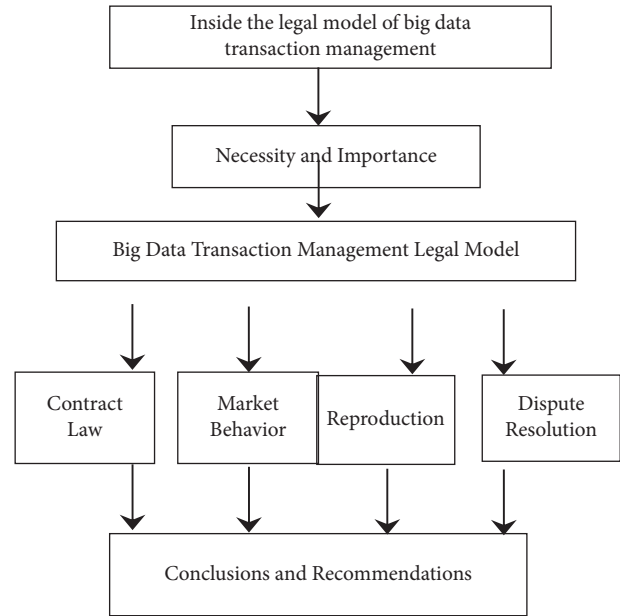


FIGURE 1: Technology roadmap.

difference between individual facts [8], a normative theory can be designed that is both consistent with specific problems and universally applicable. The legal model of big data transaction management is a model that applies the legal model to the process of big data transaction management, in which big data transactions mainly involve e-commerce, digital copyright transactions, and commercial banks' participation in securities investment funds [9, 10], so the model can be regarded as an important application of the legal model in the field of big data transactions. However, the model is not a simple application of the legal model, but has its own special characteristics. First, the legal model of big data transaction management is a systematic and standardized research system for solving the legal aspects of big data transactions [11], and the important reason for its emergence is that traditional legal provisions cannot effectively and scientifically solve new socioeconomic problems because they are in fact beyond the scope of application of traditional legal provisions. The construction of legal models can meet the problems that human society cannot cope with by amending modern law. Secondly, from the doctrinal point of view, many new socioeconomic problems are beyond the scope of application of traditional law, which means that traditional law lags behind the social practice and urgently needs to adapt to the new situation, and big data transaction is one of the more prominent and important phenomena. The legal model of big data transaction management actually applies the legal model to the field of big data transaction for analysis so as to effectively adjudicate the relevant cases [12, 13]. Finally, the understanding of the connotation of the legal model of big data transaction management cannot be viewed only from a static perspective, but needs to be understood from a dynamic evolutionary perspective. That is, judicial decision-making needs to cross national boundaries and the law itself [14], and the theory behind it is more or less mixed with some

ideologies, while the process of big data transactions itself is characterized by temporal continuity and dynamic evolution, so the legal model of big data transaction management must be viewed from a dynamic developmental perspective.

**2.2. Necessity and Importance.** The construction of the legal model of big data transaction management has important theoretical and practical significance both for promoting the construction of Chinese jurisprudence system, better serving the legal time, providing scientific analysis framework for legal texts, and effectively preventing and controlling the risks of data transactions.

First of all, the legal model of big data transaction management is a scientific method to promote the Chinese jurisprudence system to absorb the excellent theories of the West so as to better serve the legal practice of China. Generally speaking, the Chinese jurisprudence system has certain differences and deficiencies compared with the Western Europe and the United States, so it should be regarded as an important progress in the field of legal research to borrow the Western legal models from the field of big data transactions and apply them to the local legal practice in China. In this process, the legal model of big data transaction management can provide a new systematic and standardized research on data legal issues such as civil and commercial, competition regulation, and state-owned enterprises, which can obviously make up for the shortage of Chinese jurisprudence system and provide important practical value for Chinese counterpart legal practice.

Secondly, the legal model of big data transaction management can provide a framework for legal texts to be used legally and a normative analysis system for solving new problems. The legal model is a normative new legitimacy standard use framework, which can be applied to the field of big data transaction management, and the relevant rights contained in it can make the legal regulation and the existing legal needs effectively integrated [15] and finally realize the new interpretation of the social and economic legal field problems and also provide a new breakthrough path to accelerate the promotion of China's legal system construction.

Again, another importance of the legal model of big data transaction management is that it can give full play to the role of data and effectively prevent and control the risk of data transactions. If a legal model is not established for big data transactions, then data management becomes more difficult and cannot realize effective management of data, nor can it prompt users to use and manage data safely and in accordance with the regulations within the scope of the law, the latter of which will generate serious risks of data flow. Therefore, it is necessary and important to build a legal model of big data transaction management in both technical and legal dimensions so that the intrinsic value of the data itself can be effectively used, the data flow risk can be scientifically and effectively prevented and solved, and the legal cases can be efficiently resolved to ensure the legitimate rights and interests of the people [16].

Finally, the market characteristics of big data transactions in the context of digital economy determine the theoretical

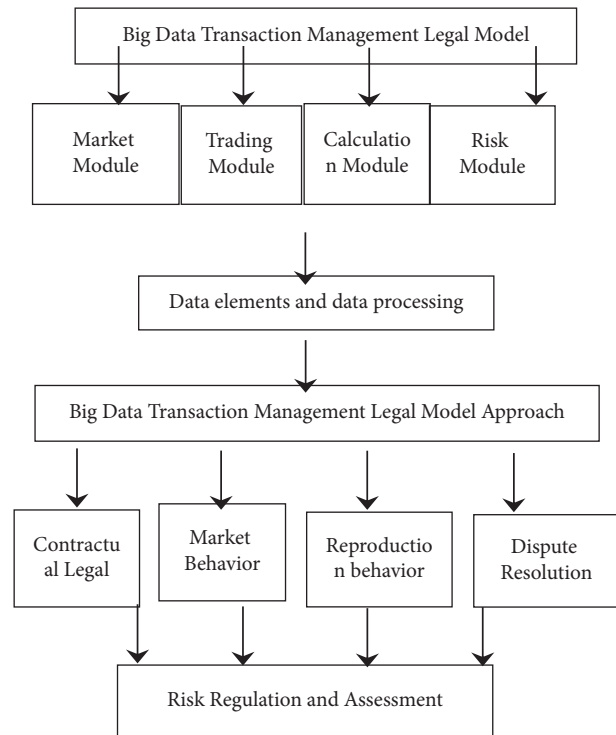


FIGURE 2: Big data transaction management approach model and methodology.

model approach behind it. That is to say, similar to other trading behaviors, big data transaction is just a market process in which big data elements flow in the market to generate circulation value and thus trigger reasonable allocation of resources, and the legal model behind the process needs to be analyzed from its own operational characteristics. The importance of the legal model of big data transaction in the context of digital economy lies in the fact that with the completion of the transaction of large amount of data, it is difficult to analyze the legal behaviors in the transaction process reasonably and efficiently by using traditional methods, and thus the necessity of establishing a legal model for research arises. The legal model of big data transaction management is backed by the formation of a large number of data transaction processes, whose process involves data collection, storage, transmission and application, and so on. We can use this to concretize and visualize the management of the risk module, transaction module, calculation module, and evaluation module of big data trading. The legal model is then reflected in the model for the lack of data legislation at this stage; the model is able to take the attribution of data, market order, and legal responsibility as legal elements for the specific construction within the module. In summary, the legal model module of big data transaction management is shown in Figure 2.

### 3. Principles Adhered to by the Legal Model of Big Data Transaction Management

**3.1. Systematization Principle.** The legal model of big data transaction management should adhere to the principle of systematization in the process of construction. In other

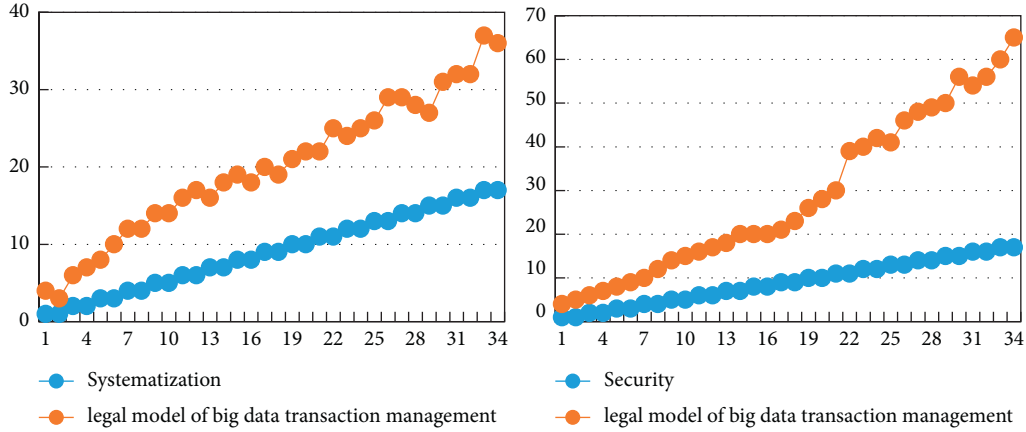


FIGURE 3: Big data transaction management approach and systematization, security.

words, when we study the problem of big data transaction management model, we need to conduct rigorous systematization research based on the relevant research of legal theory, which is only more conducive to the construction of the model and the free flow of data and convenient data transactions. From the existing research, there are problems such as systematic dislocation and insufficient coordination in China's big data transaction management laws. Therefore, under the guidelines of adhering to data power protection and free flow and security of data, China should regulate data transactions as a whole. This process needs to ensure and adhere to the principle of systematization because it may be difficult to ensure the safe flow and timely protection of personal information and data transactions if the principle of systematization is not adhered to. For example, some scholars point out that the provisions of the Civil Code of the People's Republic of China (hereinafter referred to as the Civil Code) are again too broad for personal information protection, and the administrative penalties and statutory liabilities of illegal and noncompliant enterprises are not yet clearly defined, which can cause the contraction of the data industry and the unfettered flow and convenience of personal data [17].

$$J_m = \sum_{i=1}^N \sum_{j=1}^C u_{ij}^m |X_i - C_j|^2, 1 \leq m < \infty, \quad (1)$$

where the range of  $m$  is a real number greater than 1;  $u_{ij}$  represents the membership degree, that is, the membership degree of  $X_i$  in the objective function  $j$ ,  $X_i$  is the  $i$ th data of  $n$ -dimensional measurement data, and  $C_i$  is the clustering center of  $n$  dimension.

$$u_{ij} = \frac{1}{\sum_{k=1}^C d_{ij}/d_{kj}^{2/(m-1)}}. \quad (2)$$

The Fuzzy classification from Internet of Things can effectively solve the interconnection between objects to objects, people to people, and people to objects.

**3.2. Security Principle.** Security is undoubtedly the primary principle adhered to by the legal model of big data transaction

management. Both in terms of the privacy of data transactions and the economic consequences of their leakage or illegal exploitation, security must be placed as the primary principle to ensure the ease and free flow of data transactions. On the one hand, the optimal operation of the digital economy requires a secure database, and if a secure transaction module will be difficult to construct due to insecure data or the existence of great risks, this will limit the rational application of the digital economy in socioeconomic life. On the other hand, because big data contains many micro-individuals' personal privacy or even national security and other important information, if the security is not guaranteed, then the risk exposed in the process of big data transaction will undoubtedly make of hazards and even endanger the whole national security. Therefore, adherence to the principle of security in the construction of the legal model of big data transaction management is an important principle to effectively prevent the leakage of personal information and privacy infringement and even avoid national security from being jeopardized. Without security, the legal model of big data transaction management and the free flow of data will not be effectively guaranteed.

$$E_k = 0.5 \sum_{i=1}^q (Y_i^k - C_t^k)^2, \quad (3)$$

where  $E_k$  represents the error between the expected value and the actual value of the neural network.

If represented graphically, the relationship between systematization and securitization and the legal model of big data transaction management is shown in Figure 3.

**3.3. Openness Principle.** The principle of openness is the basic guarantee for the legal model of big data transaction management to achieve effective international data connection and orderly flow of cross-border data. If the big data transaction is in a relatively closed environment, it is impossible to talk about the cross-border flow of data flow and the connection with the international market. In fact, at present, China's big data transaction market has a variety of problems such as chaotic transaction order and weak

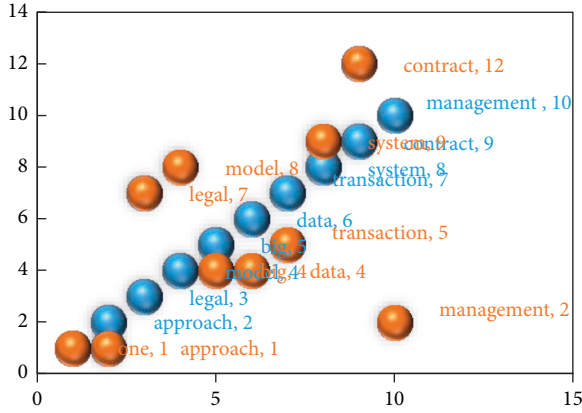


FIGURE 4: Big data transaction management approach and openness.

international discourse, which forms an unfavorable constraint on the management of big data transactions in China. Therefore, the principle of openness should be adhered to in the process of constructing the legal model of big data transaction management in order to accelerate the promotion of the extensiveness of big data transactions in the context of digital economy and realize the effective connection with the international market.

Suppose the network input layer is  $m$ , hidden layer is  $l$ , and output layer is  $n$ . The output of hidden layer is as follows.

$$h_{i,l} = f\left(\sum_{p=1}^m W_{i,l}^{(1)} x_{i,p} + b_{i,l}^{(1)}\right), p = 1, 2, \dots, m. \quad (4)$$

The output layer with input and output is shown in follows.

$$y_{i,l} = f\left(\sum_{q=1}^l W_{i,n}^{(w)} h_{i,q} + b_{i,n}^{(2)}\right), q = 1, 2, \dots, l. \quad (5)$$

The relationship between the openness principle and the legal model of big data transaction management can be represented in Figure 4. It can be seen from it that the two basically show a positive relationship.

#### 4. The Construction Method of Legal Model of Big Data Transaction Management

Contractual legal model method, dispute resolution legal model method, replication behavior model method, and market behavior model method are the four basic methods for the construction of legal model of big data transaction management. Fundamentally, the construction of the legal model of big data transaction management is a research method formed to solve the relevant legal issues arising from big data transactions in the context of digital economy. Therefore, by definition, the method is mainly to study the legal issues related to big data transactions through the methodological level, and the solution to these legal issues requires legal elements as the basic basis and criterion. If we analyze from this perspective, we can analyze the construction

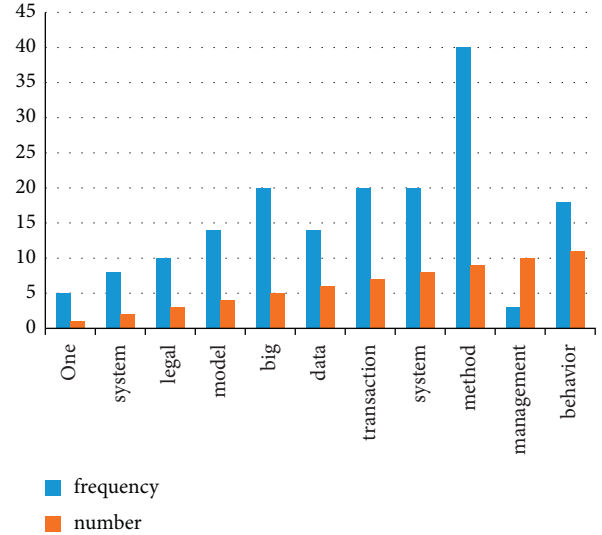


FIGURE 5: Frequency of major words of contractual legal modeling approach.

method of big data transaction management from the perspective of legal model, and this paper believes that it can be elaborated from the perspectives of contractual legal model method, dispute resolution legal model method, replication behavior model method, and market behavior model method, respectively.

**4.1. Contractual Legal Modeling Approach.** One of the approaches to the legal model for managing big data transactions is the contractual legal model. This model is mainly formed based on the system contract, and its principle lies in the use of computer systems to complete the system contract [18], which ultimately realizes the communication of artificial information. The contractual legal model is characterized by the fact that unlike ordinary contracts, this contract achieves the timely transmission of human will mainly through system procedures, for example, electronic contracts and electronic signatures inside the system contract, and so on, and even the copyright transaction process at the digital level is also applicable. If the contract legal model is applied to the management level of big data transaction, it is to reflect the big data transaction system in the form of creating electronic contracts and contracts, and then use the third-party mechanism to make a systematic fair and objective assessment of the whole model and study whether it conforms to the reasonable design at the level of technology and legal system. If it is unreasonable, or even if the system fails, it is necessary to readjust the legal model of big data transaction management contract so that various cases under new technology and new environment can be solved by the legal model. The frequency distribution of the words with high occurrence in this paragraph can be represented in Figure 5.

MAPE not only considers the error between the predicted value and the real value, but also shows the ratio of the error to the real value.



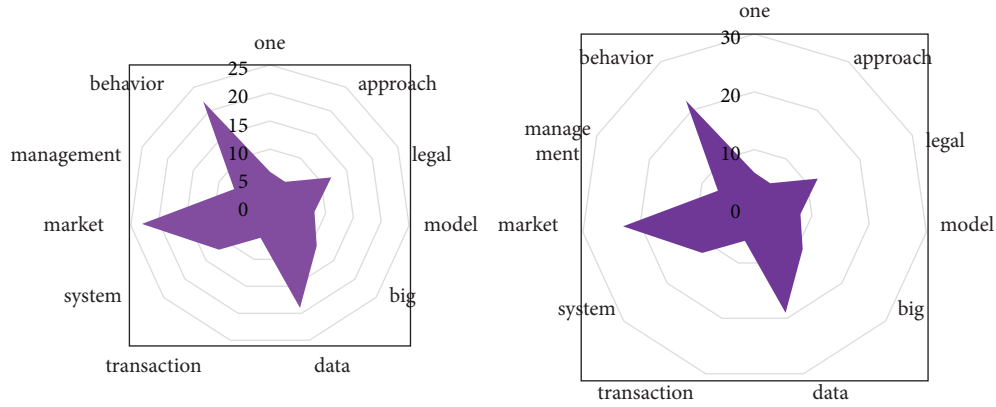


FIGURE 6: Frequency of major words of dispute resolution legal model and reproduction behavior approach.

$$\text{MAE} = \frac{1}{n} \sum_{i=1}^n |x_i - y_i|. \quad (6)$$

**4.2. Dispute Resolution Legal Model Approach.** One of the important approaches to the legal model of big data transaction management is the dispute resolution legal model. As the name implies, the dispute resolution legal model is created for solving legal disputes, so using this method in the field of big data transaction management also means that big data will generate certain dispute relationships in the transaction process, which will lead to legal disputes. Separately, big data transactions involve more data elements; for example, there is a class distinction problem in digital copyright transactions, and the solution of this problem is also applicable to e-commerce disputes, and the solution to the problem includes both litigation and arbitration. First of all, as an important composition of dispute resolution, litigation is mainly applied to the dispute problem of electronic contract in the field of big data transaction, and the jurisdiction of litigation applied by the law is determined by the place of performance of electronic contract, and not others. And in the context of the digital economy, as big data transactions usually in the network through the server to achieve data exchange, its own virtual digital characteristics determine the litigation jurisdiction should actually be based on the server decision. Secondly, since there are some new problems in the legal issues in the field of big data transactions, it is very important to use litigation to better solve the disputes arising in the process of big data transactions. Finally, big data transactions are different from ordinary commodity transactions, and its own electronic properties mean that it not only has circulation properties, but also has certain social and cultural characteristics, which will make it more difficult to solve the legal problems arising from the management of big data transactions, for example, how to claim the rights and interests of the collective management organization whose interests are damaged in the field of big data transaction, and its use in public interest litigation is clearly still controversial. In fact, the difference between the development of

technology and the social function of entertainment industry can cause some differences in the definition of litigation system and power. Figure 6 visualizes the frequency distribution of the words that appear higher in this paragraph; the left graph corresponds to the market behavior approach and the graph corresponds to the market trading behavior approach.

$$\text{MSE} = \frac{1}{n} \sum_{i=1}^n (x_i - y_i)^2. \quad (7)$$

RMSE is sensitive to outliers.

$$\text{RMSE} = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - y_i)^2}. \quad (8)$$

MSE will mainly evaluate the stability of the model through the square amplification error with large deviation

$$\text{MAPE} = \frac{100\%}{n} \sum_{i=1}^n \left| \frac{x_i - y_i}{y_i} \right|. \quad (9)$$

**4.3. Copying Behavior Model Approach.** The replicative behavior model is essentially a legal model, and applying it to the field of big data transactions becomes an important research method [19]. First, the replication behavior model is determined by the replicability of big data and the replication behavior of methods such as hand copying and printing techniques. Therefore, the model if used in the legal model is to show that the model mainly examines the replicability of legal elements. In the field of big data trading, especially in the context of digital economy, the core right of big data trading gradually develops from copy-centrism to contact right-centrism, whose core function is to achieve control over others' use of data, reflecting the capitalization process of big data trading market [20]. For example, in the era of digital economy, society at large has access to a large amount of data and information through computers, cell phones, and other smart devices. Second, the flow of a large amount of data in the context of the digital economy raises

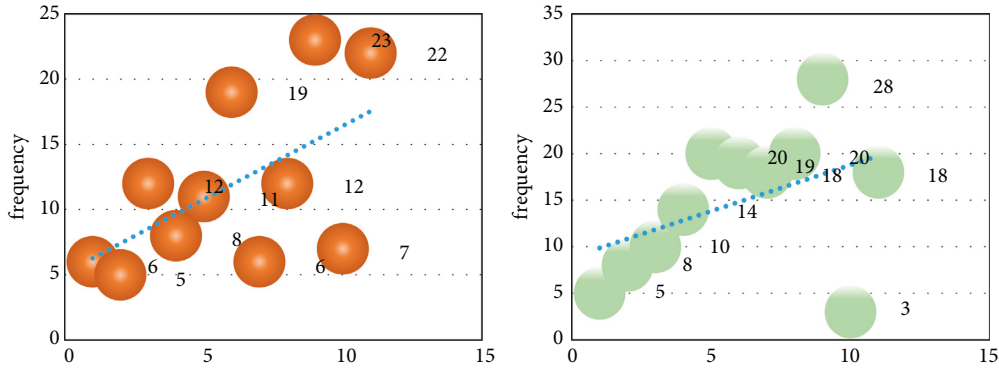


FIGURE 7: Frequency of major words of market behavior model approach.

the issue of access and access rights. If the data security is not guaranteed by illegal access or use, it will give rise to legal management problems on big data transaction management, which will give rise to the need of establishing a legal model to solve the problem of big data transaction. And in fact, the replication behavior model in the construction of big data transaction management is an important method to manage big data transactions from the replicability of big data as well as legal elements, and the method solves the related problems from the perspective of replication behavior as well as the dissemination of replication rights.

**4.4. Market Behavior Model Approach.** The market behavior model is an important approach to apply legal models in the field of big data transaction management [21]. The market behavior model is a method that relies on database technology to realize information and big data transmission, thus achieving a perfect combination of big data transactions and information digital technology [22]. Fundamentally, the digital economy perspective does not have a relevant market behavior model that is fully suitable for big data transactions, but is the result of borrowing from the market behavior model in the legal model [23]. Because the market behavior model is different from the traditional level of market transactions of products and services, the market in this model mainly deals with a large number of data streams and information technologies, and the legal model for managing big data transactions relies on these information technologies to achieve the legal management of big data [24]. Therefore, the market behavior model can be regarded as an important method for the construction of big data transaction management model, and its essence still has the characteristics of legal model. Figure 7 visualizes the frequency distribution of the words that appear higher in this paragraph.

$$s_k = \sum_{j=1}^n w_{kj}b_j - \theta_k, \quad (10)$$

where  $s_k$  is the connection weight between the  $j$ th neuron in the hidden layer.

In summary, the legal model construction of big data transaction management is a research method formed to

address the relevant legal issues arising from big data transactions in the context of digital economy. Therefore, by definition, the method is mainly to study the legal issues related to big data transactions through the methodological level, and the solution to these legal issues requires legal elements as the basic basis and criterion. One of the approaches of the legal model for managing big data transactions is the contractual legal model. This model is mainly formed based on the system contract, and its principle lies in the use of computer systems to complete the system contract, which ultimately enables the communication of artificial information. The contractual legal model is characterized by the fact that, unlike the ordinary contract, this contract achieves the timely transmission of human will mainly through system procedures. The dispute resolution legal model is created for solving legal disputes, so the application of this method to the field of big data transaction management also means that big data will generate certain dispute relationships during the transaction process, which will lead to legal disputes. Separately, big data transactions involve more data elements; for example, digital copyright transactions have the problem of distinction in class, and the solution to this problem also applies to e-commerce disputes, and the solution of the problem includes both litigation and arbitration. The model of copying behavior is determined by the reproducibility of big data and the copying behavior of methods such as hand copying and printing techniques. Therefore, the model if used in the legal model is to show that the model mainly examines the replicability of legal elements. In the field of big data trading, especially in the context of digital economy, the core right of big data trading gradually develops from copy-centrism to contact right-centrism, whose core function is to achieve control over others' use of data, reflecting the capitalization process of big data trading market. Market behavior model is an important method when legal model is applied in the field of big data transaction management. The market behavior model is a method that relies on database technology to realize information and big data transmission, thus realizing the perfect combination of big data transaction and information digital technology. The distribution graphs of higher occurrence of phrases in all big data transaction management legal models are shown in Figures 8 and 9, where

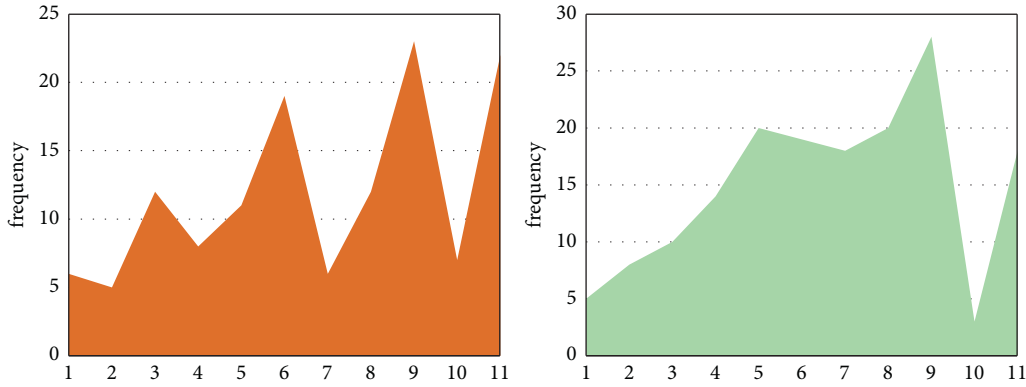


FIGURE 8: Frequency of major words of all legal model approach one.

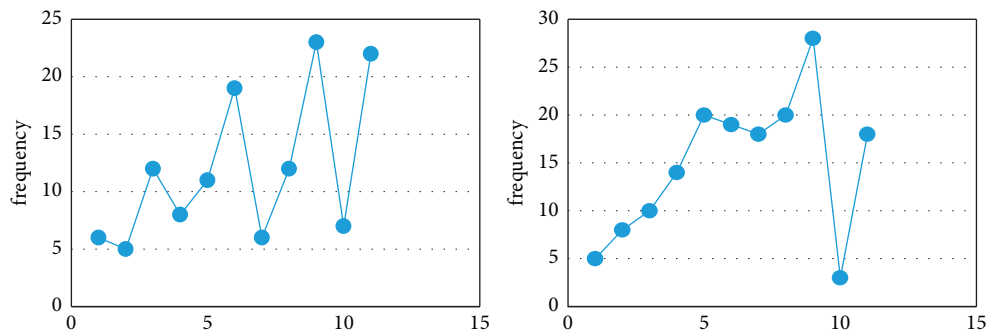


FIGURE 9: Frequency of major words of all legal model approach two.

Figure 8 corresponds to the cumulative distribution and Figure 9 corresponds to the folded distribution.

$$b_j = \frac{1}{1 + e^{-s}}, \quad (11)$$

$$X^{(1)}(k+1) = \left[ X^{(0)}(0) - \frac{\hat{u}}{a} \right] e^{-ak} + \frac{\hat{u}}{a}.$$

## 5. Conclusions

The rapid development of digital economy has prompted digital resources, typically represented by big data, to gradually become a new type of production factor, which, unlike traditional factors such as labor, capital, and technology, has a comprehensive and unstoppable impact on social economy and thus has a huge impact on social production and life. The important way to solve this problem is the need to build a reasonable legal model method of big data transaction management according to the background of the era of digital economy. In view of the above analysis, this paper argues that by establishing a legal model construction method for big data transaction management, it is conducive to effectively protecting the rights and interests of big data, ensuring the reasonable use of big data, and ultimately guaranteeing the effective and free flow of data according to the law and driving the healthy and sustainable development of China's data element market. And to solve the above problems, this paper believes that analyzing the

legal issues arising in the process of big data transaction from the dual dimensions of legal dimension and technical dimension is the key to ensure the security and free flow of big data transaction.

The rapid development of digital economy puts forward theoretical and practical requirements for the construction of legal model of big data transaction management. The new problems of ambiguous data attribution, privacy leakage, chaotic order of digital transactions, and low nationalization appearing in the context of big data transactions have largely restricted the role of China's big data transaction market and related laws and regulations, which is not conducive to promoting the scientific and standardized development of China's digital economy. In this paper, we find that the analysis of the construction of the legal model of big data transaction management needs to adhere to the principles of systematization, security, and openness, and we can explore how to construct the legal model method of big data transaction management in the context of digital economy from the perspective of four methods, such as contractual law, market behavior, replication behavior, and dispute resolution. The main purpose of constructing these methods is to solve the relevant legal problems arising from big data transactions, so it can help accelerate the standardization of big data transactions in China and promote the construction of the digital economy market system. The research in this paper provides reference to the methods of constructing legal models related to big data transactions.



## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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