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Research Article

Financial Management Performance Evaluation of Institutions on the Basis of Intuitive Fuzzy Information

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As government reform continues to progress, institutions are also involved in this wave of reform. To be specific, there have been changes in both the structure and scope of operations of institutions. The continuous improvement of the socialist market system has further stimulated the reform of financial management. Nowadays, unlike enterprises, the financial management system of institutions is backward and the subjective nature of financial management is poor, which is far from meeting the needs of reform and development. As a result, in order to enhance the efficiency of the use of funds in institutions, financial management should adapt to the needs of reform and development and follow the trend of reform. In addition, the financial management system should adapt to the development of the times and the concept of financial management should keep pace with the times. Furthermore, with the reform of China's political system and the rapid development of the market economy, there are more and more uncertainties in the management of the daily affairs of the grassroots institutions, which brings more and more pressure on the management of local financial affairs. As a result, in order to improve the efficiency of grassroots financial management and effectively adjust the financial management activities of government and departments at all levels, the transition from manual income and expenditure management to information technology has become an inevitable trend. To perform public duties, the important material basis of business units is fixed assets. In recent years, with the increasing proportion of fixed assets in the total assets of the society, the problems of fixed asset management in institutions have become more and more obvious, such as focusing on the management of budgetary funds but neglecting the management of fixed assets, irregular basic work, disconnection between business and financial management, unbalanced allocation, low efficiency in use, and low activation rate of fixed assets, as well as even loss of fixed assets. Financial management performance evaluation has achieved some research and practical results. As an extended field, performance evaluation of state-owned asset management is gradually being emphasized by theoretical and practical circles. As a public service function of institutions, it is necessary to have a material basis to perform. Performance evaluation of state-owned asset management in institutions can improve the level of asset management, achieve higher management performance, and ultimately realize the purpose of providing high-quality public services needed by society. As a result, this study takes this as the starting point to establish a performance evaluation model around the financial performance management funds of institutions.

1. Introduction

The nature of institutions is not for profit, but to serve the society, and the scope of services covers many aspects, such as science, education, culture, and health [1]. As a result, in China, the main social functions and institutions are business units. As shown in Figure 1, China's institutions are divided into administrative institutions and operational institutions. However, nowadays, most of the institutions are still funded by the state [2]. Therefore, the attributes of the institutions are owned by the state, and the institutions themselves are less involved in business activities. In other words, this nature somehow determines that the financial management of the institutions will be based on budget rather than operating income [3]. In the actual survey, it can be found that institutions are often easy to ignore the

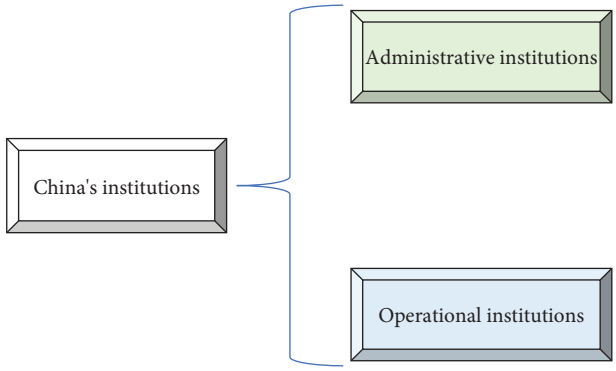

Figure 1: Component of China's institutions.

economic benefits of the institution [4]. In other words, the financial management work is not rigorous or the management activities are too one-sided, with accounting as the main focus and ignoring overall management [5]. At the same time, unit leaders do not pay much attention to financial work and focus on fulfilling social responsibilities. In fact, this is the main reason why the state spends a lot of money, but the institution feels the lack of funds and cannot obtain social benefits well [6].

In recent years, due to the influence of national policies and changes in relevant government departments, institutions have begun to pay attention to internal management and reform their systems [7, 8]. In this context, China's institutions have started to go out into the society and participate in the market competition and are no longer in a noncompetitive state under the protection of the government. Changing the original management concept and establishing a better management system, as well as adapting to the new situation of financial management will be the key issues to be solved by domestic institutions for a long time [9]. Nowadays, the main target of spending money on the activities of institutions is the society. As a result, they can fully perform their role as state institutions [10]. In fact, the purpose of financial management activities is to better integrate budgeting with actual asset management [11]. For example, in the area of public procurement, it is necessary to strictly control unnecessary purchases, which can speed up the operation of funds and improve their utilization. At the same time, risk awareness can be strengthened and a sound performance management system can be developed according to the actual situation of the unit. For the purpose of financial management, Chinese scholars have also put forward many feasible suggestions [12]. On the one hand, it is necessary to strengthen the accounting team. On the other hand, it is quite necessary to increase internal audits [13]. As a result, in order to improve the efficiency of the use of state funds in social welfare activities and to improve business performance, institutions should first improve their financial management theories [14]. Furthermore, they should apply advanced management concepts in order to social welfare activities as well as improve their practical skills [15].

With the political reform of our society and the rapid development of the market economy, there are more and more uncertainties in the management of the daily affairs of the grassroots institutions. At the same time, this has put more and more pressure on the management of local financial affairs [16]. As a result, in order to improve the efficiency of grassroots financial management and effectively adjust the financial management activities of the government and departments at all levels, the transition from manual income and expenditure management to information technology has become an inevitable trend [17]. However, traditional financial management relies heavily on manual processes. While recording budgets and accounts, accounting and auditing staff at all levels are needed to maintain an ever-increasing number of paper tickets [18]. The drawbacks are obvious: the workload is heavy, the preparation time is long, and the content is single and not comprehensive. From the perspective of the finance department alone, the budget must be consolidated and organized by the finance department after it has been submitted by all departments concerned [19]. Nevertheless, the budgeting methods used vary from department to department. In fact, coupled with the lagging nature of the work at the grassroots level, this can add to the uncertainty of the workload as finance is burdened with increasingly heavy adjustments as well as the need to constantly coordinate budget submissions across departments [20].

In fact, our institutions mainly provide social services to the public. By performing social functions, they can ensure that the needs of public utilities such as education, culture, and health are effectively met [21]. Therefore, the development of institutions is closely related to the management of state-owned assets. At the same time, the development of such units cannot be achieved without state-owned assets [22]. Looking at the current situation of state-owned asset management, we can see that there are still some problems, such as an inadequate system, unclear evaluation subjects and objects, imperfect evaluation indicators, and insufficient application of evaluation results [23]. As a result, how to strengthen the management of state-owned assets, evaluate the efficiency and effectiveness of the use of state-owned assets, and ensure that institutions can fulfill their social responsibilities more efficiently is the main research issue of this study [24]. In view of the shortcomings revealed in the management of state-owned assets, the application of a performance evaluation system for state-owned asset management to institutions can effectively solve these problems. It can promote asset management in institutions and improve the efficiency of using state-owned assets [25]. In addition, it can realize the combination of budget management and asset management, which is also a necessary way to deepen the government accounting reform.

Institutions cannot operate and develop without the support of state-owned assets. After all, only with sufficient state-owned assets can institutions fulfill their responsibilities, provide various public services to the public and society, meet the development needs of education, health, and culture, and ensure the smooth promotion of various public programs [26]. Strict management and control of state-owned assets can ensure that financial distribution meets the requirements of fairness and justice and that social order can be effectively maintained. However, at present, there are

many problems in the management of state-owned assets in China [27]. The reasons for these problems are that, on the one hand, the units themselves do not strictly follow the requirements of the new system and, on the other hand, it is expected that the problems of state-owned asset management will identify the imperfections of the current management system in China and propose some strategies and methods to solve them. In addition, there are only a few studies on the performance evaluation of state-owned asset management in public institutions, and most of the studies focus on the overall performance of administrative institutions, so it is expected that the study will add to the existing literature [28].

From the perspective of practical work, the establishment of a financial performance management evaluation system is a guideline for practical work [29]. Some problems were faced in practice, such as focusing on the management of budgetary funds but neglecting the management of fixed assets, high duplication rate of purchase, irregular basic work, inadequate specific systems, low efficiency of use, and low rate of asset revitalization, etc., which limit the development of fixed asset management in institutions. In addition, the new government accounting system has put forward new requirements for the classification, accounting, measurement, approval, and reporting of fixed assets. Faced with these problems and requirements, it is quite necessary to establish scientific and reasonable performance evaluation indexes from the perspective of performance evaluation, which can provide comprehensive feedback data [30]. Furthermore, it can make the fixed assets use the maximum efficiency, thus improving the level of fixed asset management in institutions and promoting the great development of fixed asset management in institutions.

Finance is a crucial department of a unit, and the normal operation of the unit cannot be achieved without the management of finance. In essence, financial management is value management. Initially, financial management was created with business activities, including financial activities and financial relations, and is a financial relations approach. The social attributes of business units, the industries they belong to, and the specific social environment are different, which directly determines the different ways of operating funds, but the final expression is the same, namely, financial management. Therefore, financial management is internal to the unit. It is also the basis and core of business unit management and is the pillar of business unit management. It is essential to study the current situation of financial management in institutions. To be specific, it is relatively important to analyze the current financial situations of public organizations at home and abroad and to learn from advanced management models and management concepts. After all, the introduction of positive management models as well as concepts should consider the national conditions of China. In other words, the financial management model needs to be adapted to the nature of local organizations in China. Ultimately, this can significantly improve the efficiency of capital utilization and business performance of public welfare organizations. At the same time, the reform of the financial management of public institutions can be a catalyst and a reference for the reform of other public organizations. This can promote the development of financial theory, which has great practical significance for individuals as well as institutions themselves.

2. Intuitive Fuzzy Information

2.1. Expression Form of Fuzzy Evaluation Information. In the process of comprehensive multi-indicator evaluation with complex fuzzy evaluation information, the evaluator should give the evaluation information value based on his own knowledge and experience and the objective situation of the evaluation object, no matter if it is a single person evaluation or group evaluation. In fact, the evaluation information is a complex fuzzy set based on intuitionistic fuzzy sets and hesitant fuzzy sets. With the introduction of intuitionistic fuzzy sets, Pythagorean fuzzy sets, and hesitant fuzzy sets, scholars have been expanding the existing fuzzy sets. As a result, more and more complex fuzzy evaluation information expressions are proposed in terms of the composition of affiliation and nonaffiliation functions and the composition elements of fuzzy sets, which are suitable for modern comprehensive evaluation processes. In addition, the expressions of subordinate and non-subordinate functions in terms of the interval, triangular, and trapezoidal numbers can reflect the fuzzy degree in the process of multi-indicator evaluation in a more detailed way. This makes it easier for the evaluator to provide comprehensive evaluation information on alternative solutions. As a result, the correlation between the indicators in the comprehensive evaluation process should not be neglected, and the existing solutions are mainly based on the Bonferroni mean as well as the Choquet integral. The process of the comprehensive evaluation method based on intuitive fuzzy information is shown in Figure 2.

Hamacher operations are a good alternative to algebraic products and algebraic sums. However, most of the existing fuzzy aggregation operators in fuzzy environments are based on algebraic operations. In this study, we use the Hamacher operator to aggregate probabilistic interval-valued hesitant Pythagorean fuzzy evaluation information and propose the probabilistic interval-valued hesitant Pythagorean fuzzy Hamacher operator rule to make the evaluation information aggregation more flexible. A new aggregation operator, the probabilistic interval-valued Pythagorean hesitant fuzzy Hamacher Choquet integral geometric mean operator, is also proposed, and the related properties of the operator are discussed. The comprehensive evaluation process based on intuition and hesitant fuzzy information is illustrated in Figure 3.

2.2. Trapezoidal Intuitionistic Fuzzy Evaluation Information. In social life, things are changing rapidly, and it is increasingly difficult for people to accurately grasp their development direction. This makes the shortcomings of the traditional multi-indicator comprehensive evaluation method come to the fore. In fact, the complexity and uncertainty of comprehensive evaluation are becoming more

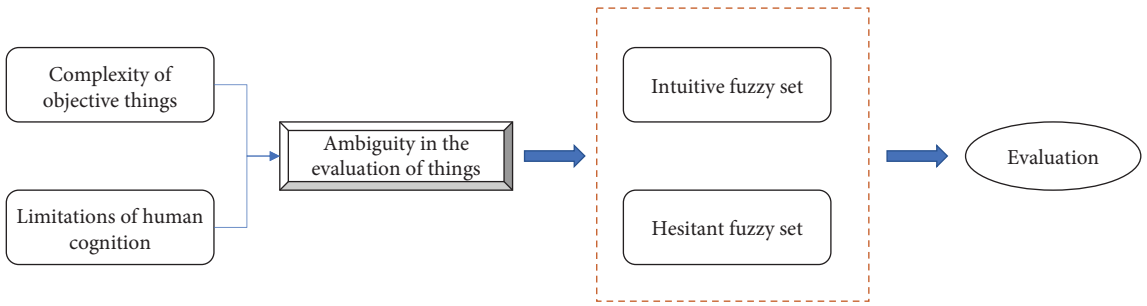

Figure 2: Evaluation method based on intuitive fuzzy information.

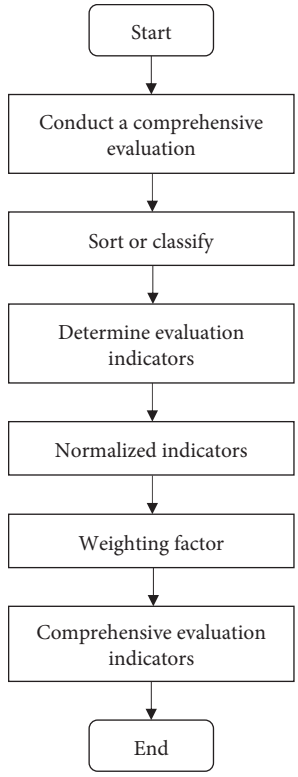

Figure 3: Comprehensive evaluation process based on intuition and hesitant fuzzy information.

and more obvious. As a result, the real-valued form of comprehensive evaluation information is replaced by fuzzy sets and intuitionistic fuzzy sets. Fuzzy comprehensive evaluation information reflects the process of the evaluator's brain and has a complete evaluation dimension of approval, disapproval, and abstention for the evaluation object.

Let $A = \{a_1, a_2, \ldots, a_n\}$ be a nonempty set; then, the fuzzy set is defined as follows:

$$F = \{\langle a, \mu_F(a)\rangle \mid a \in A\}, \tag{1}$$

where $\mu_F(a)$ refers to the affiliation of the element a in A belonging to F.

In addition to approval and disapproval, the intuitionistic fuzzy set can better fit the psychological activities of the evaluator. To be specific, it can express neither a favorable nor an unfavorable attitude toward the evaluation object according to its own perception, which ensures a more scientific and comprehensive evaluation process. However, with the rapid development of the social economy, the subordinate degree function of the intuitionistic fuzzy set with exact value and the non-subordinate degree function have large errors, which cannot well represent the complexity as well as the uncertainty of the comprehensive evaluation process of multiple indicators. As a result, the interval value contains more evaluation information than the exact value.

Obviously, the domains of both intuitionistic fuzzy sets and interval intuitionistic fuzzy sets are discrete sets. Its limitation is that it can only broadly represent the subordination and non-subordination functions of fuzzy sets. Therefore, it cannot express fuzziness and hesitancy at the same time. As a generalization of interval intuitionistic fuzzy sets, trapezoidal intuitionistic fuzzy sets can better portray the complexity of the comprehensive evaluation process. The trapezoidal intuitionistic fuzzy set is defined as follows:

$$\mu_{\tilde{z}}(a) = \frac{(a - z)\omega_{\tilde{z}}}{y - z}, \tag{2}$$

where $\omega_{\tilde{z}}$ represents the maximum degree of affiliation.

In addition to this, the trapezoidal intuitionistic fuzzy number can be represented in Figure 4.

3. Financial Management Performance Evaluation of Institutions

3.1. Demand Analysis. The main functions of the system can be basically determined through the demand research on the current situation of financial management of institutions. Figure 5 depicts the main use case of the system. To be specific, the whole use case consists of login management, user management, payroll management, budget management, account management, announcement management, and other modules.

The main purpose of login management is to complete the user login. The system is designed in such a way that only users authorized by the super user have the right to log in and view the system records of the corresponding department. In addition, each user can modify their personal information after logging in. Users can only perform other business operations if they have successfully logged in. The specific login management use case is shown in Figure 6.

Among them, the use case description of user login through the web side is shown in Table 1.

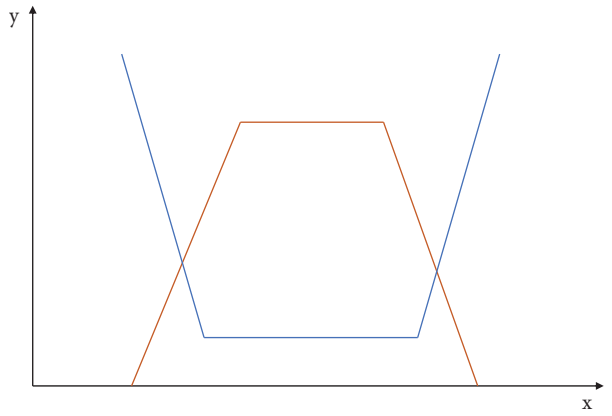

Figure 4: Trapezoidal intuitionistic fuzzy number.

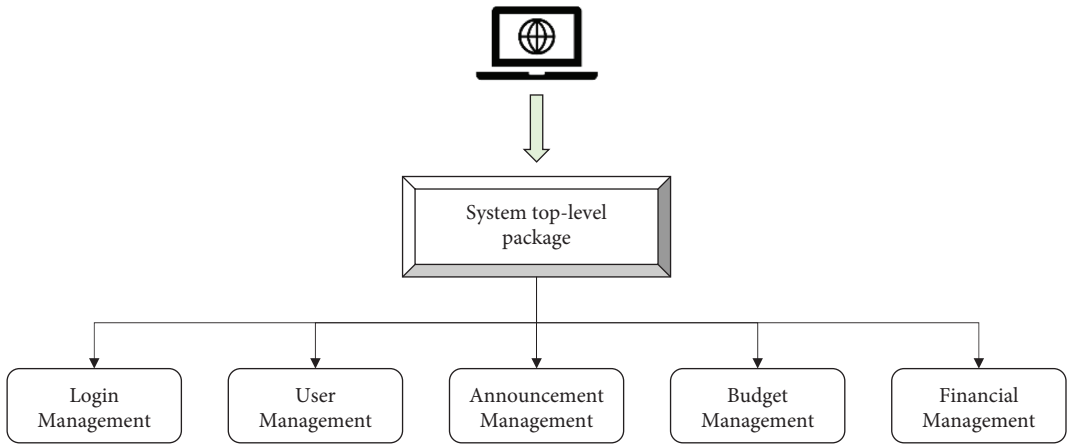

Figure 5: Main use case of the system.

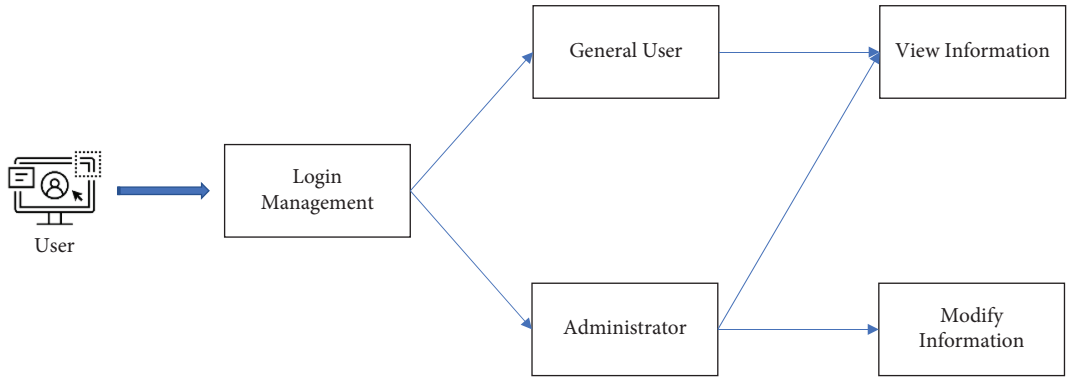

Figure 6: Specific login management use case.

User management is mainly used to maintain the information of the system users. The system is designed to allow employees from different departments to log in to the system with certain rights. The management of users can be divided into functions such as adding, modifying, querying, and deleting. In particular, users can be authorized to operate during the process of adding and modifying users. The example of user management is shown in Figure 7.

3.2. Current Status of Institution's Asset Structure. Some institutions are engaged in public services, and their assets are nonoperating assets. In addition, some institutions have been restructured to operate according to the laws of the market, and their assets have been converted to operating assets. As our country grows stronger and stronger, the volume of institutions has also grown rapidly. The number of state-owned assets held by business units has also

Table 1: User login system description.

Objective	Access to the system
Participants	Administrators and regular users
Prerequisites	User is already registered
Postcondition	Successfully enter the main interface

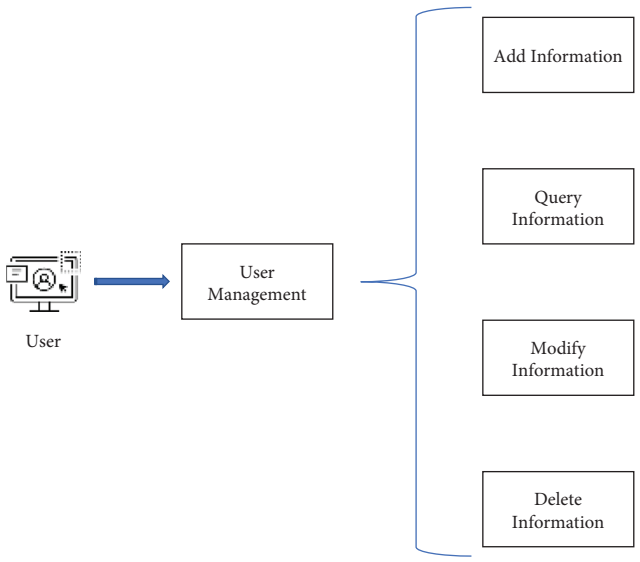

Figure 7: Example of user management.

continued to increase. These assets include real estate and buildings, as well as office equipment, vehicles, and instruments. Table 2 shows the asset structure of China's institutions from 2016 to 2021.

The management of state-owned assets by business units is included in the financial management system. Therefore, the reform of the relevant system is covered by the reform of the financial system. At present, the hierarchical management of state-owned assets in institutions is also determined by the current financial management system. Since the establishment of the State-owned Assets Management Department in 2004, the state-owned assets of institutions have been managed in a unified manner. At the same time, governments at all levels have also established special management departments. After more than a decade of development, the management system has achieved remarkable results. In addition, there are also documents that clarify that state-owned assets of institutions in China have been unified under state ownership and that institutions are managed by the government at all levels, while state-owned assets are occupied and used by each institution.

In fact, the business unit adds assets through procurement or redeployment. However, the initial source of funds must be the budget. The process of fund movement is to have a budget first and then financial expenditure and finally become state-owned assets. Therefore, the core aspects of financial management include budget management, financial expenditure management, and management of state-owned assets of institutions. As a result, the main contents of the current budget performance management system in China are formed.

Table 2: Asset structure of China's institutions from 2016 to 2021 (trillion yuan).

Year	Total asset	Total current asset	Net asset
2016	13.32	4.23	10.97
2017	14.79	4.56	9.45
2018	15.85	4.97	8.89
2019	16.78	5.03	8.27
2020	17.74	5.21	7.46
2021	18.85	5.87	6.75

Although China's system for evaluating the performance of state-owned assets of institutions has clarified some requirements and evaluation contents, the system as a whole is not standardized enough, which is also the most prominent problem at present. On the one hand, there are no special laws and regulations for the current performance evaluation activities, and there is no unified legal regulation for the specific operation of each state-owned unit. In addition, there are no unified operation rules, so it is difficult for each unit to standardize its behavior when carrying out work, and the operation methods adopted by each unit vary greatly. Although the existing Interim Measures for the Management of State-owned Assets of Public Institutions have set forth requirements for performance management, the system support and implementation measures are not reflected in the document. Among the existing relevant documents, a few of them specify the design direction of the relevant indicators. Therefore, in general, there is a gap in the laws and regulations on the performance evaluation of state-owned assets of public institutions in China. In other words, the existing supporting documents only contain individual provisions of some institutional documents, but there is no set of scientifically complete and operationally tested institutional systems.

3.3. Financial Performance Evaluation Index System. In order to revitalize state-owned assets and promote the development of the local economy, Chinese institutions have chosen a market-based model for managing state-owned assets to enhance the development of institutions. In the management process, performance evaluation tools should be introduced to assess the management of state-owned assets and guide institutions to adopt standardized management behaviors. In addition, government finance departments at all levels need to be involved in the management process. The design of the indicator system should be based on the principles of comprehensiveness and systematization. The successful implementation of this principle can complement the limitations of the system. Secondly, it is important to follow the principles of scientific, which can make the performance evaluation more accurate and scientific to meet the management needs. Only in this way can the indicator system ensure accurate results and lead to an overall improvement in asset management. Then, the principle of both qualitative and quantitative analysis should be used, and quantitative analysis of indicators should be conducted when selecting evaluation indicators to make them easier to operate.

For factors that cannot be analyzed quantitatively but are mandatory to evaluate the effect, a comprehensive qualitative analysis is also required. Based on the principle of quantitative calculation and qualitative requirements, it is necessary to make performance evaluation completer and more systematic. Finally, the principle of the hierarchy should be followed. This is a requirement that the unit should be realistically adjusted to meet the specific needs of the unit based on the purpose of the performance evaluation.

4. Conclusion

Common approaches to managing state assets include intermediate management, macromanagement, and micromanagement. In practice, a combination of these approaches is required. In addition, it is necessary to strengthen the internal supervision of the institutions. The finance department should carefully review all the economic operations of the institutions. The asset management department is mainly responsible for managing maintenance and asset acquisition. At the same time, they should manage and inventory assets in a timely manner to ensure that the accounts and cards are consistent. The audit department is responsible for auditing the use of state-owned assets in business units, rectifying, analyzing, and giving feedback on the problems found in a timely manner, and holding the responsible persons responsible for serious problems accountable. At the same time, external supervision should be strengthened.

The performance management of state-owned assets in administrative institutions is a complete framework covering goal setting, performance mechanism establishment, performance evaluation, and an improvement plan proposal. The fundamental purpose of performance evaluation is to promote the improvement of the quality, level, and efficiency of state-owned asset management in public institutions. The fundamental purpose of performance evaluation is to promote the improvement of the quality, level, and efficiency of state-owned asset management in public institutions, and the subsequent summary and improvement plan are more important than performance evaluation.

However, the research content of this study is preliminary, and somewhat objective, and one-sided. Therefore, there is a need to pay attention to the theoretical guidance measures related to the reform of the classification of institutions in the future. Only by applying financial management norms to the internal responsibilities of units can we promote the normal, perfect, and smooth reform transition of operating institutions from the source.

Data Availability

The labeled dataset used to support the findings of this study can be obtained from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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