Research on the Effectiveness Evaluation of Internal Control in Administrative Institutions Based on Network Analytic Hierarchy Process

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Abstract: Since the promulgation of the code for Internal control norms of administrative institutions (for Trial Implementation) in 2012, it is unknown whether the internal control system of relevant departments is standardized and effective. Therefore, from the perspective of urban business environment, combined with the working mechanism of administrative institutions, this paper selects indicators from the level of unit management and business activities to build an internal control evaluation system. On this basis, it uses the network analytic hierarchy process (ANP) to calculate the weight of evaluation indicators at all levels, and then uses the fuzzy comprehensive evaluation method to calculate the comprehensive score of effectiveness. Finally, according to the evaluation results, it is found that the problems existing in the unit's internal control in the unit management and business workflow, in order to comprehensively promote the construction of the internal control system, which is of great significance to improve the effectiveness of the unit's internal control, enhance the unit's administrative efficiency, people's satisfaction and improve the urban business environment.

Keywords: Business environment; Administrative institutions; Internal control; ANP

1   Introduction

The 19th CPC National Congress proposed that we should be determined to overcome the obstacles and shortcomings in China's organizational function system, further optimize the setting of functions and powers and improve work efficiency, and better serve the people. Administrative institutions have a large number of social public resources and capital. They must strictly regulate the use of public power and scientifically and reasonably allocate social resources in order to fundamentally alleviate people's problems and improve people's satisfaction. As an important part of the national management system, the internal management system of administrative institutions has a direct impact on the overall efficiency of government services. Therefore, the ultimate goal of the reform is to establish an internal supervision system in relevant government departments. With the promulgation of the code for internal control of

units in 2012 [1], it provides a basic framework for various organs in China to carry out the construction of internal control, and is also a milestone for promoting the design and implementation of an effective internal control system in administrative institutions across the country.

The fundamental purpose of evaluating the effectiveness of internal control in administrative institutions is to improve the internal management level, improve work efficiency, meet public needs, eliminate fraud and standardize operation, so as to improve the administrative efficiency of the whole industry and create a good urban business environment. Based on the background of the promulgation and implementation of the code for internal control of units, this paper attempts to evaluate the management process of various internal work of administrative institutions from the perspective of urban business environment, and uses the combination of ANP and AHP to evaluate the effectiveness of their internal control, in order to comprehensively promote the construction of internal control system and promote the effective operation of public services of government departments.

2 Research Status of Internal Control Evaluation of Administrative Institutions and the Introduction of Business Environment

2.1 Development and existing problems of internal control evaluation

Internal control evaluation is the development process from external independent audit to self-evaluation. In the traditional external audit, external auditors mainly check the approval procedures of relevant departments, and its evaluation often contradicts the authenticity of financial reports. At present, the research contents of internal control effectiveness of administrative institutions are roughly divided into two categories: the research on internal control effectiveness evaluation system and the research on internal control effectiveness evaluation methods [2].

In the existing domestic research literature on the effectiveness evaluation of internal control, Qinglong believes that for administrative institutions, setting up internal control index system with the goal of improving public service efficiency and accelerating urban construction is the key to evaluate the effectiveness of internal control [3]. Dapeng learned from the experience of enterprise internal control evaluation, guided by institutional needs, combined the evaluation mode at the unit level and business level, in which goal orientation is the evaluation mode at the unit level and element orientation is the evaluation mode at the business level, so as to construct the internal control evaluation system [4]. Xiaogang established a comprehensive and dynamic internal control cycle evaluation system, and analyzed the evaluation process from the two levels of unit and business, so as to evaluate whether the establishment of internal control system is effective [5]. Dapeng Tang and Lulu Wang constructed an internal control system from the perspective of budget decentralization, proposed to add horizontal and vertical power supervision and accountability mechanisms inside and improve the information disclosure mechanism outside, providing a new research perspective for the construction of an effective internal control system [6].

Many domestic scholars are actively exploring the methods suitable for the effectiveness evaluation of internal control. Hanwen Chen draws lessons from the relevant research of enterprise internal control evaluation and puts forward the methods for the effectiveness evaluation of internal control, mainly based on the basic evaluation method and detailed evaluation method, which also lays the foundation for the internal control evaluation of Administrative Institutions [7]. Sihao Li (2014) established a grey evaluation model to evaluate the internal control, and obtained the general situation of the implementation of internal control according to the grey reference. Yan Chen and Hongjian Yu (2015) used a combination of qualitative and quantitative methods to evaluate the internal control of government departments based on the AHP method and Fuzzy comprehensive evaluation method, which made up for this deficiency. Tuo Ding et al. (2018) based on a brief description of the current situation of internal control, divided the evaluation of internal control system into internal control construction evaluation and internal control implementation evaluation. Taking a school as an example, they selected indicators to build the evaluation system in the two evaluation aspects, and finally calculated the score by Delphi method and AHP to evaluate whether the school's internal control is effective.

With the development of the times, government functions are strengthening and business is increasing. It is very important to evaluate the effectiveness of internal control of administrative departments to standardize their operation, eliminate fraud, avoid risks and enhance the urban business environment index. However, due to the difficulty of quantifying the evaluation indexes of the internal control system, most scholars use the analytic hierarchy process to determine the index weight, while ignoring the interactive relationship between the indexes. Based on this, this paper uses the method of network analytic hierarchy process to analyze and explore the implementation of internal control from the perspective of urban business environment.

2.2 Research on the logical relationship between urban business environment and internal control of administrative institutions

In recent years, the party and the state attach great importance to the development of urban business environment. The quality of urban business environment directly affects the efficiency of the government. Guangyuan Wang (2009) believes that as a government department with huge social public resources and public funds, effective internal control is the primary guarantee to ensure the effective use of national assets and strengthen the prevention of clean government risks. Chengwu Lou (2018) stressed that the business environment has increasingly become the main breakthrough for local governments to increase urban competitiveness in the context of national governance. Therefore, Hong Cui and Zhongxiu wu (2018) believe that the strength of the internal control effectiveness of a city's administrative institution also represents its governance ability and, to a certain extent, reflects the quality of the city's business environment. Qunli Sun and Hailin Chen (2020) analyzed the main factors affecting the business environment by establishing a model, and proposed that the government's simplification of administration and decentralization, simplification of approval process and improvement of business efficiency are of great significance for optimizing the business environment, talent introduction and increasing employment. These influencing factors are part of the internal control system. Therefore, from the perspective of affecting the urban business environment, we should select relevant indicators to build an internal control evaluation system, so as to evaluate the

effectiveness of internal control of government departments. While improving the internal control system, we can also enhance the urban business environment index.

3 Application of ANP in the effectiveness evaluation of internal control in administrative institutions

3.1 Brief description of ANP system

Analytic network process is a new set of scientific decision-making method which is constantly revised and improved on the basis of AHP. The traditional AHP classifies the complex element relationships according to the vertical dominance relationship to form a hierarchical model, and then obtains the importance of each influencing element under the overall goal dominance relationship through comprehensive comparison. However, AHP only applies to elements that are independent of each other at the same level. Therefore, its research scope is often subject to certain constraints. ANP can make up for the deficiency of AHP in this aspect. ANP system is composed of control layer and network layer. Generally, the target layer and control standard are divided into control layer. The control layer can have upper and lower hierarchical levels and dominant relationship. The network layer elements are dominated by the control layer, and each element can have correlation and dependency. The connection between the control layer and the network layer forms the ANP structure, as shown in Figure 1.
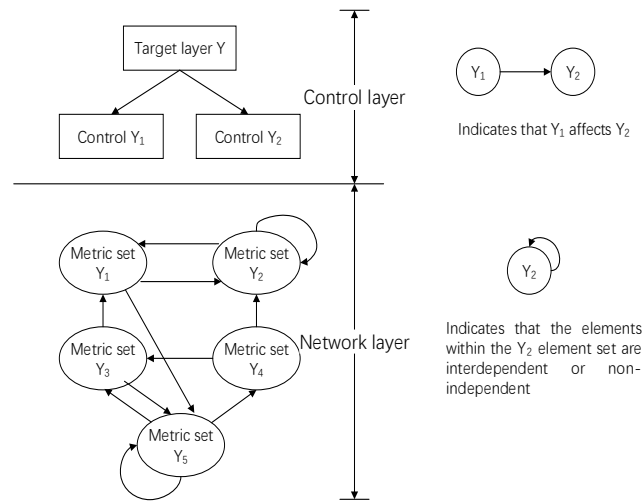

Figure 1: Typical ANP Tier Institution

3.2 Setting of evaluation objectives for the effectiveness of internal control in administrative institutions

If the evaluation objective of internal control effectiveness is taken as an important starting point for evaluating the internal control of administrative institutions, the core content of internal control is the formulation of internal control objectives, which is a key link related to the normal

and efficient operation of the unit. The internal control specification clearly stipulates that the internal control objectives should ensure that all economic activities of the unit comply with various rules and regulations, the fair and equitable distribution of unit assets, and the authenticity of financial data Strengthen integrity and eliminate fraud, improve work efficiency and people's satisfaction. As a national public service department, the internal control goal of administrative institutions is different from that of enterprises pursuing the maximization of corporate interests, but pays more attention to improving the efficiency of public services and people's satisfaction while preventing financial risks and eliminating fraud.

The objective of effectiveness evaluation is to evaluate on the basis of internal control objectives, inspect and supervise from the internal control objectives, so as to evaluate the completion degree of the implementation objectives of the unit's internal control, and also provide incentives and promotion for the operation of the unit's internal control, so as to improve its ruling ability.

3.3 ANP evaluation system of internal control in administrative institutions

From the unit level, this paper sets up four elements: control environment, risk assessment, information communication and supervision and evaluation, and the business level sets up the elements of control activities, which constitutes the primary evaluation index of the internal control evaluation system. On the basis of the first level evaluation index, combined with the factors affecting the urban business environment of government efficiency, 20 evaluation indexes are selected to form the second level index of the internal control evaluation system. On the basis of the second level index, each index can be divided into several sub indexes to elaborate and form the third level evaluation standard. Therefore, the evaluation system of internal control effectiveness of administrative institutions from the perspective of urban business environment is shown in table1.

Table 1: This caption has one line so it is centered.

Primary index	Secondary index	Tertiary indicators
Control environment (Y1)	management philosophy (Y11)	The department should pay attention to the implementation of internal control and establish good communication channels
	Department culture (Y12)	Departments must have a sense of responsibility and cultural system construction
	organization structure (Y13)	Departments should set up audit and internal audit departments, and have clear distribution of powers and responsibilities
	human resources (Y14)	1. Whether there are clear HR policies and talent qualification requirements; 2. Whether there is a standardized process for clearly introducing talents and dismissing employees.
	internal auditing (Y15)	The unit should establish an internal audit department and establish relevant norms
	Allocatio of rights and responsibilities (Y16)	The unit should implement the power and responsibility distribution system and implement the accountability system;

risk assessment (Y2)	Goal setting (Y21)	1.Whether the resource allocation and power operation of the unit are legal and compliant; 2. whether there is a risk of underutilization
	Risk identification (Y22)	Whether the unit risk mechanism is reasonable and effective, whether the risk is comprehensively checked and corrected in a timely manner
	Risk handling (Y23)	Whether the unit handles abnormal situations in a timely manner and pursues responsibility.
Control activities (Y3)	Business process approval control (Y31)	Whether unit authority and affairs management is standardized, expeditious and effective.
	Incompatible post separation (Y32)	Authorization approval, business processing and review are separated.
	Unit asset management (Y33)	The registration and management of unit assets is implemented to individuals, and the physical assets are regularly checked for account verification.
	financial management (Y34)	Whether the budget and final accounts preparation and approval procedures are standardized and reasonable.
	Project bidding management (Y35)	Whether the bidding procedures and management of the unit are open, reasonable and standardized.
	contract management (Y36)	Implement centralized management of contracts, regularly monitor the performance and acceptance of project contracts, and set up special teams to resolve disputes.
Information communication (Y4)	Information system management (Y41)	Build a scientific and effective internal and external information system and establish an information communication mechanism between superiors and subordinates.
	Establish an effective mechanism of mutual assistance (Y42)	Establish an anti-fraud mechanism and a confidential complaint window.
Supervision evaluation (Y5)	Supervision mechanism (Y51)	Units should set up supervisory departments and norms.

Evaluation mechanism (Y52)	Establish an effective internal control evaluation system and implement a self-evaluation mechanism and issue corresponding reports.	
Accountability mechanism (Y53)	Establish a system of supervision, auditing, and an assessment system that balances performance and accountability.	

The internal control evaluation indicators of administrative institutions are not independent of each other. For example, the establishment of the unit's management concept (Y11) affects the formation of department culture (Y12) and the formulation of various training plans of human resources (Y14); As an invisible force to guide the ideological unity and positive progress of the Department, unit culture (Y12) can standardize the compliance operation of unit rights (Y21), indirectly promote the efficient operation of the whole information communication (Y41, Y42), and create a working atmosphere of mutual learning and supervision (Y51); The implementation of the organizational structure of the unit (Y13) is effective, which promotes employees to consciously cultivate the awareness of internal control construction (Y15), improve their professional ability (Y14), perform their duties and work strictly, and improve the work efficiency of the unit (Y21); The internal audit (Y15) mechanism of the unit is divided into unit management review and business process review. It regularly checks the work efficiency (Y21), identification (Y22) and treatment of management risks (Y23), financial business (Y34) and information disclosure for the people (Y41), and puts forward improvement suggestions for the defects existing in the unit and financial management through the supervision mechanism (Y51); A good power and responsibility distribution mechanism (Y16) is conducive to the smooth implementation of responsibility investigation when the risk treatment (Y23) mechanism occurs, the separation of incompatible posts (Y32) according to the regulations, and further strengthen the fairness of the accountability mechanism (Y53); Risk assessment (Y2) mainly involves two aspects: unit governance and business process management, and goal setting (y21) runs through the whole process of its coverage. At the same time, risk treatment mechanism (Y23) also provides guarantee for the effective operation of risk identification (Y22); The control activity element (Y3) covers the evaluation indicators at the business level of the unit. Among them, budget management and procurement management are uniformly included in the evaluation elements of financial management (Y34). Financial management is the manifestation of budget and procurement management and the basis of contract management (Y36). The payment of contract funds is inseparable from the support of financial funds. Asset management (Y33) includes physical assets and unit funds, It is the result form of financial activities (Y34). The openness and transparency of project bidding (Y35) requires the effective implementation of information communication (Y4) mechanism; The establishment of a scientific information system (Y41) is conducive to improving the effective mechanism of mutual assistance (Y42), further improving the supervision function of the unit supervision mechanism (Y51), and improving the work efficiency of serving the people and the effect of the implementation of internal control; The supervision and evaluation mechanism (Y5), the last element of the second level indicators, is divided into supervision mechanism, rating mechanism and accountability mechanism. A supervision mechanism (Y51) is established to regularly supervise and inspect the unit management and business processes of

the unit's internal control, improve and perfect the weak links in the control activities through the evaluation mechanism (Y52), and finally the accountability mechanism (Y53) to investigate the responsibility of the problems, through the punishment mechanism to restrict the main body of internal control activities, and finally make the construction and implementation of internal control more effective. The detailed indicator correlation is shown in the table 2.

Table 2: Internal control evaluation index correlation table.

Primary index	Secondary index	Metrics associated with this metric
Y1	Y11	Y12, Y14, Y15, Y16, Y21
	Y12	Y14, Y21, Y41, Y42, Y51
	Y13	Y15, Y16, Y21, Y22, Y34, Y41, Y53
	Y14	Y15, Y16, Y21
	Y15	Y21, Y22, Y23, Y34, Y41, Y51
	Y16	Y23, Y32, Y33, Y36, Y53
Y2	Y21	Y22, Y33, Y34, Y41, Y42, Y52
	Y22	Y23, Y31, Y32, Y33, Y34, Y35, Y36, Y41, Y42
	Y23	Y52, Y53
Y3	Y31	Y33, Y34, Y35, Y36, Y42, Y51, Y53
	Y32	Y33, Y34, Y51
	Y33	Y34, Y36, Y41, Y52
	Y34	Y36, Y41, Y42, Y51, Y53
	Y35	Y36, Y41, Y42, Y51
	Y36	Y41, Y42, Y51, Y52, Y53
Y4	Y41	Y42, Y51
	Y42	Y51
Y5	Y51	Y52, Y53
	Y52	Y53
	Y53	

4 Demonstration of effectiveness evaluation of internal control in administrative institutions based on ANP

4.1 Construction of internal control evaluation system based on ANP algorithm

According to the correlation between the three-tier indicators, this paper uses yaanp software to establish a single network model for internal control effectiveness evaluation. The model is divided into two parts: control layer and network layer. The target layer of this paper is the internal control effectiveness evaluation of administrative institutions. There is mutual connection between the five indicators of the second layer control elements and the twenty evaluation indicators of the third layer under its control, forming a network, that is, the network

layer. The combination of control layer and network layer jointly constitutes the internal control network evaluation model.

4.2 Calculation of effectiveness evaluation index weight

List judgment relation matrix: When calculating the weight of the evaluation index in the ANP structure model, the judgment matrix must be constructed first, that is, under the premise of given evaluation criteria, judge the importance of one index relative to another index, so as to form the judgment matrix. In this paper, the 9-level scaling method is selected, and the number indicates the importance of one index compared with the other. The detailed importance scale values are shown in the table 3.

Table 3: Importance scale aij value table

Standard value	definition
1	Xi compared with XJ, one is more important than the other
3	Xi is slightly more important than XJ
5	Xi is obviously more important than XJ
7	Xi compared with XJ, one is more important than the other
9	Xi compared with XJ, one is more important than the other
reciprocal	Xj is compared with Xi and the judgment valueaji=1/aij, aii=1

Acquisition of data and establishment of super matrix: In order to ensure the credibility of internal control evaluation, this paper uses the form of questionnaire to obtain data, specially invited four experts to compare and score the importance of internal control evaluation indicators to form expert group decision-making, and then weighted average the comparison matrix of group decision-making to obtain the judgment results of expert aggregation. The basic steps are as follows:

First, check the consistency of the indicators, and the calculation formula is as follows:

$$C.I. = \frac{\lambda max - n}{n - 1}$$

(1)

Where n is the order of the judgment matrix and λ_{max} is the characteristic root of the judgment matrix.

$$C.R. = \frac{C.I.}{R.I.}$$

(2)

Where R.I. is the consistency index of the average value and C.R. is the consistency proportion. When C.R. < 0.1, it means that the consistency test is passed and the judgment matrix Wij is obtained.

$$W_{ij} = \begin{pmatrix} W_{i1}^{(j1)} & W_{i1}^{(j2)} & \cdots & W_{i1}^{(jn_i)} \\ W_{i2}^{(j1)} & W_{i2}^{(j2)} & \cdots & W_{i2}^{(jn_i)} \\ \vdots & \vdots & & \vdots \\ W_{in_i}^{(j1)} & W_{in_i}^{(j2)} & \cdots & W_{in_i}^{(jn_i)} \end{pmatrix}$$

(3)

Here, the column vector of Wij is the element Yi1, ..., Yin for element Yji, ... In Yj, the importance ranking vector of Yjn. If the element in YJ is not associated with the element in Yi, Wij = 0. In this way, the super matrix w under the BS control layer can be obtained.

$$W = \begin{matrix} 1 \\ \vdots \\ n_1 \\ 1 \\ \vdots \\ n_2 \\ 1 \\ \vdots \\ n_n \end{matrix} \begin{bmatrix} W_{11} & W_{12} & \cdots W_{1N} \\ \\ W_{21} & W_{22} & \cdots W_{2N} \\ \vdots & \vdots & \vdots \\ \\ W_{N1} & W_{N2} & W_{NN} \end{bmatrix}$$

(4)

There are m such super matrices, all of which are nonnegative matrices, and the sub matrix Wij is a column normalized matrix.

Calculation of evaluation index weight: Because there are 20 evaluation indexes in the third layer of the internal control system and there is an associated network relationship between them, a super matrix will be formed when calculating the network weight. Because the calculation process of super matrix is very complicated and difficult, this paper uses yaanp software to solve it. In this paper, the excel questionnaire is used to import the judgment data of all experts, determine the comprehensive judgment matrix, and test its consistency. The output results of yaanp software are shown in the table 4.

Table 4: List of evaluation index weights

Primary index	Weights	Secondary index	Cluster normalized weights	relative weight
Y1	0.3549	Y11	0.038	0.004
		Y12	0.031	0.003
		Y13	0.119	0.013
		Y14	0.263	0.028

		Y15	0.408	0.044
		Y16	0.141	0.015
Y2	0.055	Y21	0.396	0.009
		Y22	0.202	0.005
		Y23	0.402	0.010
Y3	0.3318	Y31	0.087	0.019
		Y32	0.051	0.011
		Y33	0.248	0.053
		Y34	0.329	0.070
		Y35	0.022	0.005
		Y36	0.263	0.056
Y4	0.1673	Y41	0.490	0.092
		Y42	0.510	0.096
Y5	0.091	Y51	0.359	0.168
		Y52	0.192	0.090
		Y53	0.450	0.210

4.3 Fuzzy comprehensive evaluation of evaluation indexes

In this paper, the ANP method has been used to establish the evaluation index and calculate the weight of each evaluation index. Therefore, the fourth and fifth steps in the fuzzy comprehensive evaluation chart and yafce software are used to calculate the comprehensive score of the internal control evaluation of administrative institutions. The calculation results with Yaahp software are shown in Table 5.

Table 5: Internal Control Evaluation Index Score Summary

target layer	Score	Primary index	Secondary index	Score
Index system (Y)	51.57	Y1	Y11	56.25
			Y12	53.75
			Y13	46.25
			Y14	42.50
			Y15	42.50
			Y16	40.00
		Y2	Y21	47.50
			Y22	52.50
			Y23	53.75
		Y3	Y31	51.25
			Y32	61.25
			Y33	47.50
			Y34	50.00
			Y35	41.25
			Y36	38.75
		Y4	Y41	65.00
			Y42	55.00
		Y5	Y51	53.75
			Y52	48.75
			Y53	52.50

By comparing the scoring grades, it can be seen that the overall internal control of bureau is generally effective. The internal environment and control activities account for a large proportion, and the scores of rights and responsibilities distribution and contract management indicators under its control layer are obviously low, while the proportion of risk assessment and supervision and evaluation is low. Therefore, bureau should pay more attention to improving the internal control environment and the content of control activities. Due to the large proportion, the improvement effect will be more obvious if good norms and measures are taken. In addition, it should pay more attention to the internal power and responsibility distribution of the construction unit and the system of project contract progress management, and accelerate the effective implementation.

5   Conclusions

From the perspective of business environment, this paper studies the application of ANP and AHP to the effectiveness of internal control in administrative institutions, and gives the specific calculation process and results combined with examples. In the process of using ANP algorithm, experts who understand the situation of departments are used to score, it can not only better understand the specific situation of the internal control implementation of each link of the unit, but also measure the effectiveness of the five control factors respectively. Finally, the overall effectiveness of the internal control of administrative institutions can be measured by using AHP, which can more intuitively understand the weak links in the implementation of the internal control of administrative departments from the perspective of business environment, so as to take more effective measures to improve the effectiveness of the internal control of administrative departments, so as to standardize the operation of administrative departments, eliminate fraud risk aversion. Therefore, it is feasible to calculate the effectiveness of internal control of administrative institutions by using network analytic hierarchy process from the perspective of business environment.

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