

Research on Government Performance Evaluation Method under New Public Management Theory

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Abstract: Since the birth of the new public management theory, governments have paid more and more attention to the quality and efficiency of public management. Therefore, government performance evaluation has become an important research topic concerned by various countries. On the basis of the new public management and big data theory, this paper has put forward the principles and ideas for the design of government performance evaluation indicator system and preliminarily designed the content of indicators in government performance evaluation. Then an evaluation method based on information entropy and information gain is proposed.

Introduction

The new public management theory was born in the 1970s. It is the reflection of a group of public management scholars represented by Janet V. Denhart and Robert B. Denhart on the new public management theory. The theory emphasizes that the government should be citizen-oriented and pay attention to citizens' interests and basic needs. With the large-scale government reform in western developed countries, new public management theory began to appear in government behavior. The new theory mainly emphasizes the role of multi-center subjects and the application of business management theory, methods and technology in public management, and also attaches great importance to the promotion role of government performance evaluation in government development.

The concept of performance evaluation indicator comes from key performance indicator (KPI). It refers to an objective quantitative management indicator to measure process performance by setting, sampling, calculating and analyzing the key parameters of the input and output terminals of the internal processes of an organization. It is a tool to decompose the strategic objectives of an organization into operational work objectives. Foundation of Performance Management [1]. In the mid-twentieth century, the developed countries such as Britain and the United States carried out the reform of government administration with the new public management as the core. They advocated introducing market competition mechanism, target management, performance evaluation and other enterprising management theories into public administration. Performance evaluation is an important part of government performance management, which plays a very important role in the government's administrative decision-making, and is of great significance in promoting the transformation of the government. Performance evaluation is playing a more and more important role in the administrative reform of western developed countries. However, when the government carries out performance evaluation, there are still some problems, such as single evaluation subject, unscientific evaluation indicators and imperfect evaluation information system, which hinder the development of government performance evaluation.

Combining with the environment of big data, applying data science, methods and theories to government performance evaluation can not only overcome the shortcomings of traditional government performance evaluation in evaluation subjects, evaluation indicators and evaluation methods, but also help to broaden the field of evaluation and improve the quality and level of government performance evaluation. Therefore, this paper proposes a method of government performance evaluation based on information entropy.

Related Work

In the research of value orientation of performance evaluation, Almond [2] believes that the value orientation of government performance evaluation mainly includes four variables: government capacity (power), people's participation in politics (democratization), economic growth (wealth) and distribution (welfare). Nicholas Henry [3] argues that the government should prove its existence with more reasonable and elaborate concepts such as efficiency and social value. Furthermore, performance evaluation should take improving organizational performance, increasing income and saving expenditure, and making clear responsibility as its value orientation. Song Qinting and Peng Wenlong [4] think that value orientation plays an important guiding role in government performance evaluation, and emphatically analyze the new challenges faced by government performance evaluation under the new normal economy and the concrete performance and establishment of the new value orientation.

In the research of government performance evaluation indicator system, in the early 1980s, the British efficiency group put forward a new scheme of integrating "3E" (economy, efficiency, efficiency) into financial management. With the rise of the new public management movement, Fulin put forward the concept of "4E" and listed the principle of "Equity" as an evaluation indicator [5]. Zhou Zhinen [6] pointed out that the evolution of performance evaluation of local governments in China can be seen as a process of constant development of subjective and objective checks and balances.

In the research of government performance evaluation methods, foreign research representatives of government performance evaluation are mainly reflected in the following aspects: "3E" evaluation method, benchmarking evaluation method and balanced scoring evaluation method [7]. "3E" (economy, efficiency, efficiency) evaluation method emphasizes cost saving, which is the beginning of the evaluation method; benchmarking evaluation means that benchmarking is determined first and then evaluated by comparison. The balanced scorecard evaluation method refers to the dimension of entrepreneurship, which can be refined into concrete values [8]. Song Meixie and Miaoshiling [9] adopt the analytic hierarchy process (AHP) to endow qualitative and quantitative indicators with different affiliation degree determination methods, and establish the local government performance evaluation indicator system to achieve both internal and external effects. At the same time, a quantitative evaluation method based on the fuzzy comprehensive evaluation model is proposed.

Design of Performance Evaluation Indicator System

Design Principles of Indicator System. The technical indicator system of government performance evaluation is not a simple accumulation and combination of some indicators, but a set of indicators based on some principles, which can reflect the technical status of local government performance evaluation. The design of the indicator system is to establish a comprehensive technical indicator system of government performance evaluation and to achieve a comprehensive evaluation based on technical indicators. Therefore, the design of the technical indicator system should follow the following principles: Systematic Principle, Comprehensive Principle, Scientific Principle, Feasibility Principle and Quantitative Principle.

Systematic principle requires consistency between the technical indicator system of government performance evaluation and the strategic objectives and objectives of its evaluation objects. The indicator system must be reasonable, coordinated and unified, reflecting the basic state of government technology in a more comprehensive way, and providing necessary data for the comprehensive evaluation of government performance based on technical indicators.

Comprehensive indicators require that the selected technical indicators should cover all relevant technical factors of the government, rather than be limited to local or specific aspects. In addition, try to select fewer indicators to reflect a more comprehensive situation, for this reason, the selected indicators should have a certain degree of comprehensiveness, and there should be a strong logical correlation between the indicators.

The design of technical indicator system strives to scientifically and accurately reflect the relationship and hierarchical structure of various technical factors of the government. The choice of indicators and the division of levels should conform to the basic logic of thinking, that is, the boundaries between indicators should be clear and clear, to avoid ambiguity and overlap.

Feasibility Principle requires that the indicators designed should have the characteristics of collectability and quantification, and each indicator can be effectively measured or counted. The indicator system is not the bigger the better, try to select fewer indicators to reflect a more comprehensive situation. The difficulty and reliability of indicator quantification should be considered.

Finally, to carry out comprehensive evaluation, it is necessary to quantify and standardize the qualitative indicators reflecting the basic characteristics of government technology.

Design Ideas of Indicator System. Whether the technical indicator system of government performance evaluation is scientific and reasonable depends to a great extent on the design idea of the indicator system.

When designing the technical indicator system of government performance evaluation, we should consider not only the content and framework of the indicator, but also the meaning and caliber of each single indicator one by one. Therefore, the design ideas of the government performance evaluation indicator system in this paper are as follows:

Firstly, the concept of government performance evaluation based on technical indicators is determined. Government performance evaluation based on technical indicators is a core component of government performance evaluation system. It is to solve the problems existing in the technical level of our government, to measure the performance of our government, and to meet the needs of service-oriented government. Therefore, the technical indicators of government performance evaluation built by us insist on the indicator system based on reality, effect-oriented, service for the people, objective evaluation and strong guidance.

Second, design representative indicators at all levels. Selection of technical indicators based on government performance evaluation is the most important part of the whole indicator system. Through the research of the existing achievements in this area, the representative secondary and tertiary indicators are designed according to the principles of the design of government performance evaluation indicators.

Thirdly, describe the three-level indicators and determine the specific content of indicators. To describe accurately the three-level technical indicators of government performance evaluation, strive to accurately summarize the contents of the three-level indicators in short sentences.

Fourth, construct the technical indicator structure of government performance evaluation. Establish a scientific technical indicator system for government performance evaluation and standardize it, so as to facilitate the standardization of operation by using unified standards. Summarize the indicators at all levels in tabular form, and construct the basic structure of government performance evaluation indicators.

Indicator System. According to the design principles and ideas of government performance evaluation indicators, we have obtained a preliminary three-level performance evaluation indicator system, the specific content of which is shown in Table 1.

Table 1 Indicator System

First-level indicators	Secondary indicators	Three-level indicators
Government Performance	Satisfaction with the Government	Public expectations
		Government Image
		Public participation
		Public perception
	Government Benefit Output	Government expenditure
		Savings in human resources
		Development of Information Technology

		Development of Information Technology
		Support for economic development
		Government Performance Ability
		Integrity of Government Services
	Sustainable Development Ability of Government Affairs	Guarantee of funds
		Technical Guarantee
		Legal Guarantee
	Organizational and leadership skills	Organizational structure
		Staffing situation
		The Role of E-government
Leadership		

Measurement Method Based on Information Entropy

Information Entropy and Information Gain. Entropy theory is the first rule for the whole natural science. [10]. Shannon introduced physical entropy into information theory and defined the magnitude of information, which is used to measure the amount of information and named information entropy. Simply, information entropy is a tool to describe the uncertainty of information before and after communication [11], and its definition [12] is as follows:

Definition (information entropy) Let X be a discrete random variable, and n is the number of its possible values, that means $X = \{x_1, x_2, \dots, x_n\}$. For each x_i , its probability value is $P(x_i)$ and its discrete probability space is:

$$\begin{bmatrix} X \\ P(x) \end{bmatrix} = \begin{bmatrix} x_1 & \dots & x_n \\ P(x_1) & \dots & P(x_n) \end{bmatrix} \quad (1)$$

And satisfy:

$$\begin{cases} 0 \leq P(x_i) \leq 1 \\ \sum_{i=1}^n P(x_i) = 1 \end{cases} \quad (2)$$

Then:

$$H(X) = -\sum_{i=1}^n P(x_i) \log P(x_i) \quad (3)$$

Information entropy $H(X)$ indicates the order of system information. The greater the entropy, the greater the uncertainty of random variables.

Information gain [13] is also called mutual information which indicates the reduction degree of uncertainty of Y when X is confirmed.

Definition (Information gain) For a given set D , which characteristic X is include, the information gain $G(D/X)$ is the difference between the overall information entropy $H(D)$ and the conditional entropy $H(D/A)$.

$$G(D,A) = H(D) - H(D|A) \quad (4)$$

Obviously, $H(D) \geq H(D|A)$, $G(D|A) \geq 0$.

Information gain represents a feature or indicator $x_i \in X$, $i=1,2,\dots,n$, the extent to which the overall uncertainties of the system are affected under given conditions. For each indicator of performance evaluation, information gain represents the extent to which performance indicator affects the performance of the government as a whole. The greater the gain, the stronger the distinction between the indicators and the overall performance, which indicates that the importance of the indicators is more obvious, and vice versa. Therefore, this paper uses information gain as the weight of each indicator in performance evaluation.

Indicator Weight Calculating Method Based on Information Entropy. The weights of government performance indicators are calculated as follows:

Step 1: Questionnaires are designed according to the indicator system in Table 1. An example of the scoring table for each indicator and the scoring standard questionnaire is shown in the following table:

Table 2 An Example of Marking Standard

Levels	Values
extremely important	8-10
Specially important	6-8
Very important	4-6
Fairly important	2-4
Unimportant	0-2

Step 2: Collect and distribute questionnaires and score and evaluate related or similar indicators. Statistics of each participant's score on each indicator and use Formula (5) to calculate each person's score on each indicator.

$$Y_i = \frac{x_i - x_{min}}{x_{max} - x_{min}} \quad (5)$$

Among them: Y_i represents the comprehensive score of the standardized item i indicator; X_{max} represents the maximum score of each participant; X_{min} represents the minimum score of each participant, the result constitutes an assignment matrix A :

$$A_{n \times m} = \begin{bmatrix} a_{11} & \dots & a_{1m} \\ \vdots & \ddots & \vdots \\ a_{n1} & \dots & a_{nm} \end{bmatrix} = (\alpha_1, \alpha_2, \dots, \alpha_m) \quad (6)$$

Among them: A_{ij} represents the standard value of the score of the j th indicator of the i th product in the user system. $a_k = (a_{1k}, a_{2k}, \dots, a_{nk})^T$. The values of each row in the matrix are added together to get the score of each indicator, that is:

$$\beta = (b_1, b_2, \dots, b_n)^T = \begin{bmatrix} \sum_{k=1}^m a_{1k} \\ \sum_{k=1}^m a_{2k} \\ \vdots \\ \sum_{k=1}^m a_{nk} \end{bmatrix} \quad (7)$$

The original assignment matrix is transformed into $A_{n \times m}'$:

$$A_{n \times m}' = (\alpha_1, \alpha_2, \dots, \alpha_m, \beta) \quad (8)$$

Step 3: According to the value of β in matrix $A_{n \times m}'$, the grade of each indicator and total score of the product can be separated for the next calculation of the entropy value. Specific levels can be set according to actual needs. For example, the level of a specific indicator can be referred to the table in step 1, and an example of the hierarchical division of values is shown in table 3.

Table 3 An Example of Grade

Levels	Scores
UNSAFE	0-30
MEDIUM	30-60
SAFE	60-90

Step 4: According to the scores and the classifications of the matrices in step 2 and step 3, the information entropy $H(\beta)$ is calculated by formula (3), the conditional entropy of each indicator $H(\beta|\alpha_i)$ is calculated by formula (5), and the information gain of each indicator $G(\beta, \alpha_i)$ is calculated by formula (6).

Step 5: The information gain of each indicator $G(\beta, \alpha_i)$ is normalized and the weights of each indicator γ_i obtained by the respondents' scores are obtained.

After calculating the weight of each indicator, the scoring situation of each indicator can be obtained through the scoring mechanism of government performance indicator or each outside

expert scoring each indicator. By multiplying the actual score with the calculated weight, the results of the whole government performance evaluation can be calculated.

Conclusion

In order to overcome the shortcomings of traditional government performance evaluation in the aspects of evaluation subject, evaluation indicator and evaluation method, etc, this paper has put forward the design principles and ideas of government performance evaluation indicator system designed a preliminary indicator system of government performance evaluation, and proposed an indicator weight calculation method based on information entropy and information gain. These provide a new way of thinking and a method for governments to measure the quality, efficiency and level of their public administration.

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