

# Construction Performance Evaluation System of Digital Publishing Public Service Platform in China based on BSC Model

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**Abstract:** In order to make the performance evaluation system of strategic transitivity, starting from the actual situation of the digital publishing public service platform, combined with the expert consultation, based on the idea of the balanced score card, built four target dimension, 12 primary indicators, a total of 27 secondary indicators of performance evaluation index system, and index weight is obtained by using the analytic hierarchy process (AHP), according to the score and the combination weights, evaluate comprehensively the performance of digital publishing public service platform.

**Keywords:** Digital Publishing; Public Service Platform; Performance Evaluation; Analytic Hierarchy Process (AHP).

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## 1. Introduction

Benefiting from policy support at the national and local levels, digital publishing achieved steady growth in 2013, by July 2013, the total value of the digital publishing industry has reached 200 billion, digital technology was maturing, and the profit model also was gradually highlighted. As a new cultural industry, the digital publishing industry has received the support of special funds for the development of the national cultural industry, local governments have also supported the digital transformation of local publishing units, set up special funds for industrial development, formulated preferential policies, provided financial support for research and development of digital publishing technology and product innovation, promoted the benign development of digital publishing industry.

In 2013, the number of mobile reading users in China reached 470 million, the development of new media will encourage more and more potential customers to become mobile reading users. Two years ago, many companies that offered mobile reading services were still under pressure from profits, but today, many companies were profitable, mobile reading business model gradually clear. In addition to reading markets such as literature and magazines, (the education market is a capital-focused influx, and the market has become a capital focus of the market, so) For example, Han Wang Technology, Founder Technology and other enterprises have explored the application of electronic schoolbag, promoted the development of educational informationization. There are some traditional book publishing groups, in the digital publishing industry has made a great attempt, People's Education Association, Higher Education Association, Foreign Research Association and so on have developed electronic textbooks, electronic schoolbag, online learning and other products, digital classroom, digital campus, virtual experimental system has become a reality, digital publishing will bring about major changes in the education industry. In addition, in mobile games, big data business and other aspects, many traditional publishing enterprises have also made bold attempts in digital technology, predicted the future

development trend of digital publishing market, and repositioned the enterprise development strategy.

In recent years, digital publishing industry has been in full swing, from the rapid development of the early stage to the current period of decline, the market has a lot of problems, for example, the content is simple and homogenized seriously, such as mobile reading is dominated by fantasy, sentiment, cross-class and other content, most of the fine content resources are still occupied by traditional publishing houses. In the digital publishing marketing channels, many large and small digital publishing enterprises divided the mobile reading market, the competition is very fierce.

At the same time, we also see many traditional publishing enterprises on digital publishing doubts and wait and see, for a variety of reasons: (1) the traditional mature publishing mode is enough to let enterprises in a certain period of time to rest easy, such as the publication of teaching materials; (2) digital publishing lacks an effective profit model; (3) traditional publishing enterprises lack IT technology and digital talents; (4) digital publishing industry lacks an effective public platform to provide distribution services for digital publishing.

In fact, paper teaching materials cannot always bring benefits to traditional publishing enterprises, the strategic transformation of traditional publishing enterprises is imperative, besides, there are already some more successful profit models can use for reference. In addition, through the establishment of a public level digital publishing service platform, for the traditional publishing enterprises to master fine content resources to provide packaging, promotion, sales and other services, dispel the last two doubts.

The public service platform of digital publishing has laid the foundation for the strategic transformation of traditional publishing enterprises, also provided a converging place for emerging digital publishing enterprises, built a virtual digital publishing industry cluster. In fact, digital base is the direct incentive to build a public service platform for digital publishing. As of March 2014, the number of national digital publishing houses has reached 12. Shanghai Zhangjiang, Guangdong, Jiangsu, Zhejiang digital publishing base output value has reached 10 billion, but there are also some base

constructions has little effect, to figure out why, mainly related supporting environment and support policies are not perfect, as well as the base internal management model backward. Based on this, the construction of digital publishing public service platform can improve the backward base management model, and can stimulate the development of most small and emerging digital publishing start-ups, and these enterprises lack the capital to build information platforms with their own strength.

## **2. The Necessity of Public Service Platform Development and Performance Evaluation**

Digital publishing public service platform is an emerging service tool in the field of digital publishing industry, it is an important part of the industrial system, in fact, the concept of public service platform is put forward because of the loose connection between the various subjects within the industrial system, thus lead to insufficient impetus for the development of the digital publishing industry. Therefore, there is an urgent need for a strong organizational platform to effectively link the stakeholders, so that the participants use the platform integration, sharing resources, to achieve common technology and key bottleneck technology sharing, such as IT technology, big data and so on, can also enhance the core competitiveness of publishing enterprises and share the benefits of different publishing achievements. Unlike, the traditional service platform, the construction of the index system of the digital publishing public service platform should not only reflect the close relationship and their respective needs of digital publishing enterprises, but also emphasize the contributions of relevant stakeholders in platform construction, such as the government, intermediary organizations, public readership groups and so on.

At present, China's digital publishing public service platform construction is still in the initial stage, the service object and function positioning are still relatively vague. We take the example of time-creative community public service platform, which was opened on January 18, 2014, which covers five sub-platforms, namely investment and financing service platform, trading service platform, public technical service platform, legal service platform and talent service platform. In addition, it also provides additional exchange training, life services, consulting services, logistics services and so on. Among them, the trading service platform should be the most important platform, it is a bridge to contact publishing enterprises and readers. But, at present, there is less research on the construction and operation mode of the digital base public service system, the public service platform of educational resources, etc., and the research on the performance evaluation of the digital publishing public service platform is very little, this paper combines the development status of the digital publishing public service platform, formulates a reasonable performance evaluation system, and supports the construction of the existing and future digital publishing public service platform.

## **3. Construction of Performance Evaluation Index System for Digital Publishing Public Service Platform**

### **3.1. Research on the Performance Evaluation of Service Platforms**

There is not much research literature on the performance evaluation of public service platforms. Lv Chengsong et al. (2012) constructed a performance assessment system for R&D public service platforms from four perspectives: platform operating environment, platform resource input, science and technology intermediary services and satisfaction of relevant interest subjects. Li Shengze (2013) studied public science and technology innovation platforms based on the performance prism model. Wang Bin and Tan Qingmei (2013) constructed an industrial innovation platform evaluation index system and weight settings from four dimensions: R&D system, environment system, peripheral support system and industrialization system. Wang Yi et al. (2014) constructed an evaluation index system for e-commerce service platforms, applied AHP analysis to determine the index weights, and used fuzzy comprehensive evaluation method to construct a comprehensive evaluation model for e-commerce service platforms.

### **3.2. Stakeholders of Digital Publishing Public Service Platform**

Digital publishing public service platforms are generally led by the government and established by integrating the advantages of publishing enterprises, technology research and development institutions, financial institutions and other resources, providing publishing enterprises with specialized distribution, data information, consulting and other services, building an efficient and convenient trading platform for readers and digital publishing enterprises, and reducing transaction costs.

For a non-profit organization with a public service nature, the construction of a public service platform for digital publishing must clarify the subject of the service, the object of the service and the process of the service. The main body of the service is generally the government's outsourcing or joint development of the service platform with the software company, as the main investment body, the government provides funds and planning solutions, and the software company is responsible for the specific analysis, design and maintenance of the platform; the object of the service reflects the "public goods" nature of the platform, digital publishing. These enterprises may not lack innovative products, but they lack sufficient funds and technical support, and there are obstacles in product production, packaging, distribution and promotion, which do not exist for large publishing groups. Finally, there is the process of service, which is a key point in determining the level of performance of the service platform. We analyse the entire service process from the perspective of the digital product value chain. In the digital product development stage with the help of the creative sharing platform in the service platform, market research and data mining based on readers' big data, in the digital product production process to provide quality monitoring, inspection and other management services, also including product design, packaging and other services, in the distribution stage to provide digital publishing enterprises with promotion, sales information management services and so on. In addition, it

also includes consulting, legal, human resources and other service contents, all of which lay the foundation for the transformation of digital publishing enterprises from the start-up phase to the rapid development phase.

### 3.3. Principles of Evaluation System Construction

First, the goal-oriented principle. The fundamental purpose of the performance evaluation of digital publishing public service platforms is not to rank the public service platforms in terms of merits and demerits, but to guide and encourage the service platforms to develop in the right direction and with the right objectives. Like enterprises, service platforms also have a life cycle, and the performance objectives of public service platforms may vary at different stages of development. Therefore, the evaluation system should also be adjusted in line with changes in the development objectives of the platform.

Second, the principle of system optimization. On the one hand, evaluation indicators should measure the true performance level of the service platform as comprehensively as possible. The digital publishing public service platform is designed for multiple stakeholders, government agencies, publishing enterprises, financial institutions, information technology consulting companies, etc. The evaluation system should take into account the relationship between all aspects and respond to the relevant activities of different subjects. On the other hand, as the evaluation elements of the platform are interconnected and mutually constrained, the horizontal connection reflects the constraint relationship and the vertical relationship reflects the hierarchical relationship. Therefore, when designing the evaluation system, the integrity and independence of the horizontal indicators should be taken into account. In addition, the hierarchy of indicators should be appropriately divided according to the progressive relationship between objectives and indicators, which makes the evaluation indicator system clearer.

System optimization is also reflected in the number of evaluation indicators, which should follow the principle of "fewer but more precise". Considering the cost of evaluation, the difficulty of information collection and other factors, the structure of the evaluation system should reflect the

performance of the service platform in a systematic way with fewer indicators.

Third, the principle of developmentality. The direct purpose of constructing the evaluation system for digital publishing public service platforms is to evaluate the performance of digital publishing public service platforms, but more attention should be paid to the future development of public service platforms. As an emerging service industry, digital publishing public service platforms still have great problems in customer service, internal processes, brand building and investment in human capital, etc. Therefore, when constructing the evaluation system, it should not only reflect the past performance, but also reflect the future dynamics and direction of the platform's development.

There are also some other principles, such as the principle of dynamism, in which performance indicators should be adjusted with the dynamic development of digital publishing market demand and platform technology; the principle of quantitative-based and qualitative-supplemented, which can improve the scientificity of performance evaluation results; and the principle of realism, in which platform evaluation indicators are based on data that are objective and realistic and easily accessible, with reliable information source channels.

### 3.4. Composition of Performance Evaluation Dimensions

According to the actual operation of the existing digital publishing public service platform, the performance evaluation system of the digital publishing public service platform is designed based on the theory of balanced scorecard and customer relationship management, combined with the relevant theories of performance evaluation. The evaluation system is roughly divided into four major dimensions - platform performance objectives, platform customer service satisfaction, platform internal processes and platform support system. There is an inherent logical relationship between the four dimensions, as shown in Figure 1. The support system determines the platform's internal operation process and its effectiveness, while the internal operation process determines the satisfaction of the platform's customers, which is directly reflected in the platform's economic and social benefits.

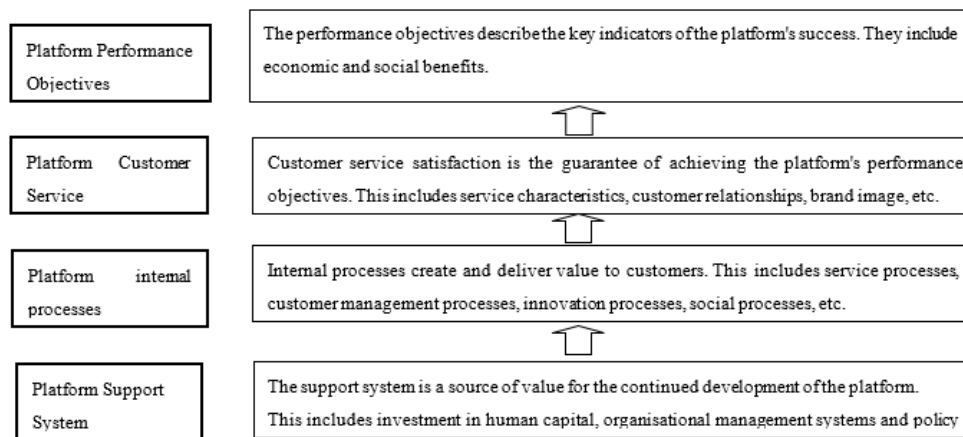


Figure 1. Logic diagram of the four dimensions of the digital publishing public service platform

In this paper, through extensive literature research, according to the principles that should be followed in designing performance evaluation indicators, combined with the balanced scorecard and the characteristics of digital publishing public service platforms, representative indicators

were selected from the above four dimensions to construct a performance evaluation indicator system for digital publishing public service platforms, and through multiple rounds of consultation with experts, the final evaluation indicator system was formed (for details, see Table 1).

**Table 1.** Evaluation indexes and weights of digital publishing public service platforms

Objectives Dimension	Tier 1 Indicator	Tier 2 Indicator	Description
Platform Benefits Objective A	Economic benefits A <sub>1</sub>	Asset utilizationA <sub>11</sub>	Ratio of investment to sales / Ratio of input to return
		Economic added valueA <sub>12</sub>	The difference between profit after tax and capital charges, reflecting the economic value or gain added by capital
	Social benefits A <sub>2</sub>	Platform turnoverA <sub>21</sub>	Annual turnover of products sold for the digital publishing business
		Profit contribution marginA <sub>22</sub>	Contribution to the profit of a digital publishing business
Platform Customer Service B	Service Features B <sub>1</sub>	Function B11	The functions and technical advancement achieved by the platform
		Quality B12	Accuracy of platform system execution, corresponding speed, safety and reliability
		Time B13	Efficiency in meeting customer needs
	Customer Relations B <sub>2</sub>	Service B21	Service satisfaction
		PartnershipsB22	Long-term cooperation of platform customers
	Profile B <sub>3</sub>	Platform Brand B31	Brand awareness and brand loyalty
Market position B32		Public service platform market share	
Platform Process Management C	Service Process C1	Identifying requirements C11	Degree of functional demand satisfaction
		Developing the Platform C12	Development efficiency, technological advancement
		Promoting the service C13	Promotion costs of the service platform
	Customer Management Process C2	Attracting new customersC21	Rate of new customer acquisition
		Retaining existing customersC22	Customer churn rate
	Service Innovation Process C3	Identifying New NeedsC31	Platform system maintenance rate and customer satisfaction
		Managing Technology DevelopmentC32	Technological firsts, development costs
		Platform RedesignC33	Platform operational cycle time, innovation rate
	Social Process C4	Staff HiringC41	Employee hiring equity
Social ContributionC42		Social impact, welfare, ethics	
Platform Support System D	Human Capital Investment D1	Internal trainingD11	Staff training effectiveness evaluation
		External Joint DevelopmentD12	Joint development of talents with external related organizations
	Organizational Management System D2	Organizational management capacityD21	Organizational staff structure, management system, management level
		Organizational changeD22	Number and effectiveness of organizational changes
	Policy system D3	Development of codes and regulations by government departmentsD31	Status of government support policies
Regulations of relevant partner agencies D32		Relevant policies provided by software development companies, financial institutions, etc.	

#### 4. Determination of the Weight of Performance Evaluation Indicators for Digital Publishing Public Service Platforms

In the past research, more expert experience method is used to determine the weight of evaluation indicators, subjectivity is too strong, this paper applies hierarchical analysis method, qualitative and quantitative combination of comprehensive analysis methods, first by experts on the relative importance of indicators subjective judgment, and then use objective calculations to arrive at the final index weight.

In order to reduce the subjective error of expert judgment, this index system first selects experts from different fields, including university professors, managers of digital publishing public service platforms, information system management experts, and uses Delphi method to determine

the value of elements in the judging matrix. The basic process is as follows:(1) each expert, based on his or her own experience, gives two or two points to the indicator according to a given scale, in this paper, the 9-level scoring method is used to develop the specific evaluation grade and assignment method of each indicator, and the ratio of the importance of any two factors  $X_i$  and  $X_j$  can be used 1,2, ..., 9 and their countdown indicate that scales 1, 3, 5, 7 and 9 represent equally important, slightly important, obviously important, strongly important and absolutely important, scales 2, 4, 6 and 8 represent the median of two adjacent judgments; (2) summarize the results of the first round of experts' score, the results of the analysis are distributed anonymously to each expert, who adjusts his or her judgment and re-rates them based on the results of the analysis; (3) repeat the above process until the experts are basically in agreement.

#### 4.1. The Target Dimension Weight is Determined based on the Hierarchical Analysis Method

First of all, according to Delphi, the experts score to determine the performance relative to the four target dimensions of the judgment matrix. In the case of elements, A and B, if A/B=2, the experts agree that the platform benefit goal is slightly more important than the platform customer service.

$$H = \begin{pmatrix} H & A & B & C & D \\ A & 1 & 2 & 3 & 4 \\ B & 1/2 & 1 & 2 & 3 \\ C & 1/3 & 1/2 & 1 & 2 \\ D & 1/4 & 1/3 & 1/2 & 1 \end{pmatrix}$$

The maximum feature value and feature vector of the matrix are then calculated. Calculate the geometric average of

the values of each row of elements,  $M_i = \sqrt[n]{\prod_{j=1}^n a_{ij}}$ ,

$i = 1, 2, \dots, n$ ,  $n$  is the matrix order; and on this basis, the weight value of each indicator is calculated,

$$W_i = M_i / \sum_{j=1}^n M_j$$

Finally, the maximum characteristic

value of the judgment matrix is calculated, and in order to calculate it easily, in this paper sum method is used to calculate the maximum eigenvalue of the matrix,

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^n \frac{(HW)_i}{W_i}$$

, among them,  $(HW)_i$  is the  $i$

component of  $HW$ . The maximum feature value of the matrix above  $H$  is calculated as follows:

$$\begin{pmatrix} H & A & B & C & D & M_i & W_i & (HW)_i \\ A & 1 & 2 & 3 & 4 & 2.2134 & 0.4797 & 1.8808 \\ B & 1/2 & 1 & 2 & 3 & 1.1892 & 0.2577 & 1.1200 \\ C & 1/3 & 1/2 & 1 & 2 & 0.7598 & 0.1647 & 0.6500 \\ D & 1/4 & 1/3 & 1/2 & 1 & 0.4518 & 0.0979 & 0.3900 \end{pmatrix}$$

$$\lambda_{\max} = \frac{1}{4} \left( \frac{1.8808}{0.4797} + \frac{1.1200}{0.2577} + \frac{0.6500}{0.1647} + \frac{0.3900}{0.0979} \right) = 4.0493$$

Finally, a consistency test is performed to determine whether the matrix is to be adjusted. If the consistency ratio  $CR \leq 0.1$ , the judgment matrix passes the consistency test, and instead the element value needs to be adjusted. Among them,  $CR = CI / RI$ ,  $CI = (\lambda_{\max} - n) / (n - 1)$ ,  $RI$  is the average random consistency indicator value corresponding to the  $n$  order matrix. The consistency ratio of the above judgment matrix  $CR = 0.0185 < 0.1$  is tested by consistency. Therefore, the weight of the platform benefit target is 47.97 percent, the weight of platform customer service is 25.77 percent, the weight of platform process management is 16.47 percent, and the weight of platform support system is 9.79 percent.

#### 4.2. Weight and Consistency Test Results for Tier I and LEVEL II Indicators

##### 4.2.1. Platform Benefit Target Dimension First-Level Indicators and Secondary Indicators Weight and Consistency Test

Platform benefit target dimension first-level indicators and secondary indicators weight and consistency test, as shown in Table 2.

**Table 2.** Platform benefit target dimension first-level indicators and secondary indicators weight and consistency test

Tier 1 Indicators	$W_i$	CR	Secondary indicators	$W_i$	CR
Economic benefits A1	0.5000	CR=0<0.1	Asset Utilisation A11	0.3333	CR=0<0.1
			Economic Value Added A12	0.6667	
Social benefits A2	0.5000		Platform turnover A21	0.6667	CR=0<0.1
			Profit contribution margin A22	0.3333	

##### 4.2.2. Platform Customer Service Dimension First-Level Indicators and Secondary Indicators Weight and Consistency Test

Platform customer service dimension level 1 indicators and

secondary indicators weight and consistency test, as shown in Table 3.

**Table 3.** Platform Customer Service Dimension Level 1 Indicators and Level 2 Indicator Weights and Consistency Tests

Tier 1 Indicators	$W_i$	CR	Secondary indicators	$W_i$	CR
Service Features B <sub>1</sub>	0.5329	CR=0.0159<0.1	Function B <sub>11</sub>	0.5865	CR=0.0127<0.1
			Quality B <sub>12</sub>	0.3100	
			Time B <sub>13</sub>	0.1035	
Customer Relations B <sub>2</sub>	0.3317		Service B <sub>21</sub>	0.5000	CR=0<0.1
			Partnerships B <sub>22</sub>	0.5000	
Image B <sub>3</sub>	0.1354		Platform Brand B <sub>31</sub>	0.6667	CR=0<0.1
		Market Status B <sub>32</sub>	0.3333		

#### 4.2.3. Platform Process Management Dimension First-Level Indicators and Secondary Indicators Weight and Consistency Test

Platform process management dimension level 1 indicators

and secondary indicators weight and consistency test, as shown in Table 4.

**Table 4.** Platform process management dimension level 1 indicators and secondary indicator weights and consistency tests

Tier 1 Indicators	$W_i$	CR	Secondary indicators	$W_i$	CR
Service Process C1	0.4213	CR=0.0801<0.1	Identify requirements C11	0.5865	CR=0.0127<0.1
			Developing the platform C12	0.3100	
			Promote services C13	0.1035	
Customer Management Process C2	0.3017		Attract new customersC21	0.4500	CR=0<0.1
			Retain existing customersC22	0.5500	
Service Innovation Process C3	0.1836		Identifying New NeedsC31	0.5023	CR=0.0291<0.1
			Managing Technology DevelopmentC32	0.1267	
			Platform RedesignC33	0.3710	
Social Processes C4	0.0934		Staff HiringC41	0.6000	CR=0<0.1
			Social Contribution C42	0.4000	

#### 4.2.4. Platform Support System Dimension First-Level Indicators and Secondary Indicator Weight and Consistency Test

The weight and consistency test of the first and second

level indicators of the platform support system, as shown in Table 5.

**Table 5.** Weight and consistency test of the first and second level indicators of the platform support system dimension

Tier 1 Indicators	$W_i$	CR	Secondary indicators	$W_i$	CR
Investment in human capital D1	0.2034	CR=0.072<0.1	Internal training D11	0.4000	CR=0<0.1
			External joint development D12	0.6000	
Organizational management system D2	0.3127		Organizational management capacity D21	0.6000	CR=0<0.1
			Organizational change D22	0.4000	
Policy system D3	0.4839		Development of codes and regulations by government departments D31	0.6667	CR=0<0.1
			Regulations of relevant partner agencies D32	0.3333	

Finally, the consistency of the total layer is tested, which is carried out by calculating the combined weight of the secondary indicator to the target dimension, and applying the

formula  $CR = \sum_{i=1}^k W_i CI_i / \sum_{i=1}^k W_i RI_i$ . Limited to space, the

combined weight table of the specific secondary indicators drawn in this paper is no longer listed, and the final calculation of  $CR = 0.0172 < 0.1$  indicates that the total layer passed the consistency test.

## 5. Comprehensive Evaluation of the Performance of the Digital Publishing Public Service Platform

In the comprehensive evaluation of the performance of the relevant digital publishing public service platform, the first data collection, according to the rating level of the indicator, and then according to the comprehensive evaluation model to calculate the final score, the specific formula is:

$$P = 100 \times \sum_{a=1}^j \sum_{b=1}^k \sum_{c=1}^{l_n} W_{abc} P_{abc}$$

Among them,  $P$  is the final performance evaluation score, is in the range of  $[0,100]$ .  $P_{abc}$  represents the c-indicator scoring value of class b in the target dimension of a, and  $W_{abc}$  is the combined weight of the c-indicator of class b in the target dimension of a,  $a = 1, 2, 3, \dots, j$ ;  $b = 1, 2, 3, \dots, k$ ,  $l_n$  is the number of class b indicators in the a dimension. In this article, a=4, b is the number of first-level indicators, b=12.

Because of the different measurement units of different indicators, the evaluation results can be more comparable by the non-scale processing of the original data, and in order to make the evaluation results more relevant, in order to calculate it easily, this paper adopts the weight method in the linear non-scale-based processing, that is, the actual value is converted into its proportion in the sum of the indicator values,

the calculation formula is,  $X_i = \frac{x_i}{\sum_{i=1}^n x_i}$ .

## 6. Conclusion

Through the investigation and research of the digital publishing public service platform, combined with the characteristics of the relevant experts' consultation and public service platform, using the idea of balanced scorecard, constructing the performance evaluation index system of the digital publishing public service platform from the four dimensions of platform benefit goal, platform customer service, platform process management and platform support system, and using the hierarchical analysis method to determine the weight of each indicator, and clarify the combined weight of the target dimension, first-level index and secondary index, this evaluation system has strong practicality, it can be used to locate the possible problems of digital publishing public service platform and guide the development of digital publishing public service platform.

In the practice of performance evaluation, the weight should be adjusted taking into account the actual situation. At present, most digital publishing public service platform is still in the early stage of construction, we should reduce the weight of the benefit target dimension and improve the customer service dimension and process management dimension. In addition, in order to improve the correctness of evaluation, the relevant management information system should be introduced as soon as possible to meet the requirements of the information required for performance evaluation.

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