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The Research of the Evaluation Indicator System for Enterprise Scientific Information Services

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Abstract: An evaluation indicator system for enterprise scientific information services can be use to guide the development directions of enterprise information services and to provide theoretical support for the government and industrial management. This evaluation indicator system is constructed according the present status of Chinese enterprise information services, by integrating scientific and practicality, integrating quantity, according to the comparability principle, by using hierarchical analysis method and considering the four aspect of information awareness and mechanism, financial investment and service facilities, in formation resource development and device effects.

Key words: Scientific information services, evaluation indicator, fuzzy evaluation model, enterprise information service

INTRODUCTION

The comprehensive construction of colleges and universities should have the support of scientific and technical information, scientific information services serve in the whole process of university management innovation and it is an integral part of university innovation. In terms of the situation of scientific information services, Managers in some universities have weak information consciousness and there are some problems in the construction of information evaluation index system (Haiyuan *et al*, 2004). By way of the research of the evaluation indicator system for enterprise scientific information services, on the one hand, it could help college administrators grasp the direction of development of scientific information services and found problems in work and be addressed to achieve the purpose of the assessment to promote the construction. On the other hand, it provides theoretical support for government departments, trade associations, colleges and universities to guide and evaluate scientific and technical information.

THE STRUCTURE AND CONTENT OF AN EVALUATION INDEX SYSTEM

Architecture of evaluation index: According to the actual situation of Scientific information service in our country, follow the scientific and practical combination of qualitative and quantitative combined with the principle of comparability, using analytic hierarchy process, construct innovative S and T information work evaluation system. Seen the structure Table 1.

Some quantitative indicators of the description: Capital investment. National Technology Center where the University finds that expenditures for science and technology funds should be more than 3% of full funding and the proportion of expenditure on science and technology funds over the previous year is greater than or equal to zero, the information resource development should be accounted for by a reasonable proportion of funding for scientific and technical information.

The amount of literature information Document Information Document Information resources can reflect the size and per capita number of documents. Number of professional books printed book number and ownership of electronic books and the number of species, number of professional journals printed kinds of species number and the right to use the number of kinds of electronic journals (excluding with the repetition of a portion of the printed journal).

Literature information rate. Document Information ownership rate can reflect the quality of the construction of information resources, according to technological innovation and university-related literature information for the evaluation of the object. Professional Book ownership rate refers to the number of kinds of professional books in book publishing with the relevant professional ratio of number of species; professional journals rate refers to the number and kinds of professional journals are produced off the ratio of the number of kinds of professional journals; electronic resources, the rate refers to the right of the number of electronic resources and electronic the ratio of the number of kinds of resources.

Table 1: College job evaluation index system of scientific and technical information

Target layer (0)	Layer guidelines (A)	Layer guidelines (B)	Index layer (C)
Scientific information services 0	Awareness and MechanismA1 (X1)	Science and Technology Information B1 (X11)	The awareness of nniversity leadership C1 (X111) Scientific and technological information awareness of staff C5 (X112)
	Awareness of scientific and technological personnelC3 (X113)	Organization Mechanism B2 (X12)	Leaders in charge of the situation C4 (X121) The status of scientific and technical information agencies C5 (X122) Internal Organization C6 (X123) Regulations C7 (X124)
		Talent and incentive mechanism B3 (X13)	Scientific and technical information staff acconnted for the proportion of scientific and technological personnel C8 (X131) The quality of scientific and technological personnel C9 (X132) Scientific and technical information and scientific and technological personnel of income for the average income ratio C10 (X133) Scientific and technical information and scientific and technological personnel of income for the average cost of training C11 (X134)
		Cooperation mechanisms B4 (X14)	The number of the establishment of scientific and technological information-sharing mechanism, universities, research institutes, C12 (X141) The number of experts go to the enterprises engaging in scientific and technical information development and exchange Annually, C13 (X142) The total number of items Cooperating with foreign scientific and technological information items in the proportion of scientific and technical information each year C14 (X143) The number of social groups to participate in scientific and technical information C15 (X144)
	Capital investment and service facilitiesA2 (X2)	Capital investment B5 (X21)	Scientific and technical information technology expenditures accounted for the proportion of expenditures C_{16} (X_{211}) Proportion of expenditure on scientific and technical information provision over the previous year C_{17} (X_{212}) Information Resources Construction accounted for the proportion of fnnding for scientific and technical information C_{18} (X_{213})
		Loan facilities and service envirounent B6 (X22)	Owe an area of premises every 100 technical personnel C19 (X221) The100th of scientific and technical personnel has a number of seats C_{20} (X_{222}) Facility configuration C_{21} (X_{223})
		Web services B7 (X23)	Network facilities C_{22} (X_{231}) Network Envirounent C_{23} (X_{232}) Internet Rate C_{24} (X_{233})
	Information resources A3 (X3)	Document information number B8 (X_{31})	The number of professional books C_{25} (X_{311}) Several kinds of professional journals C_{26} (X_{312}) The number of having the right to use electronic resources C_{27} (X_{313}) The number of professional books each person has C_{28} (X_{314}) The number of professional journals each person has C_{29} (X_{315})
		Document information ownership rate B9 (X32)	Professional Books ownership rate C_{30} (X_{321}) Professional journals ownership rate C_{31} (X_{322}) Electronic Resources ownership rate C_{32} (X_{323})
		The use of the cost of electronic resources B10 (X33)	Cost of using E-book C_{33} (X_{331}) Cost of using E-journal C_{34} (X_{332}) The cost of professional database C_{35} (X_{333})
	Service effect A4 (X4)	The number of services B_{12} (X_{41})	The number of books borrowed per capita C_{40} (X_{411}) The number of annual per capita use of electronic documents C_{41} (X_{412}) SDI services accounted for the proportion of scientific and technological development projects C_{42} (X_{413})

Table 1: Continued

Target layer (0)	Layer guidelines (A)	Layer guidelines (B)	Index layer (C)
			Click the number of science and technology information sites per capita C_{43} (X_{414})
			Training account for the proportion of scientific and technical persounel each year C_{44} (X_{415})
		Service Satisfaction B_{13} (X_{42})	The easy degree of accessing to information C_{45} (X_{421})
			The level of meeting the Scientific and technical information C_{46} (X_{422})
			The level of service satisfaction C_{47} (X_{423})
		The effectiveness of services B_{14} (X_{43})	Million investment in scientific and technical information for each new product sales revenue C_{48} (X_{431})
			Scientific and technical information for each million of new investment in profits from product sales C_{49} (X_{432})
			Scientific and technical information for every million dollars invested to obtain the number of patents C_{50} (X_{433})

The cost of using the electronic resources. The cost of electronic resources to use electronic resources equals the use of the purchase price divided by the number. It reflects the use of electronic resources, the economy and purchase of electronic resources is reasonable.

THE ESTABLISHMENT OF FUZZY COMPREHENSIVE EVALUATION MODEL

We can see Scientific information services from the colleges and universities can not find job evaluation, the evaluation indicators include a wide range of indicators are difficult to quantify, leading to evaluation of the complexity of the ambiguity, it is impossible to use precise mathematical tool for propaganda analysis. Here we apply the principle of fuzzy mathematics of fuzzy comprehensive evaluation method for quantitative description and evaluation, the symbol represented in Table 1.

Establishing an evaluation factor set: Guidelines for the evaluation index system layer (A) of the indicators as a sub-factors, denoted as:

$$X = (X_1, X_2, X_3, X_4)$$

To the criteria layer (B) of the sub-factors as the two sub-factors, denoted as:

$$X = (X_{11}, X_{12}, X_{13}, X_{14}),\ldots, X_4 = (X_{41}, X_{42}, X_{43})$$

Indicator layer (C) of the sub-factors X_{ijk} as (k = 1,2,...,5) three sub-factors, denoted by:

$$X_{11} = (X_{111}, X_{112}, X_{113}, \cdots),\ldots, X_{43} = (X_{413}, X_{423}, X_{433})$$

Determining the reviews set: The evaluation is divided into five grades, denoted as:

$$Y = (Y_1, Y_2, Y_3, Y_4, Y_5)$$

where, Y_1 stands for good, Y_2, stands for better, Y_3, stands for general, Y_4, stands for lower, Y_5, stands for poor.

Determining the weight vector

Constructing comparison matrix: According to the theory of AHP, experts pair wisely compares on all levels of indicators by1-9 scale method (Zhiren *et al*., 1992), determine the ratio between each indicator scales and thus construct comparison matrix. Each level of each of the next level of a set of indicators form a comparison matrix A total of 19 comparison matrix that constitutes:

$$0\text{-}A;\ A1\text{-}B1,\ B4,\ldots,\ B14\text{-}C49,\ C51$$

Seeking the size of weight by the square-root method: As for the matrix $0\text{-}A = (a_{ij})_{m\times n}$, if the compatibility of $0\text{-}A = (a_{ij})_{m\times n}$ is good, we use the weight vector to obtained accuracy, which can fully meet the needs (Yue *et al*., 1992). The demanding weight vector is as follows:

$$W = (w_1, w_2, \ldots, w_n)$$

$$W_i = (w_1, w_2, \ldots, w_n)\ (i = 1,2,\ldots,4;\ k = 1,2,\ldots,5)$$

$$W_i = (w_1, w_2, \ldots, w_n)\ (i = 1,2,\ldots,4;\ j = 1,2,\ldots,5;\ k = 1,2,\ldots,5)$$

Determining the evaluation matrix: Fuzzy evaluation of R is a fuzzy mapping for the $X \rightarrow Y$ (Puying and Mengda, 2002). When conducting a comprehensive evaluation for the criteria layer B_i = (i = 1,2,..., 14), we should make no class treatment be for the quantitative indicators, that is, the industry's most enterprises good value is divided by the actual value and this value is less than or equal to 1, the assignment of qualitative indicators to quantify using membership degree conferred law, this value is $0 \sim 1$. X_{ijk}

is subordinate to the first t (t = 1,2,..., 5) reviews Y_t extent Y_{ijkt} using an expert assessment of law, namely, Determining X_{ijk} which belongs to a number of experts reviews t class accounted for the proportion of total number of experts, this value r_{ijkt}, which constitutes the fuzzy evaluation matrix, $R_{ij} = (r_{ijkt})_{k\times t}$. So constitutes A total of 14 fuzzy evaluation matrixes, namely:

$$R_{11} = (r_{11jt})_{3\times5},\ldots,\ R_{43} = (r_{43jt})_{3\times5}$$

For fuzzy comprehensive evaluation: In order to fully reflect the various factors on the impact of the comprehensive evaluation, we use a comprehensive evaluation of the weighted average-type function to take one level fuzzy comprehensive evaluation (Zuzeng and Wenyu, 2002), obtain fuzzy comprehensive evaluation at various levels of trace and take evaluation vector corresponding reviews focused on the largest level, the index rating:

Taking an initial rating: We make a fuzzy comprehensive evaluation for the branch of the guidelines (B) indicator X_{ij}.

$$S_{ij} = W_{ij} \cdot R_{ij} = \left(S_{ij1}, S_{ij2}, \cdots S_{ijk}\right) \begin{pmatrix} r_{ij11} & r_{ij12} & \cdots & r_{ij15} \\ r_{ij21} & r_{ij22} & \cdots & r_{ij25} \\ r_{ij31} & r_{ij32} & \cdots & r_{ij35} \\ r_{ij41} & r_{ij42} & \cdots & r_{ij45} \end{pmatrix}$$

Where:

$$s_{ijk} = \sum_{k=1}^{5} w_{ijk} \cdot r_{ijkt},\ \sum_{k=1}^{5} w_{ijk} = 1$$

According to the biggest membership degree principle, rating the indicators. By the above method, we make an evaluation of 14 indicators followed by scientific and technological information awareness B_1 = (i = 1, j = 1), the organization of institutional mechanisms B_2 = (i = 1, j = 2),... ..., the effectiveness of services B_{14} (i = 4, j = 3).

The results will serve as a guideline layer (A) of the two indicators to assess the evaluation matrix. For the criteria layer (A) index A_i of the evaluation matrix as follows:

$$R_1 = \begin{pmatrix} S_{11} \\ S_{12} \\ S_{13} \\ S_{14} \end{pmatrix},\ R_2 = \begin{pmatrix} S_{21} \\ S_{22} \\ S_{23} \end{pmatrix},\ R_3 = \begin{pmatrix} S_{31} \\ S_{32} \\ S_{33} \\ S_{34} \end{pmatrix},\ R_4 = \begin{pmatrix} S_{41} \\ S_{42} \\ S_{43} \end{pmatrix}$$

Conducting second-level evaluations: We make the layer of the guidelines (A) indicator A_i for second-level fuzzy comprehensive evaluation (Wei-guo and Wei-jun, 2006):

$$S_i = W_i \circ R_i = (S_{i1}, S_{i2},\ldots S_{ik})\ i = 1,2,\ldots,4,\ k = 1,2,\ldots,5$$

According to the biggest membership degree principle, rating the indicators

The results of the evaluation of job evaluation can be seen as a college three-level scientific and technical information evaluation matrix, that is:

$$R = \begin{pmatrix} S_1 \\ S_2 \\ S_3 \\ S_4 \end{pmatrix}$$

Conducting third-level fuzzy comprehensive evaluation:

$$S = W.\ R = (S_1, S_2, S_3, S_4, S_5)$$

$$. = (w_1, w_2, w_3, w_2) \circ \begin{pmatrix} S_{11} & S_{12} & S_{13} & S_{14} & S_{15} \\ S_{21} & S_{22} & S_{23} & S_{24} & S_{25} \\ S_{31} & S_{32} & S_{33} & S_{34} & S_{35} \\ S_{41} & S_{42} & S_{43} & S_{44} & S_{45} \end{pmatrix}$$

Based on the above results and the principle of maximum membership degree, we take the largest number of S corresponds to the level of reviews set and make the rating for the scientific information service.

The results of evaluation (Rijia *et al.*, 2006): In order to show the results of evaluation quantitatively and comprehensively, we can assign to the class. If the good as 100 points, better for 80 h, general for 60 points, 40 points lower, the poor of 20 points, constitute a vector Q = (100, 80, 60, 40, 20), then the assignment after the quantitatively: Z = S·Q. By comparing the size of Z and the number of enterprises within the industry, for example, we sort for the scientific information service by the size of Z.

If the mathematical tools and experts and that it is complemented by computing, the system will become an effective and easy method evaluating the scientific information service.

REFERENCES

Haiyuan, H., S. Jing and S. Yuanyuan, 2004. Development and utilization of large and medium enterprise information resources. J. Modern Information, 24: 178-179.

Puying, L. and W. Mengda, 2002. Fuzzy Theory and its Applications. Wuhan University Press, Wuhan, ISBN: 7810244981.

Rijia, D., X. Chunhua and C. Jiapeng, 2006. Fuzzy synthetic evaluation: A new method on evaluating science and technology production changing into international standards. World Standardization Qual. Manage., 10: 33-35.

Wei-guo, Z. and X.U. Wei-jun, 2006. The FCE model about the system of innovation in enterprise and the empirical analysis. Mathematics Practice Theory, Vol. 36.

Yue, Z., Z. Shouping and S. Fang, 1992. Fuzzy Mathematics Method and Its Applications. China Coal Industry Publishing House, Beijing, ISBN: 7502005749.

Zhiren, Z., H. Qi and S. Jianjun, 1992. Quantitative Analysis of Information Research. Nanjing University Press, Nanjing.

Zuzeng, P. and S. Wenyu, 2002. Fuzzy Mathematics and Its Applications. Wuhan University Press, Wuhan, ISBN: 7307033682.