Evaluation of Management Information Resource Allocation Based on Cloud Gravity Center Theory

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Abstract—According to the structure of generalized information resource, in this paper the evaluation index system of management information resource allocation is established. Based on the cloud gravity center theory, the allocation evaluation model is constructed. The cloud gravity center theory is the effective evaluation method.

Keywords—Cloud gravity center theory; Information Resource; Allocation; Evaluation

I. INTRODUCTION

With the information age’s coming, the information resource is becoming more and more important in increment of matter resource and energy resource using, and it becoming more and more distinctness in weakening the incertitude of management decision. Information resource is turning into one of the three backbone resources of modern community development. The key of the information resource allocation is how to optimize the distribution in time, space, and quantity. By efficiency evaluating information resource allocation, not only the problem of the allocation can be found, but also the optimization of resource can be lead.

II. INFORMATION RESOURCE STRUCTURE AND ALLOCATION

Generalized, information resource is the set of information, information producer, and information technology. It includes: the set of useful information accumulated in management activities; the set of information producer, information manager, information servicer; the set of information technology facilities which used to process, dispose, transfer useful information. Form the noumenon theory view, information resource corresponds to information noumenon resource, main body resource, and exterior resource[1]. Thereinto, information noumenon resource is the core, information main body resource is the guarantee, information exterior resource is the means. According the different arrangement, department, quarters, different verities, structures, formals information resource should be allocated different time-efficiency, different requirement of different arrangements, departments, and quarters.

Information resource time allocation is the distribution in time coordinate, which disported to past, now and future in configuration, and disported to size, continuum or not in period of time. The allocation meaning of information resource in time vector is decided by its time efficiency, a timely information maybe invaluable, whereas, a lateness or premature information maybe nothing. Videlicet speaking, information avail is osculation correlate with the choice of start point and size.

Information resource space allocation is the distribution in different management arrangement and different management department, materially, it is the allocation in different use direction. The difference of information resource content is the existent precondition of space allocation, and it company with the difference of user information demand causes the flowage between departments, furthermore, they cause the difference of information resource structure. Information resource space allocation actually is quest a best optimize permutation and combination, and achieving a best usage benefit.

Information resource quantity allocation is the distribution of varieties and quantity in different space and time. The manners of the allocation are existence quantity allocation and increment quantity allocation. The chiefly problem is adjust exist information resource, insuring limited invest acquire max output. At the same time, not only more information resource launched into, but also new information resource allocated to management activities, and information resource can be used high efficiency.

III. INFORMATION RESOURCE ALLOCATION EVALUATION INDEX SYSTEM

Information resource allocation is the integration course of complex system, the allocation aim is not only efficiency utilize resources, but also dynamic development and increment. According to the resource structure and allocation allocate character, following the principle of system, tropism, comparable and synthesis, a multilayer evaluation index system of management information resource allocation is established[2], as Fig.1 shows.

A. Information noumenon resource

Information noumenon resource allocation is estimated by information quality and information demand satisfied condition. Information quality includes: veracity, marching grade of information and reality; timely, information adopted time; security, the security grade of transmission, storage and utilization; criterion, the grade of standardization; unhomogeneity, information types and contents of allocation and possession are not repeat with each other. Information demand satisfied condition mostly includes: the grade of information content marching users’ demand, the grade of
information carrier marching users’ demand, the grade of information adoption method marching users.

B. Information main body resource

Information main-body resource allocation is measured by information main body diathesis, ability and structure. Information main body diathesis is the sciential level of information knowledge that personal have had, it includes: information personal educated condition, specialization level and so on; information main body resource ability is the operation ability of management information and technology information main body resource structure is the distribution of information personal quantity, age, and technique condition, it includes of the information personal quantity suitability and ladder-structure responsible grade.

C. Information exterior resource

Information exterior resource is examined by the teches of collection, transmission, storage and issuance. Information collection includes: collection facility matching rate, collection facility dependability, collection facility utilization; information transmission includes: network dependability, network transmission efficiency, network establishment and facility utilization; information storage and issuance includes: storage and issuance ability, which are closely associated with the construction level of data center.

IV. INFORMATION RESOURCE ALLOCATION EVALUATION MODEL

Some of existence evaluation methods are subjective qualitative estimate, lack objectivity and quantitative analysis; others are rigid carve quantitative data up, inadequate macrocosm and profundity; or else are mix math models and quantitative calculation with qualitative analysis. All the methods mentioned above are demand manpower operation, lack objectivity. Cloud gravity center theory actualizes the nature conversion between qualitative language data and quantitative numerical data, and evaluation result accords with anthropic thought. The theory is the availability method to research incertitude problems, and it widely used in varies management evaluation.

A. Cloud gravity center evaluation elements principium

Based on traditional fuzzy set theory and probability statistics, cloud gravity center theory integrates fuzzy quality and randomicity together, and structure the mapped between quality and quantity. Using this theory, the extension and distribution rule of quantitative data can be turned into qualitative information expressed in language data, and the apt qualitative language data can be switched from exactitude numerical data.

The cloud can be described by number characters, such as expected data $E_x$, entropy $E_n$, windage $D$, and so on. Thereinto: $E_x$ is the gravity center of cloud, it demarcates the center data of fuzzy notional concept; $E_n$ is the measurement of fuzzy degree, it reflects the adopt data extension that can be accepted by quality concept; $D$ is the measurement of cloud, and it is the max of the whole cloud and reflects the disperse grade.

$$T = a \times b$$

Thereinto: $T$-cloud gravity center;

$a$-cloud gravity center position, that is expect data;

$b$-cloud gravity center height, that is emphasis grade.

For any system, when information expect data changed, information center data of cloud gravity center changed, and cloud gravity center position also changed. Therefore, by researching the change of cloud-gravity center position, we can control system condition and evaluate system.

B. Cloud gravity center evaluation process

a) Establish of cloud model indexes

Based on structuring index system, n groups evaluation are abstracted to compose decision matrix, and all number style indexes can be denoted by cloud models.

$$E_i = (E_{i_1} + E_{i_2} + \ldots + E_{i_n})/n$$

$$E_n = [\max(E_{i_1}, E_{i_2}, \ldots, E_{i_n}) - \min(E_{i_1}, E_{i_2}, \ldots, E_{i_n})]/6$$

Language data type index:

$$E_i = (E_{i_1} + E_{i_2} + \ldots + E_{i_n})/(E_{i_1} + E_{i_2} + \ldots + E_{i_n})$$

$$E_n = E_{i_1} + E_{i_2} + \ldots + E_{i_n}$$

In the formula, if indexes are accurate numerical data, $E_{i_1} \sim E_{i_n}$ are data of indexes; if indexes are language data...
Thereinto: $p$ capability indexes are depicted by $p$ cloud models, and system condition are expressed by $p$ dimension integration cloud. $P$ dimension integration cloud shape changes with system condition, and the gravity center also changes. $p$ dimension integration cloud gravity center $T$ is denoted by $p$ dimension vector.

$$T = (T_1, T_2, ..., T_p)$$

Thereinto: $T_i = a_i \times h(i = 1, 2, ..., p)$. If system condition changes, its gravity center changes $T' = (T_1', T_2', ..., T_p')$.

b) Ascertain indexes weight

There are many methods to ascertain weight, in order to avoid artificial affection, the method hereafter adopted to ascertain weight:

$$w_i = \frac{1}{2} \left( \frac{2 \sin \frac{\theta - \theta_i}{2}}{\sin \frac{\theta}{2}} \right), 1 \leq i \leq n$$

Thereinto: $p$-index number; $i$ -index $p$ number according to concernment, different index can be put in same grade.

c) Calculate cloud-gravity center departure degree

Hypothesis: On ideal condition, the position vector $a^0 = (E_{i1}^0, E_{i2}^0, ..., E_{in}^0)$, and the height vector is $b = (b_1, b_2, ..., b_p)$, $b_i = W_i^*$. So: On ideal condition, cloud gravity center vector is $T^0 = a^0 \times b^0 = (T_{i1}^0, T_{i2}^0, ..., T_{ip}^0)$.

Sameness, hypothesis $p$ dimension integration cloud gravity center vector is $T = (T_1, T_2, ..., T_p)$.

So: Using weighted departure degree $\theta$ measure the different between integration cloud gravity center of two condition, the different litter the $\theta$ litter, reverse the bigger the more distinctness.

$$\theta = (\sum_{i=1}^{n} W_i^* T_i^0)$$

Thereinto: $p$-index number;

$W_i^*$ -weight data of number $i$ index;

$T_i^0$ -synthesis normalized data of cloud gravity center vector.

$$T_i^0 = \begin{cases} \frac{(T_i - T_i^0)}{T_i^0} & T_i < T_i^0 \\ \frac{(T_i - T_i^0)}{T_i} & T_i \geq T_i^0 \end{cases}, \quad i = 1, 2, ..., p$$

d) Establish evaluating remark gather

Using 11 grade remark gather$^{10}$,

$$V = (V_1, V_2, ..., V_11) = (\text{nothing, extraordinary poor, awfully poor, quite poor, poor, common, good, preferable, very good, beyond compare, up to the hammer})$$

System ideality condition is counted to be up to the hammer, $\theta$ data is littler, system condition is more approach to the ideality, capability is better, vice versa. 11 valuating remarks are put in a consecutive language scale, and quality evaluating and structure are used to actualize evaluating gathers for establishing a generator, as table 2 shows. As single evaluating, there are two activation condition when $\theta$ data is put into cloud generator, the first is one of the cloud object is much larger than the other, the data is output as evaluating result; the second is two of the cloud object has close activation degree, using synthesis theory establish a new cloud object, the expect data is output as evaluating result, the quantity description of expect data afford by valuator.

C. Evaluation Instance$^{10}$

According to the structure of index system of management information resource allocation evaluation, designing a questionnaire and selecting some evaluation expert to range the index of evaluation in order of rank and give the data, the result of the sequence is presented in Table 1, the evaluation result is presented in Table 2.

According to the basic progress of cloud gravity center evaluation and the sequence of evaluation in order of rank, by calculating the authority of every index and unify them we get:

| $w_{x}$ | $0.5,0.325,0.175$ |
| $w_{a}$ | $0.667,0.333$ |
| $w_{y}$ | $0.5,0.325,0.175$ |
| $w_{b}$ | $0.334,0.242,0.129,0.091$ |
| $w_{c}$ | $0.5,0.175,0.325$ |
| $w_{d}$ | $0.333,0.667$ |
| $w_{e}$ | $0.278,0.2,0.4,0.122$ |
| $w_{f}$ | $0.333,0.667$ |
| $w_{g}$ | $0.282,0.436,0.282$ |
| $w_{h}$ | $0.5,0.325,0.175$ |
| $w_{i}$ | $0.667,0.333$ |

According to the evaluation result of index given by table 2, the weighted departure degree of each index we get through calculating are presented in table 3. We input weighted departure degree $\theta$ in the cloud-generators to activate the object of cloud. On the whole, the level of information resource collocation $\theta = -0.550$ is between “poor” and
“common”. On the others the level of “noumenon information resource” $\theta = -0.415$ is “good”, the level of “main body information resource” $\theta = -0.464$ is “common”; the level of “surface information resource” $\theta = -0.657$ is quite “poor”. In the whole collocation system, both the quality of information resource and the satisfaction status of information requirement in the main body information resource collocation are better than “common”; The construct level of “information transmission” and information storage and issue in the surface information resource collocation are “poor”. In the main body resource collocation, the “quality of main body information” and “the ability of main body information” are between “common” and “good”, and “the structure of main body information” is “poor”.

V. CONCLUSIOIN

The cloud gravity center theory which is based on the expert’s experience, applies the cloud model to describe the index of Management Information Resource Collocation and the collection of remark. It does a good job on transforming the qualitative concept to the quantitative one and reserving the uncertain information to a great extent. The theory has great objectivity and reliability, and the outcome it evaluates is very intuitionistic.

REFERENCE