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Assessment of Outsourcing Management Efficiency Based on Cloud Models

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Abstract. In order to solve the subjectivity and ambiguity problem in qualitative and quantitative conversion process with traditional assessment methods, application of the cloud model in IT outsourcing project management efficiency assessment methods. To give a final assessment value through a synthesized cloud model merge four indicators, assessment set is determined using a model based on the Model-driven method, and to conduct a comprehensive assessment. Finally, the example shows the feasibility of the method, it provides a new idea for the assessment method based on cloud model.

Keywords: cloud model, outsourcing management, uncertain concept, efficiency assessment, synthesized cloud.

1. Introduction

Information systems are often seen as providing a core service to the bank customer, for this reason it seems most likely not to be outsourced. However, in the early 1990s, mainframe-based information systems cannot be fast and flexible response to changing customer needs, Continental Bank made the decision to outsource information systems. After 20 years of development, information systems outsourcing has become very common in bank, especially for small and medium-sized banks [1]. At present, for outsourcing management of research focused on identifying and controlling risks, the method for the assessment of management efficiency study is relatively small. Common methods can be divided into subjective and objective methods.

2. Natural Language Representation Based on Cloud Models

2.1. Cloud definition

Cloud model is a kind of transform model between qualitative concept and quantity by using linguistic value [2]. Cloud is made up of many cloud drops. Every cloud drop is a point, which is one-to-one mapping from qualitative concept to numeral field spaces, namely is a realization of sample reflected quantity.

Let U be a quantitative value on accurate representation of the domain, C is a qualitative concept on U. If the quantitative value $x \in U$, and x is a random realization of the qualitative concept C, x of C membership $\mu(x) \in [0,1]$ is a stable tendency of random numbers

$$\mu : U \to [0,1] \quad \forall x \in U \quad x \to \mu(x)$$

The distribution of x in the domain U called cloud. Each x is called a cloud drop.

Cloud model has three digital characteristics, i.e. Expected value Ex, Entropy En and Hyper-Entropy He. The expected value Ex of a membership cloud is the position at the universe of

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discourse, corresponding to the centre of the gravity of the cloud. In other word, the element Ex in the universe of discourse fully belongs to the linguistic atom represented by the cloud model.

The step of calculating the three digital characteristics is as follows:

$$① \; Ex = \bar{X} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

$$② \; S^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \bar{X}\right)^2$$

$$③ \; En = \sqrt{\frac{\pi}{2}} \times \frac{1}{n}\sum_{i=1}^{n}\left|x_i - Ex\right|$$

$$④ \; He = \sqrt{S^2 - En^2}$$

2.2. Forward cloud generator

Cloud generator is cloud generation algorithm. Forward Cloud Generator is a forward, direct process, enter the three cloud digital characteristics (Ex , En , He) and the need to generate the number of cloud drop, output coordinates of each cloud drop in the domain and each cloud drop represents degree of certainty in concept. Backward cloud generator is the reverse of the forward cloud generator. Enter comply with a distribution of drops, it outputs the corresponding three digital characteristics (Ex , En , He).[3]Algorithm of forward normal cloud is as follow:

① Produce a normal random number En' , according to expected value En and variance He ;

② Produce a normal random number x , according to expected value Ex and variance En' ;

③ $Y_i = \exp\left(-\dfrac{\left(X_i - Ex\right)^2}{2(En_i')^2}\right)$;

④ Gain a cloud drop $i\left(Xi, Yi\right)$;

Repeat ①-④ until enough drops of cloud produced as you like.

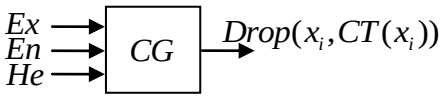

Fig. 1: Forward cloud generator.

2.3. Normal cloud models

There are many kinds of cloud models, such as normal cloud. A lot of uncertainty concepts behave normal clouds in social and natural phenomena, so normal cloud has a certain universality [4]. The mathematical expectation curve as follow [5]:

$$MEC(x) = \exp\left(-\frac{\left(x - Ex\right)^2}{2En^2}\right) \tag{1}$$

Examples of a normal cloud model 1 is obtained by the above method, Ex = 0, En = 3, He = 0.3, N = 10000 is the number of cloud drops.

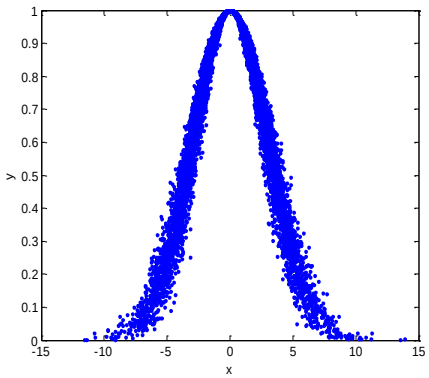

Fig. 2. Normal cloud model.

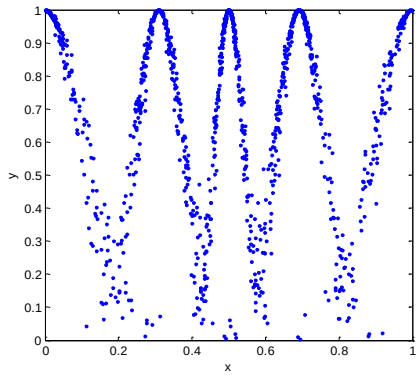

Fig. 3. Assessment cloud.

3. Research Design

3.1. Selecting indicators

In order to establish IT project outsourcing management assessment standard system, consider three fundamental principles on assessment system: The overall index, do not overlap each other and easy to obtain data, combined with the actual situation case study object, [6], [7] select the item separately from the two sub-indices of input and output indicators, investment management and outsourcing cost components input indicators, the amount of code and project composition quality output indicators. As shown in Table 1.

Table 1. Indicators Table.

Target layer	Index code	Index layer	Unit
Assessment Criteria	I1	Time-consuming	Man-day
	I2	Outsourcing costs	Ten-thousand yuan
	I3	Lines of code	Rows
	I4	Quality rating	Points

It can be seen with different dimensions and different economic significance between the original indicators. If the original index calculated directly composite score, it will be difficult to give a reasonable explanation in economic [8]. Moreover, in order to avoid the correlation between the index caused by the weight bias, a preconditions is between indicators should not have a strong correlation.

3.2. Assessment method

Currently, there are two concepts Generation Based on Cloud Model: Data-driven method based on Cloud Transformation and Model-driven method based on golden section method, the former applies to the case of large amount of data. On the division of the domain [0, 1], the latter should be used.

Between [0,1], we divided the domain into five assessment levels: “best”, “good”, “medium”, “bad”, “worst”, Corresponding to the cloud model C1(1, 0.1031, 0.013), C2(0.691, 0.064, 0.008), C3(0.5, 0.039, 0.005), C4(0.309, 0.064, 0.008), C5(0, 0.1031,0.013).[8] As shown in Fig. 3.

3.3. Synthesized cloud model

Synthesized cloud can combine two or more flowers of the same type of sub-cloud. Generate a new, more high-level concept of the parent cloud. Its essence is to enhance the concept of the two or more values of the same type of language integrated into a broader concept of linguistic values.

For example, there are Cloud1 (Ex_1, En_1, He_1) and Cloud2 (Ex_2, En_2, He_2), $CT1(x)$ and $CT2(x)$ are expected curve. Get synthesized cloud model. Algorithm is as follows [9], [10].

$$\begin{cases} Ex = \dfrac{Ex_1 En_1' + Ex_2 En_2'}{En_1' + En_2'} \\ En = En_1' + En_2' \\ He = \dfrac{He_1 En_1' + He_2 En_2'}{En_1' + En_2'} \end{cases} \tag{2}$$

$$CT_1'(x) = \begin{cases} CT1(x) & CT1 \geq CT2 \\ 0 & Other\ case \end{cases} \tag{3}$$

$$CT_2'(x) = \begin{cases} CT2(x) & CT2 \geq CT1 \\ 0 & Other\ case \end{cases} \tag{4}$$

$$En_1' = \frac{1}{\sqrt{2\pi}} \int CT_1'(x)dx, En_2' = \frac{1}{\sqrt{2\pi}} \int CT_2'(x)dx \tag{5}$$

4. Case Analysis

4.1. Computing synthesized cloud process

To visually illustrate the application process of the assessment method, now give example to be verified. Taking a bank system outsourcing project management, for example, the project manager is bank employee, responsible for project management.

Table 2. Project Management Date

Project No.	I1	I2	I3	I4	S1	S2	R1	R2
1	2.7	6	1933	100	716	16.67	0.6692	0.6668
2	5.5	5	3594	80	653	16,12	0.6103	0.6400
3	2.5	6	2001	60	800	14.55	0.7477	0.4800
4	2.5	5.5	2257	80	903	22.22	0.8439	0.5820
5	5	4.5	3126	100	625	18.18	0.5841	0.8888
6	6.9	5.5	5794	80	840	22.22	0.7850	0.7272
7	6.4	4.5	5009	100	783	13.33	0.7318	0.8888
8	6.5	7	6764	80	1040	25	0.9720	0.5332
9	4.5	4	4819	100	1070	22.22	1.0000	1.0000
10	6	4.5	4960	100	827	14.55	0.7729	0.8888
11	6.5	5.5	5292	80	814	20	0.7607	0.5820
12	6.6	5	5074	100	769	18.18	0.7187	0.8000

First, the data were normalized, and obtain the correlation matrix indicators shows that between I1 and I3, I2 and I4 are two pairs of indicators having a strong correlation.

Table 3. Correlation Matrix.

	I1	I2	I3	I4
I1	1.0000	-0.1563	0.8979	0.2429
I2	-0.1563	1.0000	0.0076	-0.6075
I3	0.8979	0.0076	1.0000	0.1559
I4	0.2429	-0.6075	0.1559	1.0000

Combination of two pairs of indicators having a strong correlation can be described as the unit cost of the rows of code and unit personnel working-time project Quality Score, and standardize new indicators S1 and S2.

Assume the maximum value is the optimal value, after the standardization process to obtain two sub-clouds. R1 and R2 are the result of S1 and S2 apply Linear scaling transformation method. CloudR1 (0.7664, 0.1126, 0.0559) and CloudR2 (0.7231, 0.1780, 0.0592) can be calculated. As shown in Figure 4. Three digital characteristics of the synthesized cloud is Cloud (0.7267, 0.2106, 0.0589). As shown in Fig. 5.

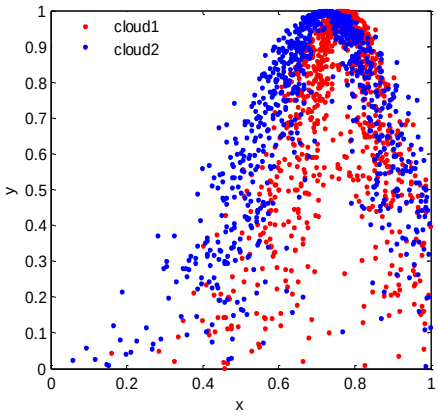

Fig. 4: Sub-cloud.

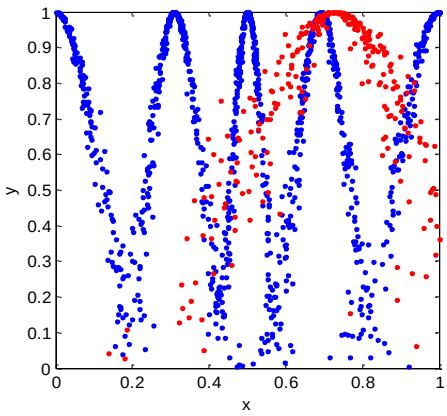

Fig. 5: Standardization cloud.

4.2. Result analysis

According to the report statistics, completed a total of 104 projects throughout the year on this system. The distribution of five classes on project assessment is (18, 64, 17, 5, 0).

Obviously, this system outsourcing management efficiency slightly better than the second class of "good". The figure shows that the vast majority of the efficiency of outsourcing projects in three classes as "best", "good", "medium". But there are a small parts of projects management efficiency in "bad" class. This result is consistent with the report.

5. Conclusions

Through case studies, the availability of this method based on cloud models has been verified. But still there are some problems that need pay attention. This method applies only to the things which obey normal distribution. *En* usually increases after synthesized cloud computing, which means uncertainty increased.

In this paper, indicator selection is not comprehensive enough, such as it does not reflect the progress of the project to meet the requirements, will further improve the indicator system. Moreover, *En* and *He* value would offset when any indicator value is abnormal, results of the accuracy would be impact, de-noise method should be applied.

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