Research on Accurate Algorithm of Construction Project Budget Under Big Data Technology

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Abstract. With the acceleration of urbanization, the number of construction projects is increasing year by year, and the competitive pressure is also increasing. In order to achieve long-term and reliable development, construction enterprises must adopt modern science and technology to optimize the project management process and standardize the project implementation process so as to ensure that the indicators of construction projects meet the requirements as well as to maximize the interests of enterprises. Based on the analysis of each stage of engineering project management from the perspective of construction life cycle, and on the premise of developing engineering budget management system with big data content of construction engineering, this paper optimizes the dominance decision method to solve the problem of mixed measure decision, and gives a set of definitions related to dominance to improve the method of obtaining dominance. The improved method is analyzed from the characteristics of sorting vector, advantage vector and comparison vector, and its complementarity and consistency are verified, and its effectiveness is proved by an example. The analysis shows that the improved method has a small amount of calculation, high accuracy and a good versatility, and realizes the optimization algorithm that meets the requirements of system operation. It reduces the configuration requirements and computing load of the system background server.

Keywords: Construction Project · Project Budget · Big Data · Improved Sorting Algorithm

1 Introduction

Engineering project information management has gradually developed since the 1970s. With the popularity of cost computerization software, engineering cost control and cost calculation have made a lot of breakthroughs. Many projects adopt an information management model. Information management system is a system that collects, transmits, processes, stores, manages and retrieves information. There are various ways of information integration, including central database integration, data interface for information exchange, and file integration [4].

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Big data comes from the transactions of the enterprise, and some budget data owned by the enterprise is formed by predicting the future based on the collation and analysis of the existing data, which is based on the possible business activities in the future [2]. In order to better analyze and solve the multi-attribute decision-making problems in cost management system, based on the theory of decision-making method, the dominance decision-making method and its ranking method are improved. The optimization algorithm is used to reduce the amount of calculation and versatility so as to meet the requirements of system server configuration and reduce the system's operational constraints and operational load, which is to better apply to the system of computing and data processing [6].

This paper improves the superiority degree decision method of mixed measure decision problems, which reflects that the superiority degree matrix has excellent consistency and complementarity. It analyzes the ranking mode of alternatives and the corresponding characteristics from the comparison vector and compares it with the ideal point method and the linear weighting method.It also finds and proves that this method has the advantages of good versatility, high accuracy and small amount of calculation. According to the actual case and the conclusion of the study, it is pointed out that the improved dominance algorithm has certain benefits. The problem of system algorithm is solved.

2 Construction Project Budget Process

At the beginning of budget-based budgeting, enterprises take value maximization as the starting point of budgeting. Then, according to the past relevant data, the performance of a future period is predicted. On this basis, the budget data is formed, which includes revenue budget, cost budget and expense budget. Compare and analyze the obtained relevant budget with the initial financial budget. If the difference between the two is within a reasonable range, the formed budget target meets the strategic needs of the enterprise and can be further decomposed and distributed.

The content flow of the budget preparation is shown in Fig. 1.

Budget management goal setting directly determines the development goal and direction of enterprises during the budget management. The proportion of each resource allocation in an accounting period and the goals and results that each responsible body needs to achieve.

3 Sorting Method Based on Comparison Vector

When the dominant vector v is used for calculation, the complexity of related calculation is reduced. But the final effect is not affected. However, if the selected direction is different from the corresponding benchmark scheme, the dominant vector k obtained will be different [10]. Even though the corresponding sorting result hasn't changed, if you want to unify the differences between the two methods, you can pair or normalize them on v_k or v'_k.

Process the high point dominant vector $v_k = (v_{k1}, v_{k2}, v_{km})^T$. According to $v'_{ki} + v_{lk} = 1$, get v_{ik}. In this way the v_k can be turned into a low point dominant vector $v_k =$

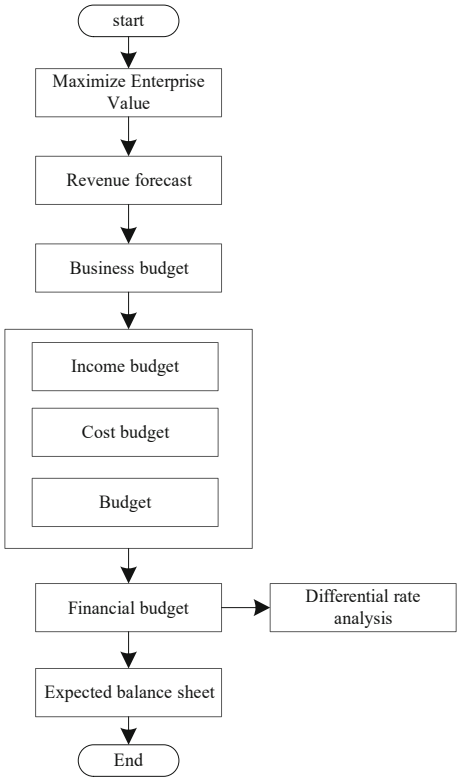

Fig. 1. Content flow of budget preparation.

$(v_{1k}, v_{2kr}, v_{km})^T$. Then process $v_{gk} = Minv_{jk}, \quad o_{kg} = v_{kk} - v_{gk}$ to make a translation transformation on the low point dominant vector:

$$v'_k = (v'_{1k}v'_{2k} \cdots, v_{km})^T = (v_{1k} + \alpha_{kg}, v_{2k} + \alpha_{kg}, v_{mk} + \partial_{kg})^T \tag{1}$$

In the process of processing, the elements in the vector are not changed. The sorting result will be more accurate [1].

Vector $\frac{v'}{-k} = (v'_1, v'_2, v'_m)^T$ is the consistency comparison vector. Fang is calculated according to the following formula.

$$v'_p = \frac{v_{pk} + okg}{\sum\limits_{q=1} m_k(v_{qk} + okg)} - \frac{v_{pk} + okg}{\sum\limits_{qkg} k_{qk} + mox_{kg}} p, q \in M \tag{2}$$

Through this method, Chang is usually in descending order to obtain the corresponding sorting results. According to the above proof, the results obtained by this method are the same as those obtained by the original method [3]. Because of the consistency $v'_{pk} = v_{pk} + \alpha_{kg} = v_{pk} + v_{kk} - v_{gk}$ of the dominant matrix, you get $\frac{v'}{k} = (v'_{1k}v'_{2k}, v'_{km})^T$. What matters in this formula is that the base value for completing the comparison has changed from the previous x_k to x_g. The direction x_g that will be used as the base point

is compared with the rest of the scheme and is normalized. Thus, the whole ranking is completed. No matter what kind of base direction and program is selected, the final result is the same [5].

4 Improve the Sorting Method

In terms of sorting, there are ways v_k, v'_k, v' to sort vectors. In operation, the three kinds of ordering methods are basically the same. They all select the corresponding benchmark scheme x_k. Take the benchmark scheme as the standard. Compare other schemes with the benchmark scheme and arrange them in descending order according to the corresponding dominance value [9]. The result of this process is to put the better solution in front and the worse solution behind.

The steps of dominance ranking are analyzed. The improved decision-making steps are given:

Step 1: The decision matrix $A = (a_{ij})m \times n$ is normalized after the matrix $R = (r_{ij})m \times n$.
Step 2: Select a baseline solution x_k in the solution set and compare the remaining solutions with the baseline solution.
Step 3: As for v_k or v'_k, calculate the consistency comparison vector v' according to formula 1.
Step 4: Sort the components in the $v' = (v'_1, v'_2, \cdots v'^r_m)^T$. After sorting them, take the maximum of v'_p as the best solution.

5 The Case Analysis

In this paper, the project budget management system was used to determine the parking guidance system (PGIS) of each project planning and construction as the prototype in the test of a construction project. The improved decision-making method was used to sort the parking construction costs of six communities and determine the community with the highest parking construction costs so as to verify the improved decision-making method [8]. Attribute values of indicators related to the parking construction costs in each community under the PGIS construction are shown in Table 1.

In Table 1, U1, U2, U3, U4 and U5 are the five data of parking construction cost used for decision-making. U1 represents the intensity of land development, which can be quantitatively calculated according to the corresponding plot ratio. U2 represents the parking supply ratio, which can be calculated by using the supply of public parking spaces per 100 m^2 of construction area. U3 represents the rationality of the distribution of relevant parking facilities; U4 represents the rationality of the traffic structure, and U5 represents the density of the road network. The last three are mainly obtained according to the suggestions and scores of corresponding experts. Get the corresponding weight $W = (0.30, 0.20, 0.25, 0.15, 0.10)^T$ of five attributes.

In order to analyze all attribute values under the same criteria, the corresponding mixed decision matrix can be established for attribute data in the table. Linear transformation method and triangular fuzzy method are used to normalize data (U3, U4, U5)

Table 1. Attribute value of related index of parking construction cost in each community.

Parameters	U1	U2	U3	U4	U5
Xl	1.009	0.967	(0.90,0.92,0.95)	(0.91,0.94,0.95)	(0.93,0.96,0.99)
X2	0.987	1.103	(0.89,0.90,0.93)	(0.90,0.92,0.95)	(0.90,0.92,0.95)
X3	1.225	0.857	(0.84,0.86,0.90)	(0.91,0.94,0.97)	(0.91,0.94,0.96)
X4	1.054	1.092	(0.91,0.93,0.95)	(0.85,0.88,0.90)	(0.86,0.89,0.93)
x5	0.883	0.758	(0.90,0.92,0.95)	(0.90,0.95,0.97)	(0.91,0.93,0.95)
X6	1.524	1.205	(0.88,0.91,0.95)	(0.86,0.89,0.92)	(0.91,0.92,0.94)

Table 2. Dominance matrix.

V	v1	v2	v3	v4	v5	v6
v_1'	0.500	0.513	0.458	0.504	0.494	0.486
v_2'	0.487	0.500	0.445	0.491	0.482	0.474
v_3'	0.542	0.555	0.500	0.546	0.537	0.528
v_4'	0.496	0.509	0.454	0.500	0.491	0.482
v_5'	0.506	0.518	0.463	0.509	0.500	0.492
v_6'	0.514	0.526	0.472	0.518	0.508	0.500

and (U1, U2). The calculation formula is as follows:

$$R1 = \begin{cases} R_{ij}^{L}, R_{ij}^{C}, R_{ij}^{R} \\ \overline{R}_{ij}^{L}, \overline{R}_{ij}^{C}, \overline{R}_{ij}^{R} \end{cases} \tag{3}$$

In it, R^* is the benefit income, and $\overline{R}^*$ is the cost.

Linear transformation method:

$$R2 = \begin{cases} r_{ij} \\ \overline{r}_{ij} \end{cases} \tag{4}$$

From the above formula, we can obtain:

$$R = \begin{cases} R1 \\ R2 \end{cases} \tag{5}$$

According to the value of the dominance degree of the algorithm in this paper, the matrix of the dominance degree is shown in Table 2.

The ranking vector $v = (0.165, 0.163, 0.174, 0.164, 0.166, 0.168)$ of the dominance matrix is calculated by formula 2. Although the calculation processes of the two methods

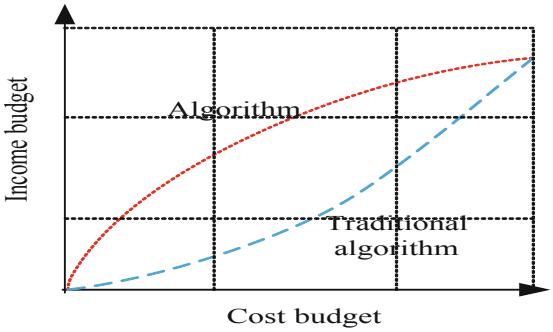

Fig. 2. Analysis of Cost budget.

are different, the final descending ranking results are both $x3 > x6 > x5 > x1 > x4 > x2$. Analysis of the results is shown in Fig. 2.

That is to say, the final results are consistent. If formula 2 is used, the calculation complexity will be very large, which is not conducive to the use in the cost management system [7]. At the same time, the requirements for background programmers to master the decision-making algorithm are much greater. It is difficult to achieve in practical work.

According to the calculation result, the descending order of any low point advantage vector (that is, for any column) and the ascending order of any high point advantage vector (that is, for any row) can be obtained. The final sorting result is $x3 > x6 > x5 > x1 > x4 > x2$. However, the two methods are also different. The values obtained after normalization using the descending and ascending orders are different, but the order and relative size of the final results are the same.

6 Conclusion

The unit module of the construction project budget management system needs to solve the multi-attribute problem. Based on the existing decision-making method research, it is likely to lose the corresponding decision-making information in the research or affect the results of relevant decisions. This paper improves the dominance decision-making method and its ranking method so as to be better suitable for the operation of the system. The analysis shows that the improved method has the advantages of small computation, high accuracy and good generality. The method also achieves the optimization algorithm that meets the requirements of system operation, and reduces the configuration requirements and computation load of system background server.

The research work of this paper has completed the establishment of the management information system architecture. But in the daily use of the system, there are some problems that can not be considered and need to be solved in time. According to the current research work, the scheme optimization can be comprehensively compared and selected from the total cost or small changes in investment. The relationship between the cost change and the structural performance parameters and effects within a certain range is gradually established, which provides a wider reference value for the information

management system to make reasonable decision-making suggestions and follow-up investment, design, construction and maintenance.

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