

## Screening Model Study on Construction Cost Index Calculation Information

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**Abstract.** Due to the diversity of the construction market, we need to select from a large number of typical projects as the research foundation to compile the cost index. Reasonable screening process and method plays as an important factor in the determination of the accuracy of the final result. This paper recommends a typical project selection process, in accordance with the results of the economic analysis, and the introduction of mathematical methods on the basis of expert advice on the adoption and also recommends that the selection should follow the principles of statistics, that is, the selection shall be taken according to expert selection method and gray correlation .T test method screening model is applied after the completion of typical project data collection thus the statistics which disturb the release of the index shall be eliminated so that indices and indicators released can better adapt to the actual situation.

### Introduction

Construction Cost Index calculation is to determine and control the project cost. Both the government department and the project side will use the Cost Index to get clues of market dynamics in order to evaluate future market direction, thus to arrange better policies in every other section. To obtain adequate and accurate cost information is critical to the Construction Cost Index calculation. All information concerning the construction cost is drawn from the actual projects in similar time period.

At the design level and construction level defaults to the average level of social premise, the cost of different types of engineering unilaterally vary greatly, if the carrying cost of index calculation, the different types of project cost information hybridist together, will cost index moot, therefore, the first work is to classify the project already done, and then measure. After dividing the functions of the building and then aggregated similar projects. Theoretically, the same type, engineering units of similar size should cost roughly the same, but because in the actual project, the same type of project will error resulting from various causes, to ensure the accuracy of the data collected, we need to collect information for screening.

### Typical Project Selection Method

The projects in construction market are diverse, in preparing the cost index, if all items of different projects are selected into as a research-based nature is the most ideal. However, the actual data collection impossible can be so comprehensive. Difficulties are faced by a huge workload and engineering problems. In order to get an accurate cost index, scientific and efficient collection of a number of representative typical project is particularly important. In the selection process people should rigorous review of construction standards, consumption levels and construction methods. Excluding unusual engineering factors, the results as the computational basis for this kind of construction cost index weights for a particular period [1].

In the past, the typical projects selected lack of uniform standards, are often judged based on the

experience of the cost of staff, While doing so with a certain rationality, but lack of quantitative analysis, failed to reflect the scientific selection process. Based on the reference price index compilation practice in developed countries, suggestions on the selection of typical engineering, according to the results of economic analysis, on the basis of taking expert advice, the introduction of mathematical methods and follow the principles of statistics, can take the expert evaluation method and gray correlation method.

### Expert Evaluation Method

Expert evaluation method is to seek the advice of experts in the industry, Firstly, based on the scientific classification of the completed project; the experts will select n projects as the project selected engineering from the finished projects. The specific steps are as follows:

- 1) Select Expert
- 2) Provide the completed project information to experts, expert opinion consultation anonymously.
- 3) Summary the opinions of the experts, the statistical results will be feedback to the expert.
- 4) Experts according to the feedback results and modify their opinions.
- 5) After several rounds of anonymous advice and feedback, to form the final conclusions of the analysis [2].

### The Gray Correlation Method

The grey system is through the collection and collation of the original data to seek the development and changes of law. This is because although numerous objective system shown by the complex phenomenon, but its development and change obey the objective laws of logic of their own, is the coordination between the various functions of the whole system<sup>[3]</sup>. An important application of gray correlation analysis is a comprehensive evaluation of the system. The basic idea is: Determined from a sample of an idealized optimal sample, as a reference to the number of columns. Through correlation calculation of each sample sequence and the reference sequence, make a comprehensive comparison and sorting for evaluated object.

According to the basic idea of the grey relational grade analysis, it can be applied to the typical project selection. Regard the ideal engineering and to be elected engineering as the two systems engineering. Through correlation calculation of these two systems can obtain the advantages and disadvantages of the evaluated object. Associate degree is bigger, the more excellent of the evaluated object; associate degree is small, the worse the evaluated object. From the geometric meaning, is the comparison of the evaluated object and ideal solution curve similar and consistent degree is the curve shape similarity measure. The closer the shape of the curve is associated with the degree of assessment between the object and the greater the ideal solution, whereas the correlation degree is small. This is the theoretical basis of grey correlation degree for the typical project selection. The specific steps are as follows:

- 1) The calculation of a class project to be selected in various engineering factors cost.

Calculated as shown in Eq.1 formula for each of the candidate projects of various elements of unilateral charge  $q_{ij}$ .

$$q_{ij} = Q_{ij} / A_i \quad (1)$$

In the formula,  $q_{ij}$  represents the i-th candidate projects j-th element of unilateral costs.  $Q_{ij}$  denotes the j-th element of the i-th candidate engineering costs.  $A_i$  represents the i-th candidate construction area.

Thus, the feature set  $Fi=[q_{i1}, q_{i2}, \dots, q_{in}]$  consisting by the unilateral cost of the elements can be obtained. In theory, under the premise of reasonable engineering classification,  $q_{ij}$  of the same elements of each selected project should be similar, for a large degree of difference data of  $q_{ij}$ , should be removed as invalid data, therefore, in the case of obtaining the  $q_{ij}$  of candidate project, Gray correlation analysis can be used for a typical project to select.

2) Determine the reference sequence of the engineering characteristics

Because of the uniqueness of the project, even the same kind of project, it still exists in some elements of unilateral cost difference. If these elements are not as the main factors that effect on the project cost is small, should not be used as the reference sequence of reaction engineering. The reference sequence in this paper is selected by experts in the various elements; these elements are composed by some representative of unilateral cost.

3) Determine the optimal index set

In this paper, the average values of selected  $q_{ij}$  as the optimal sequence, Write as Eq.2

$$F = [q_1^*, q_2^*, \dots, q_n^*] \quad (2)$$

4) Grey absolute correlation degree of each candidate project and optimal index set to calculate respectively

Convert the time (t) concept into space (j) concept in the grey relational theory definition. And j is the number of multiple factors. To obtain the sequence comparison  $F_i = [q_{i1}, q_{i2}, \dots, q_{in}]$ , Use of grey absolute correlation degree method, to calculate the correlation degree.

5) Sort by relevance degree

The absolute correlation  $\varepsilon_i$  descending sorting. The degree of similarity is greater; the greater is the  $\varepsilon_i$ , In accordance with the requirements, choose the maximum value of  $\varepsilon_i$  corresponding to a typical engineering project.

### The Construction Cost Information to Establish Screening Model

After using gray correlation select typical projects completed, Summarized data can be collected, the authenticity and reasonableness of the data collected directly impact to measure the accuracy of the final value. Since the construction cost index calculation information is to determine and control the project cost basis, to obtain accurate, adequate cost information is critical to the cost of index calculation.

Therefore, it needs model to filter all of the data, as far as possible to select the most reasonable data as the basis of measurement.

This article uses the T test methods to remove the data of having a greater impact of publishing the indices and indicators, so that release of indices and indicators correspond with the actual.

Assuming the overall X mean of  $\mu$ , the corresponding variance is  $\sigma_2$ , The sample of overall X is  $X_1, X_2, \dots, X_p$ , You can get parameter set  $X = (x_1, x_2, \dots, x_p)$ , Must now determine the confidence interval of the mean value  $\mu$ , excluding some samples having large deviations, so that the final index of more reasonable cost.

From the central limit theorem, When the sample size n is sufficiently large,  $\frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$  approximately obey the standard normal distribution  $N(0, 1)$ , among them  $\bar{X} = \frac{1}{n} \sum_{i=1}^n x_i$ , since the sample variance  $s^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2$  is unbiased estimator of  $\sigma_2$ , so we can use  $s^2$  approximate substitute  $\sigma_2$ .

When n is sufficiently large,  $u = \frac{\bar{X} - \mu}{s/\sqrt{n}}$  is still approximately obey the standard normal distribution  $N(0, 1)$ , so that for a given confidence level  $1-\alpha$  ( $0 < \alpha < 1$ ), when the sample size is sufficiently large, by the definition of sub-standard normal distribution sites, the presence of  $Z \frac{\alpha}{2}$ ,

$$\left\{ \left| \frac{\bar{X} - \mu}{s/\sqrt{n}} \right| < z_{\frac{\alpha}{2}} \right\} \approx 1 - \alpha$$

such that ,Therefore, the confidence level of  $\mu$  is  $1-\alpha$ , the confidence interval of  $\mu$  is approximately shown in Figure 1.

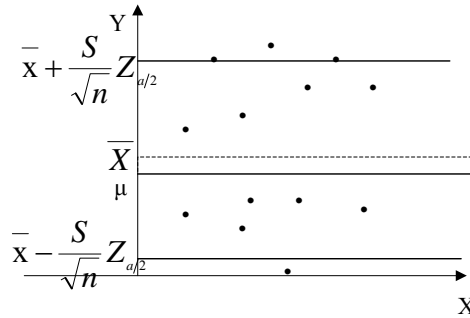


Fig. 1 The Confidence Interval of  $\mu$

Known:  $\left( \bar{X} - \frac{s}{\sqrt{n}} z_{\frac{\alpha}{2}}, \bar{X} + \frac{s}{\sqrt{n}} z_{\frac{\alpha}{2}} \right)$  so that  $\alpha = 0.1$ , then the confidence level of the mean value  $\mu$

of these samples is 0.9, according to the normal distribution quintile table,  $Z_{\frac{\alpha}{2}} = 1.282$ , the confidence

interval of  $\mu$  is  $\left( \bar{X} - 1.282 \frac{s}{\sqrt{n}}, \bar{X} + 1.282 \frac{s}{\sqrt{n}} \right)$ .

(2) At the same time, it should be carried out on each sample parameter hypothesis testing, to test whether the samples had significant impact on the mean  $\mu$  of the overall  $X$ , and such factors should be removed, to test the hypothesis:  $H_0 : \mu = \bar{X}$ ,  $H_1 : \mu \neq \bar{X}$ .

When  $H_0$  is true and the sample size  $n$  is sufficiently large, Statistics  $\frac{\bar{X} - \mu}{s/\sqrt{n}}$  ( $I=1,2,3,4,\dots,n$ ) is still approximately obey the standard normal distribution  $N(0, 1)$ , Shown in Figure 2. Thus, the rejection

region of hypothetical question is approximately equal to  $|u| = \left| \frac{\bar{X} - \mu}{s/\sqrt{n}} \right| \geq Z_{\frac{\alpha}{2}}$ .

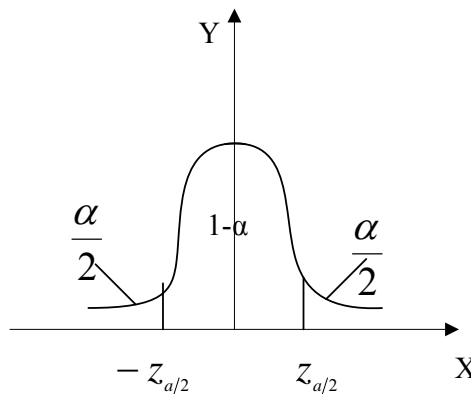


Fig. 2 The Confidence Interval of  $\mu$

Since the confidence level has been given,  $\alpha=0.1$ ,  $Z_{\frac{\alpha}{2}} = 1.282$ , when the value of the final calculated  $|u| \geq 1.282$ , reject the hypothesis  $H_0 : \mu = \bar{X}$ , accepted hypothesis  $H_1 : \mu \neq \bar{X}$ , then the

sample should be excluded factors, namely the error of the sample is large, cannot be the reference; when the value of the final calculated  $|u| \geq 1.282$ , reject the hypothesis  $H_1: \mu \neq \bar{X}$ , accepted hypothesis  $H_0: \mu = \bar{X}$ , the sample factors can be retained.

$$\mu = \frac{1}{m} \sum_{i=1}^n y_i (1, 2, 3, \dots, m)$$

Order samples preserved is  $y_1, y_2, \dots, y_m$ , then  $X' = (y_1, y_2, \dots, y_m)$ , that is

Following the above acquisition cost information stored in the library, for the base period cost information, this article using statistical software manual processing cost information, using SPSS for screening based on cost information; for the reporting period information, basic principles and T-test method is the same, but the system will automatically set up by early screening.

## Conclusion

Throughout the whole construction period, the parties involved in the construction personnel will need access to accurate and timely cost information. The cost index is used to measure the project's representative thereof prices and consumption, prices will simplify complex engineering and representative process in favor of the parties involved in the exchange of information and communication engineering cost[4].

Currently, the analysis of construction cost index is still remaining in the manual analysis stage. It is difficult to summary all areas information, most of the information will be retained to complete the project, and no longer use. Therefore, finding the right way to collect data, establish screening typical engineering model and application software index system analysis, mathematical statistics method is applied to the analysis of the typical cost information, but also the realization of construction projects information important work.

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