

# The Study of Project Cost Management Base on the Whole Procedure Control

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**Abstract:** In project construction process, cost control with quality and schedule control stands at the center of project management. Project cost control should start from offer of the project bid to the settlement when the project is completed, run through the whole process of project implementation. The level of cost management will directly determine the effect of cost control. In this paper, basic procedure of project cost management is systematically analyzed, including the detailed analysis of cost plan, cost accounting, cost analysis and cost assessment, etc. This paper focuses on the concrete methods of cost control and cost analysis with some project cases.

**Keywords:** Project Cost Management; Procedure; VE

## 1. Introduction

The survival and development of construction enterprises rely on getting more construction projects in the competition, and create considerable economic and social benefits by organizing the project. With ensuring quality, safety as a prerequisite, to implement each construction project well and to create satisfactory and maximized economic profits are the key factors for completing each projects' construction, these are not only the existed fundamentality of construction enterprises, but the favorable protection of getting a broader market. Therefore, the project cost management becomes the core of construction project management.

## 2 The Process of Project Cost Management

In accordance with the principles of dynamic cost management and the content of cost management, the project cost management process of contracted enterprises includes six procedures, such as cost estimation, cost planning, cost control, cost accounting, cost analysis, cost assessment.

### 2.1 Cost Estimation

Cost estimation methods can be divided into qualitative forecast and quantitative forecast. As the qualitative prediction relies mainly on the qualities and assessment capabilities of the managers, so this approach should on the basis of a profound understanding about historical data, status and impact factors of the project cost. This method is simple and easy to apply, it is the best used when the data is lack and quantitative prediction is the most difficult to apply. Using the historical cost statistics information and quantitative relationship between cost and influence factors, quantitative prediction presume and calculate the possible results of future cost by setting up a mathematical model. The common quantitative predic-

tion methods include weighted average method, regression analysis method and so on.

### 2.2 Cost Planning

Cost planning is an expression of the target cost, is the basis to establish the project management responsibility and carry out cost control and accounting, and it is for the main basis for cost control. After project manager accepted the commission of the legal representative of enterprise, he/she should organize the compiling of construction budget and determine the project cost of planning objectives by the auspices of the project management implementation plan to seek ways to reduce costs. Base on the auspices of the project management implementation plan, the project manager should make a practical planning cost of each item, including annual, quarterly and monthly liability cost plans. During the compiling of practical planning cost, project manager should decompose the controlled liability target cost and then devolves out into the relevant departments, the construction teams and the groups. The ways to make the compiling of practical planning cost are various, such as the target profit method, technological progress method, calculation in reality, fixed rate estimation, etc, these methods can be used according to the different situations of project.

### 2.3 Cost Control

According to the principle of cost management of whole process, cost control should be run through the various stages of construction, which is the core of the project cost management and the most complex and content-based management content with the most uncertain factors. The center of cost control should be placed on the project management department, including three important aspects such as plans to pre-control (prior control), process control (a matter of control), corrective con-

control(subsequent control). The management of risk cost and the cost of uncertainty should be considered at the same time, in order to achieve the overall management of the project cost. The ways and methods of project cost control are the following:

(1)The Project Cost Analysis Table Method

Common cost analysis cost analysis table includes monthly cost analysis table, the daily or weekly cost report table, monthly cost calculation and the final forecast table.

(2) The Earned Value Method<sup>[1]</sup>

This method is a analytic method of comprehensive control of the project cost and schedule. By comparing the different value between the Budget Cost for Work Performed (BCWP) and Actual Cost for Work Performed (ACWP), the cumulative cost deviation that the actual price changes caused can be analyzed. By comparing the different value between the Budget Cost for Work Performed (BCWP)and the Budget Cost for Work Scheduled (BCWS), the cumulative cost deviation that the schedule deviation caused can be analyzed.

$$\text{Cost deviation} = \text{ACWP} - \text{BCWP} \quad (1)$$

$$\text{Schedule deviation} = \text{BCWS} - \text{BCWP} \quad (2)$$

For example, a project took a period of 9 months, the monthly planning cost and actual cost is in Table 1. According to the data in Table 1, the comparing bar graph of three types' cumulative costs can be drew. According to this figure, we can directly know that the project cost overspends throughout the construction period, the total overspending is 15,745,000 Yuan; the project postpones from March to August; two kinds of deviation was in dynamic trends with the progress of the project. Therefore, in the construction process the changes of two deviations should be paid close attention to, identify problems in time and take corrective measures to achieve the objective of cost minimization.

(3) The Value Engineering Method<sup>[2][3][4]</sup>

Value Engineering method is an important method of prior cost control of the project, in construction phase, through value engineering activities and the technical and economic analysis of construction scheme to determine the optimal construction plan, reduce construction costs. The coal storage silo project of a factory, designed storage capacity of coal is 48,000 tons with 24 (three groups) round and thin-walled connected silos, which diameter is 11m, wall thickness is 200mm. This project has enormous size, and the structure is complicated. We take this project as an example to do a Value Engineering analysis. The project consists of three main components: the underground base, from the surface to 16m height is the frame installing steel funnel, above 16m are the bottom ring beam and silos. As for these three parts of the main projects, some indexes such as such as the construction time, real work quantity, construction machinery occupancy, construction difficulty and artificial occupation are calculated. The results show that the silo project accounts for first place in all indexes, therefore, the correct handling of the problems facing the silo project and selecting the proper construction method in accord with technical and economic conditions of this enterprise are crucial to completing the construction on schedule. We use Value Engineering to optimize the design of silo construction organization. There are 4 optional construction programs of silos: A, slide model construction program. B, turning model construction program. C, large model construction program. D, contract outsourcing program. Figure 2 is a table compared the estimated cost of the each program with the value indexes. The calculation results show that program B (i.e. turning model construction program) is the optimal solution.

**Table 1. The cost data thousands of yuan.**

Project	1	2	3	4	5	6	7	8	9
The monthly BCWS	880	880	690	690	550	370	530	310	0
Total BCWS	880	1760	2450	3140	3690	4060	4590	4900	4900
The monthly BCWP	880	880	660	660	410	355	515	415	125
Total BCWP	880	1760	2420	3080	3490	3845	4360	4775	4900
The monthly ACWP	1012	924	726	759	451	390	618	456	137
Total ACWP	1012	1936	2662	3421	3872	4262	4880	5337	6474
Cost deviation	132	176	242	341	382	417	520	562	1574
Schedule deviation	0	0	30	60	200	215	230	125	0

**Table 2. The Budget Cost of the each program with the value indexes.**

Program	Target cost	Budget cost	The value index
A	6,300,000	7,108,301	0.88
B	6,300,000	6,303,465	0.999
C	6,300,000	6,607,496	0.95
D	6,300,000	7,500,000	0.84

## 2.5. Costing Accounting<sup>[5]</sup>

The basic accounting range of Project cost accounting should be based on the responsible cost objectives of the project manager, the accounting's objects are controllable cost that is corresponding with the authorized domain of the project manager. The whole process of accounting should be tracked monthly. The cost accounting methods include "form accounting method" and "accountant accounting method". Form accounting method is easy to operate and form format is free, It is more practical to carry out a responsibility accounting of each station of the project because it can set up a variety of forms according to the business management and requirements. Accountant accounting method makes use of the integrated features of its unique debit and credit bookkeeping method and full accounting of income and expenditure, according to the project cost content and the range of income and expenses, organizes the project construction cost accounting, including the accounting of direct cost and indirect cost. There are two noticeable problems in cost accounting: First, we must strictly distinguish between the operating cost of enterprise and the production cost of project, in the project implementation stage, the operating cost of enterprise cannot be apportioned in order to reflect accurately the income, expense, settlement and transformation of the project controllable cost and management performance of the project cost management. Second, controllable and uncontrollable cost should be strictly distinguished, for example: if the enterprise purchases steel in united price, the steel market prices are uncontrollable cost in terms of project, and it is not the factor of cost accounting. Otherwise, the proportion of steel costs to the total project cost and the probability of the changes of the steel market prices should be analyzed in order to decide whether list steel price as factor of cost accounting or not.

## 2.6. Cost Analysis

Technical methods of cost analysis include comparative method (mainly including the comparative analysis between the actual project quantity and the estimated project quantity, the comparative analysis between the actual consumption and planned consumption, the comparative analysis between the actual price and planned price and the comparative analysis between the actual expenditure and the planned expenditure), factor analysis method, margin calculation method, ratio method, etc. In this paper, factor analysis method will be introduced in details. Factor analysis method is a cost expense analysis method, which divides the integrated indexes of construction cost into the original factors of the connection of each item, in order to determine influence degree of each factor that caused the changes of each index. It can measure the influence degrees of the various factors so

that the ascertain reasons and main problems, and then propose improvement measures to reduce cost.

For example, the planned brick construction volume of the project is 200m<sup>3</sup>, in accordance with the provisions of the budget scale, 510 red bricks per cubic meter are used, the planned price of a red brick is 0.25 yuan; But the actual amount of bricks construction volume is 250m<sup>3</sup>, real consumption of red brick per cubic meter is 500, the actual price of red brick is 0.30 Yuan. To analyze the cost with factor analysis method, the actual cost of bricklaying is 12,000 yuan higher than planned cost, mainly due to increased work and higher prices of red brick; In addition, since economizing the consumption of red brick, so that the cost of economize saves 625 yuan. The ways to analyze comprehensive cost such as sub-part project cost, monthly (quarterly) cost and annual cost is: make a comparison of the estimated cost, target cost and the actual cost, calculate the deviation of the actual cost and the estimated cost, the actual cost and the target cost, analyze the reasons of deviation for the sake of providing evidence of making effective measures to save the project cost.

## 2.7. Cost Assessment<sup>[6]</sup>

Project cost assessment is combined with the project construction plan, construction methods and construction technology, it proposes based on technological progress and cost control. The content of project cost assessment should include the accounting of the completion of program objectives' cost and cost management performance assessment. According to the requirement of project management, the main project manager should bear the following responsibilities in the process of the project cost accounting:

### (1) Project Manager

Take responsibility for expenditure of the planned total construction cost of the project.

### (2) Cost Accountant or Accounting Staff

Take responsibility for the accuracy of cost accounting of construction cost of the project.

### (3) The budget officer

Take responsibility for the amount of sub-total cost expenditure of the project.

### (4) The Staff of material

Take responsibility for total expenditure of gross of project materials, the united price of purchase and leasehold items.

### (5) The Staff of Labor and Management, Statisticians

Take responsibility for the accounting cost of evaluation of each job.

### (6) Mechanical Manager

Take responsibility for the total cost of leasehold machinery and equipment, own small machinery and equipment.

### (7) Construction workers

Take responsibility for the cost of their managed or

responsible scale.

### 3. Conclusion

In summary, the six steps of the project cost management are interdependent and mutually conditioned. Cost estimation and cost planning provide the requirements and objectives for cost control and cost accounting, cost control and accounting bring the basis to cost analysis and cost assessment, the results of cost analysis and cost assessment is fed back to the step of Cost estimation and cost planning, as reference of forecast and plan of the next period. This project cost management forms a spiral progressive management style, this management method would benefit improving the project cost management.

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