

Study on Application of Value Engineering on Construction Design

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Abstract - At present, our country construction technical level is low, management and construction career behind the vigorous development of variance exist. Meanwhile, adapt to the development of modernization needs the new progress of science and technology industry has not yet been fully formed. So strongly advocate application of value engineering in the construction industry. Construction enterprises need to improve product value and promote the value of traditional products innovation, foster and form the core of enterprise competitiveness, promote national economic and social sustainable development, both has long significance.

Keywords - Cost control; Value Project; Management

I. INTRODUCTION

With the development of socialist market economic system, the establishment and improvement of increased competition among enterprises, low-cost as an important competitive advantage of one of the criteria. Strengthening cost management to reduce costs in the enterprise business strategy has been extremely important in the central position. Enterprises, in order to gain a foothold in the competition must have advantages in cost management. The positive significance of value engineering: equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow. Through analysis of the value of the project activities could be defined more clearly the requirements of owners of units, and more familiar with the design requirements, structural characteristics and where the natural and geographical conditions, thus more conducive to the formulation of the construction program, more easy to organize and control project construction. Engineering activities can under the premise of quality assurance for the owners to save investment, improve function and reduce life-cycle costs. Keeping mutual benefit relations between the two sides harmony and collaboration. Through the analysis of engineering design of value engineering activities, to improve the quality of project organization, improving the internal organization management, reduce the unreasonable consumption etc.

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II. APPLICATION OF VALUE ENGINEERING IN CONSTRUCTION COST CONTROL

Value engineering as a result of cost control has expanded the scope of work, from the control of the project life cycle cost of construction should be starting to study the engineering design of the techno-economic rationality, and exploring the possibility of improving the availability, specifically the application of value engineering, analysis the relationship between function and cost in order to enhance the value of coefficient of the project. At the same time, through the analysis to find and eliminate the unnecessary function of engineering design, to reduce cost, lower investment purposes.

All charges are applied value engineering, building products are generally costly, so value engineering is promising. In the construction project implementation and operation of the decision, the whole life process can be carried out, and the implementation of the project or any decision are early directly or indirectly affect the follow-up every stage of the work of value engineering, so using the sooner, the better. Relative to the construction projects, can form the basic procedures of investment estimate, design, construction drawing budget estimates, contracting contract with the final settlement price. These cost exists between the former to the latter, who added the control of such interaction, according to the former, the latter control relation of the investment estimate by means of various plays a role, cost is limit goal. Thus, strengthen the depth of project decision-making in engineering application value in the construction project; the project can effectively improve the benefit of investment.

III. DISCUSSION

Aim of value engineering is to improve the product value. Increase value, the pursuit of the goal, and the fundamental interests of the two is consistent. Enterprises shall study product function and cost of best match. The basic principle of value engineering formula $V = F/C$, deeply reflects value products and product function, realizing the function of the relationship of the cost of consumption. According to the standard of value engineering, combining the construction work, the work of value engineering construction projects for the following three stages can program implementation:

A. The preparation stage

. The application of value engineering and the problem need analysis object, should according to the specific circumstances of the project can be determined from three aspects, to consider; Design, such as design standard exorbitant, design content in any unnecessary function; etc. The construction aspect: mainly is to find the best in quality requirements, such as analysis of construction scheme, construction method, mechanical equipment, and other water without unnecessary function; Cost: mainly in quality requirements for the premise way to reduce costs, should choose the value of large project focused on the analysis.

.Establish value engineering team, according to the selected object.

.The plan of value engineering, the main content should include: the target, group goal, team members and division, the activities of the methods and steps, etc.

B. Scheme evaluation stage innovation

. Put forward the improvement plan. Its purpose is to find any other method can realize the function of concrete engineering, such as whether new mix or mixed with additional agent, deep foundation excavation engineering have different methods, etc.

.Assessment improvement, it is mainly for the improvement scheme, from two aspects of function and cost calculation, to evaluate the new scheme of cost and function.

C. Experiments and acceptance stage

.New scheme, submit to project manager for examination and approval, and some even get supervision engineer, design units.

. Acceptance and summarizes the achievements

IV. VALUE ENGINEERING WORK PROGRESS

Before Value engineering, improve product value for the purpose. Enhance the value of both the needs of users, but also the production of the goal pursued by the operator; the fundamental interests of both are the same. Enterprises should study the cost of product features and the best match. The basic principles of value engineering formula $V = F / C$, profoundly reflect product value and product features and realize this feature by the relationship between consumption cost.

From the basic formula of value engineering, the following formula: value can be get value index (VI) = function index (FI) / cost index (CI) to calculate the value of objects of different evaluation index.

Value index can have three cases.

VI = 1: the importance of function equal to cost roughly, is a relatively reasonable, no value analysis.

VI < 1: evaluation scheme of relative cost less than relative functions, proportion of relatively high cost, which should find way to reduce costs.

VI > 1: function of the relative costs to meet the minimum program, that is to say the economy is relatively better technology options.

According to the value of engineering work standards, combined with the characteristics of construction, construction project value engineering work processes can be implemented in three phases as follows:

A. The preparation stage

1) *Preparation phase*: Application of value engineering objects and needs analysis, should based on the specific circumstances of the project, generally from three aspects to consider:

.Design aspects: such as the design standard is too high, the design of the content whether or not unnecessary features, etc;

.Construction: The principal objective is to meet the quality requirements to find the best construction programs, such as analysis of construction methods, assembly-line, mechanical equipment;

.Cost: The principal objective is to find the quality to meet the requirements of the decline in low-cost way to select a value larger project focused on analysis.

The value of the project plan, the main content should include: target, target group, panel members and the division of activities, such as the methods and steps.

Assessment improvement is for the improvement scheme, from two aspects of function and cost calculation, to evaluate the new scheme of cost and function.

B. Program innovation and evaluation stage

Improve the program, aiming at finding whether or not other ways to achieve this function, such as concrete projects with the availability of a new ratio or doped with additives, deep foundation excavation works whether or not different methods.

Evaluation to improve, with proposed to improve the program, from both functional and cost to conduct the evaluation, the specific calculation of the cost and functional value of new programs.

The nature of the optimal program, it is the basis of improving the evaluation of the program, which preferred the best option.

C. Experimental and acceptance stage

New proposal, submitted to the project manager for approval, and some also need recognition of supervision engineer, design unit owner.

. Implementation and inspections of the new program.

Conduct and summarize the results of acceptance

. VALUE ENGINEERING COST CONTROL IN THE APPLICATION OF CASE ANALYSIS

Optimize the construction program by using value engineering. In the project implementation process to determine a reasonable use of value engineering, and optimize the construction program, will enable the project specific conditions to achieve good quality, short duration, low cost, superior investment returns with good results.

Take the main floor of a cast-in-place construction project for example, construction units to speed up the template for working capital, demolish as early as the use of Steel-wood combination of the formwork system or small steel formwork construction. Both the technical economic indicators are shown in table 1 below.

TABLE I
TECHNICAL AND ECONOMIC INDICATORS

Item	Small steel formwork	Steel-wood combination formwork
Unilateral cost	130(Yuan/)	250(Yuan/)
Total cost	1500000	1300000
The actual efficacy	16(/day	22(/day)
Cycle template	12days	4days

Disassembly operation and machinery could operate by skilled workers. The construction is simple and reasonable, in order to determine the optimal program, it was decided to use value engineering based on the indicators of techno-economic analysis above.

A. Value Engineering

That is, value analysis, the use of collective intelligence, through organized activities, focuses on functional analysis of the products so that a lower total cost, reliable product to achieve the necessary function, thereby enhance the product value by scientific technical and economic methods.

Formula: $V = F / C$

Where: V- value analysis
F-function evaluation index
C- Project cost

B. Determine the function evaluation

Calculate index of function importance. According to the function of cast-in-situ floor template, divide it into unilaterally cost, total cost, efficacy, cycle, disassembling operating. Employ design, construction, owner, etc, score respectively, the average score 10 points for partial function, grading results shown in table 2.

TABLE
SATISFACTION SCORE TABLE

Evaluation factor	Score	
	Small steel formwork	Steel-wood combination formwork
Unilateral cost	10	7
Total cost	9	10
Actual efficacy	6	10
Cycle	7	10
Disassembly operation	8	10

Importance of each function index take 10 score method, and calculate the importance of each function index in Table 3 below

TABLE
FUNCTIONAL IMPORTANCE AND FUNCTION IMPORTANCE FACTOR SCORE

Factor	A	B	C	D	E	Score	index
Unilateral cost A		0	2	3	3	8	0.2
Total cost B	4		3	4	2	13	0.325
Actual efficacy C	2	1		3	1	7	0.175
Cycle D	1	0	1		1	3	0.075
Disassembly operation E	1	2	3	3		9	0.225

According to important sub-function index, the program function points, function score derived programs, program evaluation function index in table 4

TABLE
FUNCTION AND FUNCTIONAL ASSESSMENT INDEX

Evaluate factor		Score	
Function	Importance factor	Small steel formwork	Steel-wood combination formwork
Unilateral cost	0.2	10 0.2	7 0.2
Total cost	0.325	9 0.35	10 0.325
Actual efficacy	0.175	6 0.175	10 0.175
Cycle	0.075	7 0.0075	10 0.075
Disassembly operation	0.225	8 0.22	10 0.225
Score		8.3	9.4
Index of function evaluation		$8.3/(8.3+9.4)=0.469$	$9.4/(8.3+9.4)=0.531$

Determine cost index, according to the total cost of each scheme were calculated the cost of each factor .As is shown in table 5

TABLE
COST INDEX CALCULATION

Scheme	Total cost index
Small steel formwork	$150/(130+150)=0.536$
Steel-wood combination formwork	$130/(130+150)=0.464$

Determine value index

$C = F/V$ results are shown in table 6

TABLE
CULATING INDEX OF VALUE

Plan	Function index	Cost index	Value index
Small steel formwork	0.469	0.536	$0.469/0.536=0.875$
Steel-wood combination formwork	0.531	0.464	$0.531/0.464=1.144$

C. Scheme evaluation.

From analysis results above, The index of value of total cost steel combination template is 1.144 Higher than the index of value of total cost of small steel formwork 0.875. So should choose combination of steel construction scheme, Give full play to the template and reduce the use function, improve the total project cost benefit of investment.

V. CONCLUSION

An Empirical Analysis of the results of this analysis, we can conclude that: In the building projects under construction, the application of value engineering cost control theory, practical operability; construction project according to the different characteristics and requirements, the focus of the study should normally be released value theory through the application of value analysis, to determine the optimal construction program, with a view to enhance the functions of the product, lower product cost. Through the empirical analysis can also clearly see that the application of value engineering theory of effective, economical and great potential, not only works to enhance the quality, can also greatly accelerate the construction schedule. Through the regular application of value engineering theory, can also give full play to the technical staff, materials procurement officers, accountants, construction workers grassroots collective intelligence that will enable an officer to more closely together to jointly study the problems, the promotion of construction enterprise management level improvement has important practical significance.

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