



## A New Conception of Engineering Cost Control of Large-scale Public Projects Under Value Management Conditions

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Value management,  
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### ABSTRACT

Traditional engineering cost control is to figure out the corresponding quantities of projects based on the construction drawing, and then apply the relevant quotas to determine the cost. However, for some extra large engineering projects, due to design depth, construction technology and other factors, the traditional method of cost control can not meet the requirements. This article will explore a new method for such kind of cost control from the perspective of value management.

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With the growth of our national economy and enhancement of our economic power, construction industry has enjoyed a fast development. In recent years, some large-scale public projects with long construction period, large investment amount and demanding project quality, have been carried out, marked by Three Gorges Project, Divert Water from South to North, Qinghai-Tibet Railway and some facilities for 2008 Olympic Games. To meet special function and highlight cultural concept, these large projects usually have no precedent to follow, thus cost control generally has to give way to function, bringing new challenges to cost control. For example, the design program of National Grand Theatre is French and complex, of which the depth does not conform to our quotas. As a result, the cost has to be estimated according to the finished project, for lack of corresponding quota standard for reference. For cost control of these large-scale public projects, it is far from enough to continue to use the traditional method, that is, cost control in accordance with the cost of project itself. Instead, we should break away from such old method so as to better control the investment of large-scale projects, which is also the demand to build resource-conserving society. Value engineering analysis is just an effective way and tool for cost control of such large projects.

Value engineering, originating from the United States, is a newly-emerging technical and economic method that will increase product value and provide users with the required product function with the lowest total cost. The relation between function and price exists in all the products in society, which make up the value of product. VE is a management technology that seeks to use the lowest life cycle cost to reliably accomplish users' required function by organized and creative work, with a purpose of raising product (or operation) value and effectively use resources. "Value" in value engineering refers to the ration of function possessed by a certain product to the total cost to gain the function and is a comparison value of the object. Its expression is  $V=F/C$ , among which V is value, F is function, that is, function possessed by the object, and C is the total cost required to gain the function( life cycle cost). Value engineering can be applied to cost control of large-scale public projects to clearly analyze the relation between their function and cost, which will explore a brand-new idea to control engineering cost.

The determination and control of engineering cost run through every stage of project construction and also each step of cost operation. In project construction, technology and economy is always a contradictory unity. We should effectively connect technology with

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economy and correctly deal with the contradictory and united relation between advanced technology and reasonable economy through technical comparison, economic analysis and impact evaluation to seek reasonable economy under the advanced technology and advanced technology on the basis of reasonable economy. In addition, we ought to fully use the concept of value management in value engineering, and penetrate the concept of controlling project investment into every phase of the project.

A construction project can be divided into four stages, that is, decision-making, design, construction, use and maintenance. Kelly's (1982) research shows that eighty percent of the cost of a project has been determined at the design stage, so the subsequent control simply influences twenty percent of the investment. But if we employ the law of value engineering at the design stage, optimize the design program, promote new applied technology and design meticulously, we can save cost to gain benefit. Such design program, using cost as little as possible to accomplish the most appropriate and most necessary product function, safety and quality, which is the very marrow of value engineering. From the perspective of cost management of total life cycle, we should guarantee the cost control technology at the existing construction stage to enhance the depth and strength of preliminary planning, and also take future operation of a project into full consideration at the design stage to improve the foresight and advance of the design. Of course, we can not always simply emphasize thrift, ignoring or lowering demands for function, safety, quality and what the society advocates, otherwise the loss will outweigh the gain. Thus

it can be concluded as satisfactory function, reliable safety, up-to-standard quality, advanced technology, reasonable economy and appropriate art.

**Table one: A comparison of conceptions of engineering cost control**

A conception of traditional engineering cost control	A new conception of engineering cost control under value management conditions
Three main controls: construction period, cost, quality, are pure cost control	Consider meeting investors' needs based on the idea of project added-value.
Engineering cost control runs through the whole process of project construction, and controls cost at every stage, puts into main manpower and material resources at the construction stage, which causes low output and efficiency.	Engineering cost control should break away from the control only at the construction stage, and make clear the project target, total life cycle cost management, governance of relative people to project profit, and project management model, reasonably stimulate them (especially construction units), the whole-process cost management, project value management to rationally control project investment.

Project construction is a process that comprehensively uses all kinds of resources and technology to carry out organized activities, including the choice of construction team and transition type, the construction of temporary facilities, field management and construction finances. Applied value engineering in construction project is meant to make functional and value analysis of every construction stage to effectively reduce the construction cost. According to the expression model of value engineering, in optimizing the decision at the construction stage, the relation model of value, function and cost can be expressed as  $V = \text{target cost} / \text{present cost}$ , which aims to make present cost equal target cost. However, it is better for present cost to be less than target cost, that is,  $V \geq 1$ . Make sure that product cost is as little as possible—who will do, how will they do, and how to allocate resources in order to get the best benefit with the lowest cost, which are all the necessary problems to consider.

## Case Study

National Stadium, as the main venue of the 29<sup>th</sup> Olympic Games, is situated in Beijing Olympic Park with a construction area of 258,000 square metres, in which such events and activities like the opening and closing ceremony, track and field events will be held during the 2008 Olympic Games. The Stadium has a capacity of 91,000 spectators, including 11,000 temporary seats. It was started constructing on Dec 24<sup>th</sup>, 2003 and planned to invest RMB38,900,000,000 Yuan. Yet on July 30<sup>th</sup>, 2004 the construction was suddenly stopped and then great changes was made in the design program—remove the openable, sliding and flexible roof at the top of the Stadium, the largest in the world, enlarge the open top and decrease the amount of steel to reduce engineering cost. At last, the investment was reduced to RMB2,267,000,000,000 Yuan. The concreted main stand was finished on Nov 30<sup>th</sup>, 2005, the steel-structured main project was closed on August 31<sup>st</sup>, 2006 and the Stadium will be completed at the end of 2007.

**Table two: Analysis of value engineering of National Stadium**

Construction cost	Change cost	Project value
Remove the reflexable roof, and enlarge the open top to reduce project cost.	Owing to changes in design and construction program, problems in economy, environment and even society can not be ignored.	The removal of the roof and the enlargement of the open top greatly reduce the project's accessory function to further reduce its future commercial value.

To sum up, one important function of value management is to control the cost of engineering project, evaluate investment intention on the basis of entrepreneurs' development strategy to help them make decisions on investment and avoid wasting of funds due to blind investment, especially by cutting in at the stage of investment intention. What's more, value management studies function of an object by means of functional analysis, etc, and eliminates unnecessary functions to save cost, which is often the result of value management instead of target.

## References

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