

CONSTRUCTION CONTRACTING: CEM 520

*The Application of Value Engineering
on Public Construction Projects in
Saudi Arabia*

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CHAPTER 1

INTRODUCTION

1.1 General

Value engineering is defined as an organized creative effort which analyzes the functions of the products or services for the purpose of achieving the required functions at the lowest possible cost without sacrificing quality, performance and reliability. This thesis will introduce the concept of value engineering as it applies to the construction industry in Saudi Arabia, finding out the extent of use of this concept in public construction projects. Also it will identify reasons and roadblocks for extending its use of value engineering in Saudi Arabia will be suggested based on the results of the analysis.

1.2 The Construction Industry in Saudi Arabia

Saudi Arabia is a rich developing country in which the construction industry represents one of the largest industries. The construction industry received 49.6% of total government expenditures during the first national development plan (1970-75) and 32% during the second (1975-80) plan. Spending during the first five year plan was SR80 billion which soared to nearly SR700 billion during the second five year development plan. The government's objectives and policies in the field of construction include the following:

- Strengthening the Saudi construction industry.
- Improving the quality of construction and maintenance.
- Increasing productivity and capability of contractors.
- Reducing the cost of construction and related maintenance.

1.3 Definition and Potential Role of Value Engineering.

There are a number of reasons for the creep of poor value or unnecessary costs into the Architect/Engineer design. Listed below are some of those reasons:

1. A limited amount of time to make every possible cost comparison in order to achieve the most desirable degree of value.
2. A lack of information about the technical aspects.
3. A lack of creative ideas in the conventional design.
4. A lack of design fees to properly complete the design which affects the quality as well as the cost of the construction project.
5. Emphasis on performance at any cost.
6. Misconceptions resulting from past experiences.
7. Temporary circumstances that inadvertently becomes permanent.
8. The habitual patterns of thinking and negative attitudes of the designer.

Value Engineering is defined per the U.S. Government Department of Defense as "An organized effort directed at analyzing the function of systems, products, specifications/standards, practices, and procedures for the purpose of satisfying the required function at the lowest cost of ownership without reducing the needed quality". The prime goals of this technique are both product improvement and cost reduction. It differs from a traditional cost reduction approach in that it is function oriented rather than item oriented.

The job plan described in this thesis consists of six phases, as follows:

1. Information phase.
2. Speculation phase.
3. Analysis phase.
4. Development phase.
5. Presentation phase.
6. Implementation and Follow up phase.

1.4 Value Engineering in Saudi Arabia

Initial efforts for value engineering started in Saudi Arabia in the mid-seventies when the Ministry of Defense and Aviation sent some employees to attend a value engineering workshop in the United States in cooperation with the U.S. Corps of Engineers.

1.5 Objectives

The objectives of this thesis are:

1. The introduction of value engineering concept as it applies to the construction industry in Saudi Arabia.
2. Finding out the extent of use of value engineering on public construction projects.
3. Determining reasons and roadblocks for extending the use of value engineering in Saudi Arabia.
4. Suggesting some ways to expand the use of value engineering in Saudi Arabia based on the results of the analysis.

CHAPTER 2

THE VALUE ENGINEERING PROCESS

Value engineering (VE) is multiphase process. Its success depends heavily on its organization and management. The greatest potential for savings can be obtained when value engineering is applied at earlier stages of project development.

2.1 The Study Plan.

A study plan must be accomplished first in order to obtain resources for the performance of value engineering. The plan should contain the following information:

- ☒ The objective and scope of the study to ensure the achievement of specific results.
- ☒ The estimated study costs and expected savings.
- ☒ The name of the team leader and his qualifications.
- ☒ The names of the team members and their qualifications and the time required by each to perform the study.
- ☒ The time limits for each phase of the value engineering job plan and the expected date of completion of the study.

2.2 Value Engineering Team Selection.

VE is a team effort. The selection of the team is based on the project type and the team members' skills and their experiences. It might be conducted by more than one team. The number of teams

depends on several factors the major ones being: project size, project complexity, contains upon the scope of the study, and the degree of completion of the design.

If the study is conducted by more than one team, VE team coordinator should be selected to lead the VE study and to coordinate between different teams. Moreover, it is important to state that all of the team members should be isolated from their normal duties during the VE study.

2.3 The Value Engineering Job Plan.

The job plan described in this chapter is broken down into six phases. They are as follows:

- a. Information Phase: During this phase, the team members should gather all information related to the project under study. This phase occupies the longest segment of the study time, so it requires greatest effort from the study team. This phase has two basic objectives:

- To educate the team members about the system, structure, or items under study and to have a complete understanding by getting all necessary up to date facts.
- To have a clear definition of the value problem by means of a functional description coupled with an estimate of the worth of accomplishing the basic and required secondary functions.

In addition, certain information and documents should be submitted by the designer to the team before the study is conducted. Such documents are:

- ☒ A complete set of drawings.
- ☒ Copies of specifications, design criteria, and design data sheet.
- ☒ Analysis of the original cost estimate.
- ☒ Any special information pertaining to the project under study.

During the analysis, focus should be drawn to items that have potential savings, such as:

- ☒ Repetitive items in the project.
- ☒ High cost items that have impact on the total cost of the project.
- ☒ Items that will have a significant impact to the life cycle cost of the project.

b. Speculation Phase: The main purpose is to generate alternative ways to perform the essential functions of the item or the design that showed a high cost to poor value ratio. The more alternatives that are explored, the greater the probability of identifying the optimum one. However, there are two ground rules that teams must follow in this phase to obtain successful results. The first rule is the elimination of all judgments and evaluations of the generated ideas until all possible ideas are produced. The second rule is to take into account all generated ideas and not to ridicule any single idea, even the impractical ones. There are two major creative techniques are used in this phase. The first one is the brainstorming in which the brain is used to storm problems in a way that keeps judgment from jamming the imagination. The second one is the Gordon technique where the team members are encouraged to generate ideas to solve problems with deferred

judgment. The only difference between those two techniques is that in the Gordon technique only the team leader knows the exact nature of the problem.

- c. Analysis Phase: it is also called the evaluation or judgment phase, and it comes after the speculation phase. During this phase, the generated ideas are tested and evaluated by the VE team, and then the most promising ideas are selected for further development. These ideas must fulfill two requirements, the first one is to fulfill the owner's need based on the achievement of the essential functions of the design or the item. The second requirement is to examine the workability of the idea and to find out if it can be done and it works in practice or if it is beyond the scope of the present technology. Then the VE team may need to compare the estimated total cost of each alternative idea and rank them according to their total cost, a weighted evaluation technique may be used at this stage.
- d. Development Phase: from many alternative ideas generated, few are to be selected in the analysis phase for further development. Consequently, the development phase comes after the analysis phase with three objectives. They are as follow:
1. To refine and test the selected ideas.
 2. To perform life cycle costing on the selected idea.
 3. To recommend the best idea for implementation.

- e. Presentation Phase: the objective is to prepare and present a proposal containing the results of the value engineering study to the decision makers for approval. The results of the value engineering study should always be made in a written form called the "Value Engineering Proposal". However, the presentation is best done when it is a combination of both a written report as well as oral presentation.

- f. Implementation and Follow up Phase: the objective is to execute the approved recommendations in the VE proposal. Moreover, the VE team should collect all actual data and information and compare it with plan to measure the success of the work.

CHAPTER 3

SURVEY METHODOLOGY

3.1 Questionnaire Design

The researcher participated in the VE workshop sponsored by the Ministry of Defense and Aviation, in December 1986. The researcher interviewed and had detailed discussions with a number of government engineers, private contractors and consultants whom were attending the workshop.

The preliminary study clearly indicated that only government agencies and consultants are involved in VE because only government agencies represent the public construction project owners who have the authority to request and conduct VE studies and the consultants provide the technical services for the these agencies. Based on these findings, it was felt necessary to develop two detailed self administered questionnaires:

1. For the government agencies
2. For the private consultants.

About 145 government agency questionnaires were distributed to Saudi engineers who are responsible for design and studies in each agency. The researcher collected a total of 109 completed questionnaires. Out of which, seven were disregarded either because they contained unreliable information or because the respondents did not follow the instructions.

On the other hand, 56 private consultant questionnaires were distributed, out of which 20 were interviewed by the researcher. Thirty six questionnaires were sent by mail and out of which only 21 were collected. Four of them disregarded, either because they contained unreliable information or because the respondents misunderstood the concept of value engineering.

CHAPTER 4

SURVEY ANALYSIS AND RESULTS

Based on their responses, the respondents have been divided into two categories, those who apply VE, and those who don't.

4.1 Those who apply VE

- a. Government Agencies: as per the survey, only the Ministry of Defense and Aviation is applying a formal VE program in Saudi Arabia, in which it is very well active and positive.
- b. Consulting Firms: the researcher realizes that the sample of 2 respondents is small; however, this represents the only consulting firms in the sample that claimed they apply VE. One can conclude that VE in consulting firms is not applied formally. It is only used as a cost reduction technique when private owners ask to review their design which was done by other firms to reduce the project construction costs.

4.2 Those who do not apply VE

- a. Level of Personal Knowledge about VE: it is concluded that formal VE education in Saudi Arabia is very limited and it will be sometime before it is known and practiced in this country in a regular basis.
- b. Reasons and Roadblocks for not Applying VE: 70.6% think that VE was not practically introduced to them. 27.2% said

that it is not applied because there were no qualified personnel to do it. 2.2% claimed that their designs are done by the best designers and therefore there is no need for VE. And non one claimed that VE is not worthwhile.

- c. Attitudes towards VE in Saudi Arabia: the researcher realized that the general attitude prevailing in Saudi Arabia is overwhelmingly positive.

CHAPTER 5

EXPANSION OF VALUE ENGINEERING USE IN SAUDI ARABIA

5.1 Awareness among Construction Parties

The prime target of awareness effort should be the owner because only the owner has the power to order the type of services he wishes to buy. The following steps are considered important to increase awareness about VE in Saudi Arabia using several steps:

- a. Universities should take the lead by organizing seminars to introduce the concept.
- b. Government agencies should be made aware of this concept by special workshops conducted by Universities.
- c. A VE society should be established with an aim to promote the idea and to produce certified VE.

5.2 Gain Top Management Support

Some basic commitments are needed towards the success of this program. These commitments include the top management's involvement as follows:

1. Personal involvement in the program.
2. Dome financial commitment for VE study.
3. Their support for systematic application of VE program.

5.3 Provide Training Program

The VE short courses, seminars, and workshops are the primary sources of training programs which help in creating a general awareness about the subject.

5.4 Financial Incentives

All construction parties that can perform VE study should be covered for financial incentives.

CHAPTER 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The objective of this thesis was to introduce the concept of VE engineering into Saudi Arabia and to assess the way VE could be introduced in public construction projects. The following conclusions can be drawn:

1. VE is a successful technique that has been tested in many countries, to optimize cost of the project without compromising the quality and performance.
2. VE was introduced into Saudi Arabia by the Ministry of Defense and Aviation in 1981. Now, VE is applied formally in almost all military large construction projects.
3. VE can be applied at any stage of the project's development. However, the greatest potential for savings can be obtained when it is applied at earlier stages.
4. The most important reason for not applying VE in this country is that the concept is not very well known.
5. Government regulations through a government procurement system do not encourage the idea of VE.

6. There are no qualified personnel to apply this concept in the Kingdom. Therefore training programs are essential to train Saudi engineers.
7. Top management's support is essential to introduce and operate a successful VE program in organizations.