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Evaluating Effective Factors on Value Engineering Implementation in the Context of Iran

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ABSTRACT

Moving forward in21st century uncertainty of the success and survival of organizations has been increased dramatically. Nowadays construction industry has been faced with several crucial problems namely rapid and unpredictable changes, financial problems, environmental conditions, special requirements, customers' different attitudes as well as profitability of the project. Value engineering has been used in several governments and in the design, construction, and manufacturing of their industries in order to optimize projects, business, manufacturing processes, and also product developments. During the current study, the researchers attempted to investigate the value engineering in construction industry of Iran due to the importance of the implementation of value engineering principles. To this aim, a survey method research has been used in order to collect the required data, by means of a questionnaire. 56 people in charge with construction industry have been participated in the current study. In order to validate the questionnaire, a pilot study has been done among a sub-sample of 15 participants. By means of statistical procedure the reliability and also validity of the questionnaire has been proved. All of the gathered data have been analyzed deceptively by version 20 of the SPSS software. During the current study researchers had two main objectives namely; identifying factors which hinder value engineering implementation in the construction industry of Iran and identifying the needs of value engineering utilization in the mentioned context. Regarding the results of the current study and based on the mean index, for the first objective of the study five items considered as the main factors namely; Outdated standards and specifications, Habitual thinking and negative attitude, Lack of local guidelines and information, Lack of knowledge and practices and Change in owners' requirements. Besides, based on the results of second objective, three items considered as the essential needs for value engineering utilization in Iran, namely; The necessity of making clients more demanding and knowledgeable of the value engineering, The importance of adding value engineering Change Proposals (VECP) clause in the Contract Document, and essentiality of updating standards and criteria in construction industry in the Iran. Hopefully the results of the current study seems to be useful for a number of people who can benefit from the results such as construction project managers, contractors and the people in charge with construction projects of Iran.

KEYWORDS: Value Engineering (VE), hindering factors, needs of value engineering, cost of projects, construction industry.

1. INTRODUCTION

Value Engineering (VE) has been considered as a systematic and innovative multidisciplinary method that examines the functional needs of a product design, service design, project design, facility and system in achieving greater value and optimum cost without affecting the level of performance in the programme and project. This process involves all stakeholders and related project experts by paying attention to function, cost and also quality of the project. Additionally, value engineering is one of the most effective tools to achieve the lowest cost to execute the plans and eliminate unnecessary expenses along with the assurance of design, usefulness, maintenance capability and preservation of the aesthetic aspects of the work. Therefore it seems very essential in order to utilize this methodology in the construction industry of several countries(Male et al., 2007).

According to Macedo (1978) in order to apply value engineering in a perfect way different factors which result in unnecessary costs should be eliminated namely wrong beliefs and working habits, reluctance to search for necessary advices from experts, not having enough information regarding the project, different changes that happen in the technology and lack of the time. Simister & Green (1996) stated that in order to avoid failure in value engineering implementation six main factors should be considered in the certain period of time such as expectations; implementation, participation, power, lack of time and uncertainty about projects. In addition, construction designers usually have different critics about value engineering implementation. Different construction designers believe that applying value engineering usually causes unnecessary costs for projects and it can increase the time of the projects as well, besides some designers have uncertainties regarding the qualifications of the value team members (Fong and Shen, 2000). Applying value engineering in the construction industry can promotes innovation but it seems very difficult to change wrong beliefs and working culturein the construction companies. In addition, there are no developed policies to promote value engineering

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implementation in construction industry and also the private sector is not strong enough to support this method (Mazlan, 1998).The concept of design liability regarding value engineering proposal considered as one of the most problematic concepts of value engineering. It results in the outline whether the design team is liable enough for any recommendation implemented (Kelly and Males, 1991).

During the current study, the researcher had two main objectives namely hindering factors of value engineering implementation in the context of Iran and also needs for value engineering utilization in the Iranian construction industry. Value engineering has been pioneered within construction projects by Mr Alphonse Dell'Isola in the 1960s. Dell'Isola identifies "improving project value" as the main objective of value engineering in different contexts. In addition, he has been mentioned that the project team should utilize value engineering in order to overcome poor project value and also improve the quality value of the project. The implementation of value engineering in construction projects in Iran has been commenced in 1975. In 1999 this methodology has been applied in construction project by several governmental notifications. In 2000, they have notified instructions of "Contract with VE services contracts with units" before the establishment of the "Iranian Society of VE (SIVE) in 2002. So it is noticeable that value engineering is in its infancy in Iran. In the construction industry of the context of Iran, utilization of value engineering has been considered as an important measure that try to enhance the function of different project activities, so it can reduce time and cost of the projects at the same quality. Applying value engineering in the construction projects has some advantages in comparison with other old methods that it can enhance the safety and productivity of the project during its implementation.

Hopefully the results of the current study, seems to be useful for different people in charge with construction industry in the context of Iran. We can name scientific contribution of the paper as follows: 1. Construction managers of several projects in Iran can benefit the results of the current study to reduce the costs and time and enhance the quality, 2. Project supervisors and contractors to enhance the project efficiency, 3. Value engineers can use the findings of the current study in order to improve their investigations regarding the value studies, and 4. Administrators in the ministry of road and transportation of Iran to use the findings of the study for revising their executive programs in the future.

In remainder of the current paper has been organized as follows, in the second section, researchers discussed about the related literature regarding the value engineering implementation. In the third section of the paper, methodology of the paper has been explained. In the fourth section of the study, results of the study have been presented. Finally in the fifth and last part of the paper discussion and conclusion of the study has been discussed.

2. LITERATURE REVIEW

"Value engineering is an organized and innovative method to identify unnecessary costs. It usually manages the costs which are never likely to increase the quality as well as performance, and also not very important from the customer point of view. On the other hand, value engineering refersto the repetition of successes" (Miles, 1972).

In 1947 "Lawrence Miles" established the origin of value engineering, this issue has been investigated with different viewpoint to overcome the problems caused by the restrictions and has been caused several changes. While Experts have different interpretations in this field, they have utilized it based on their expertise and also interests. Value engineering is focus on (Wilson, 2005):

1. Improving project quality,
2. Reducing project costs,
3. Fostering innovation,
4. Eliminating unnecessary and costly design elements,
5. Develop implementation procedures.

In early 1960's Mr Alphonse Dell'Isola (known as the pioneer of value engineering within construction) introduced the value engineering concept in to the American construction industry (Fong and Shen, 2000). His goals were developing value analysis process for construction. He identifies "improving project value" as the major objective of value engineering. "The project team should utilize value engineering to overcome poor project value and quality" (Dell'Isola, 1982). Value engineering is not simply about money, but it is considered with the value (Kirk et al. 2002).

The Society of American Value Engineering (SAVE) has defined it as "the application of recognized and creative systematic methods that aims to distinguish and remove unnecessary costs as well as increasing the function of several services during its lifecycle". "The creation of value for the client is intertwined with the exploration and resolution of project functionality." (Kelly and Male, 1993).

Understanding of function is the required precursor to uncover the alternatives (Sperling, 2001). Generally Dell'Isola (1982) believes that traditional methods of cost reduction have limited functions. Function analysis has been considered as a very significant part of value engineering by considering why an item is necessary than just thinking about that item. Indeed, it is function-oriented than being just item-oriented. The SAVE International standard has been adopted the term value methodology which covers processes like Value

Analysis, Value Management, Value Engineering, Value Improvement, Value Assurance, and Value Control (Male et al., 2007).

Many analyses have portrayed the construction industry to be uncompetitive and inefficient with up to 40% of the effort expended in developing capital works being wasted, adding no value to the client, depleting both the respect between, and the profit and reputation of professionals, contractors and clients alike and exacerbating the adversarial condition so prevalent in the construction industry (Gallo et al., 2002).Moreover, construction industry all over the world has not been a static procedure and the reasons for this include clients' growing demand, complexity of construction projects, advancement in technology and introduction of new innovations amongst others. Demand for value engineering all over the world has been increased dramatically (Morrison, 1984). The discipline of value engineering, which was first applied to construction projects in the United States in 1970s according to The College of Estate Management (1995), has been received an increasing amount of attention within the international project management community (Green, 1994).

Value engineering has been practiced for half a century in the construction industry with an aim to produce innovative ideas and solutions for enhancing the value of the project (Zhang et al., 2009). Value engineering has been considered as an organized approach which can obtain the most optimum value of the unit cost, while assures the quality, safety, reliability, and maintainability of a construction project. It should be noted that value engineering can be utilized at any of the three main stages of a construction project namely, planning and design stage, construction stage and maintenance and operations stage. The greatest potential for the application of value engineering exists during the planning and design stage because its usage in the later stage will greatly increase the level of effort/investment to implement any meaningful changes which will result in large cost savings. "The reason being that if changes can be found at these stages the major cost savings being realized by the client will not have to be shared with the contractor" (Zimmerman and Hart, 1982). One of the best filed to apply value engineering concepts refer to the productivity of construction projects. The productivity in construction projects is the most critical factor which determines the project cost, duration and as a result the benefit for all parties (Abidin et al., 2007).

According to the researches, it can be concluded that improving project value needs enhancing the below factors (Dell'Isola, 1966).

a) Management factors;
b) Environmental factors;
c) Organizational factors;
d) Technology

Considering to the mentioned factors, it is clear that that the main root of all of them is the lack of access to the accurate information at the project definition stage. In addition to whatever procedure which has been employed to implement value engineering for a construction project, alternatives that are expected to maximize the whole-life value are selected based on the best judgment of the study team.

3. METHODOLOGY

During the current study, researchers have been used quantitative method in order to collect the required data. Quantitative method is used in understanding opinions and thoughts and constructing a basis for decision making. It should be noticed that SPSS software version 20 have been used to analyze the collected data. In order to examine the validity of the questionnaire, before starting the main study, researchers distributed questionnaire among a subsample of 15 participants and factor analysis has been run to see the validity of the questionnaire. Usually as KMO measure goes closer to 1 the validity of the test seems better. When the itis near 1, a factor or factors can probably be extracted, since the opposite pattern is visible. Therefore, KMO "values between 0.5 and 0.7 are mediocre, values between 0.7 and 0.8 are good, values between 0.8 and 0.9 are great and values above 0.9 are superb" (Field, 2009).The results of the factor analysis, has been shown in the following table.

Cronbach's Alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor

Table 1.. Reliability analysis ranking of the questionnaire

As it has been shown in the table 2 Kaiser-Meyer-Olkin Measure of Sampling Adequacy of the factor analysis was 0.882, which is close to 1, and it shows that the questionnaire is good regarding to its validity. As this study aims to identify the obstacle factors which hinder the value engineering implementation in the construction industry of Iran, it is necessary to have the series of proper procedures for conducting this particular research in the construction industry.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**0.882**
Bartlett's Test of Sphericity	Approx. Chi-Square	3301.45
	df	231
	Sig.	0.00

Table 2. The Result of Validity Test

The required data has been collected by questionnaire by means of mailed-questionnaire online, which is most economic and convenient way for data collection. Questionnaires of the current study have been sent to 56 participants. For the data analysis, descriptive statistics method has selected. (Naoum, 2007).

3.1. Objectives of the study

Developing countries are still in infancy in terms of using value engineering and Iran is not an exception. Modern manager must enhance the organization's strategies and policies adapting to changes. Value engineering as one of the most successful management tools has an effective role in planning and managing resources. Many things must be taken to considerations about professionals administrative in Iran to utilize the opportunities which have been provided by value engineering to reduce costs of projects as much as possible. During the current study, researchers have been investigated about different affecting factors in value engineering (VE) implementation in the context of Iran. To this aim, following research objectives have been investigated:

1. To identify factors which hinder value engineering implementation in construction industry of Iran.
2. To establish essential needs of value engineering utilization in Iran.

3.2. Research questions

Since the construction industry includes competitive atmosphere, value engineering (VE) can be used as an efficient method to accomplish the project goals with minimum cost as well as maintaining quality in most developing and developed countries. Regarding this case, main research questions which have been focused on in this study are:

1. What are the hindering value engineering factors in the construction industry of Iran?
2. What are the essential needs of value engineering utilization in Iran?

4. Result of the study

To investigate about the mentioned objectives of the study, a four part questionnaire has been used for the data collection procedure. In this chapter the collected data of the study and results of their analysis based on the mentioned objectives has been presented.

4.1. Results of the first objective of the study (Hindering factors for value engineering implementation in Iran)

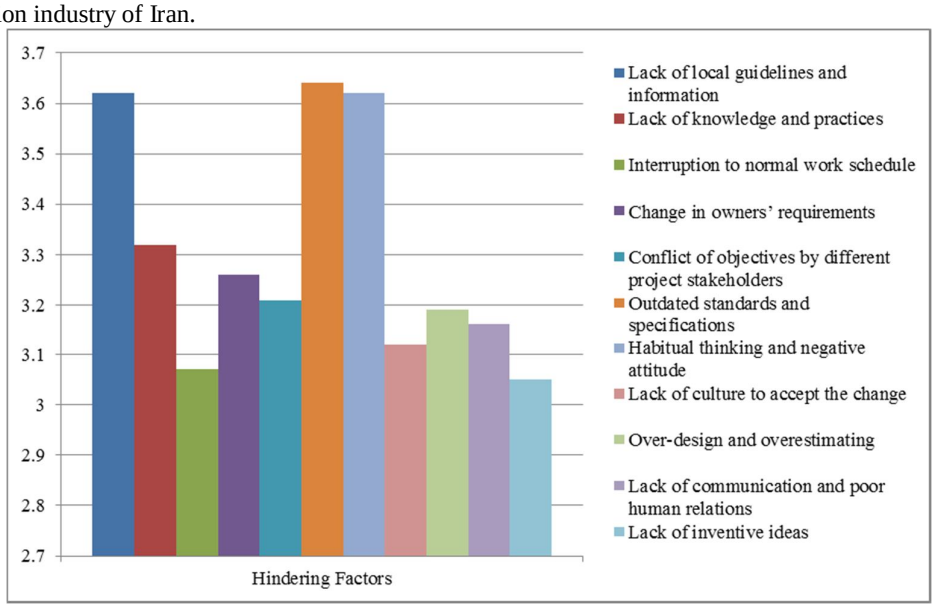
In this part, the results of first objective of the study have been presented. In order to attain the first objective of the study, eleven questions designed based on literature review. The results have shown in the following tables and figures.

No.	Item	Percentage				M.I.
		Disagree	Moderate	Agree	Strongly Agree	
1	Lack of local guidelines and information	3.57%	5.35%	16.07%	75%	3.62
2	Lack of knowledge and practices	8.93%	7.14%	26.78%	57.14%	3.32
3	Interruption to normal work schedule	8.93%	19.64%	26.78%	44.64%	3.07
4	Change in owners' requirements	10.71%	10.71%	19.64%	58.93%	3.26
5	Conflict of objectives by different project stakeholders	7.14%	12.5%	32.14%	48.21%	3.21
6	Outdated standards and specifications	1.78%	3.57%	8.93%	82.14%	3.64
7	Habitual thinking and negative attitude	1.78%	5.35%	14.28%	76.78%	3.62
8	Lack of culture to accept the change	3.57%	12.5%	30.35%	48.21%	3.12
9	Over-design and overestimating	1.78%	10.71%	25%	55.35%	3.19
10	Lack of communication and poor human relations	5.35%	16.07%	21.42%	53.57%	3.16
11	Lack of inventive ideas	3.57%	14.28%	26.78%	48.21%	3.05

Table 3. Value engineering hindering factors in Iran

As it seems clear from the above table, eleven different hindering factors regarding the value engineering implementation in the context of Iran have been surveyed among the participants of the study. According to the obtained data and based on the mean index of the scores, five main items with highest mean index were: Outdated standards and specifications, Habitual thinking and negative attitude, Lack of local guidelines and information, Lack of knowledge and practices and Change in owners' requirements. So it seems very essential

to consider these items in order to eliminate hindering factors in the value engineering implementation in the construction industry of Iran.



Graph 1. Mean index of value engineering implementation hindering factors

Based on the mean index and according to the participants' ideas regarding the factors which hinder the implementation of value engineering, five factors have been identified as the most problematic out of eleven factors that has been asked from the respondents. As it can be seen in Graph 1, the most problematic factors for value engineering implementation are: Outdated standards and specifications, Habitual thinking and negative attitude, Lack of local guidelines and information, Lack of knowledge and practices and Change in owners' requirements.

4.2Results of the second objective of the study (Needs for value engineering utilization in Iran)

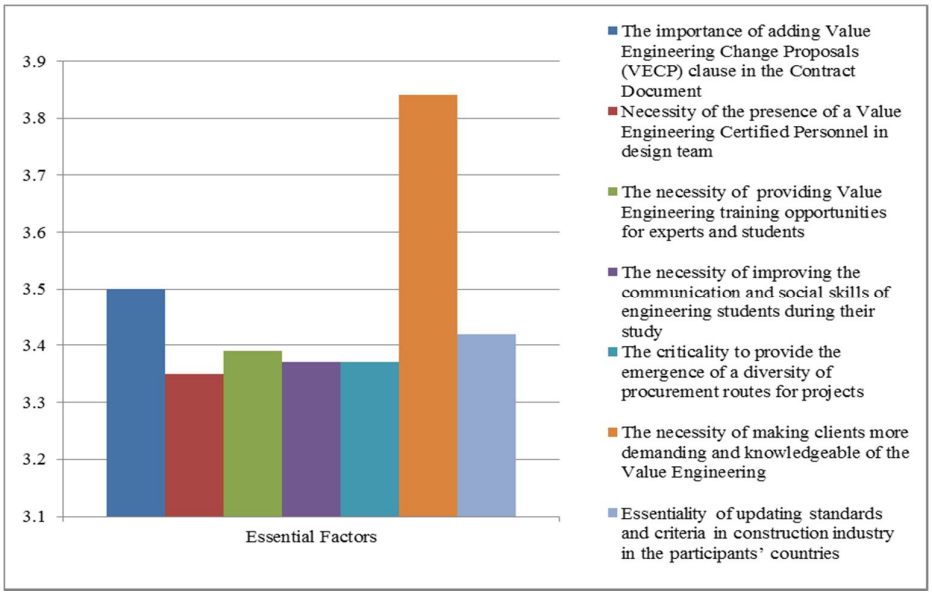
In this part, the results of second objective of the study have been presented. In order to achieve the third objective of this study, seven factors which are essential to improve value engineering utilization obtained from interviews. These factors had used to design the questionnaires to be asked about their necessities. The results have shown in the following tables and figures.

No.	Item	Percentage				M.I.
		Disagree	Moderate	Agree	Strongly Agree	
1	The importance of adding Value Engineering Change Proposals (VECP) clause in the Contract Document	10.71%	8.93%	19.64%	60.71%	3.50
2	Necessity of the presence of a Value Engineering Certified Personnel in design team	10.71%	12.5 %	21.42%	55.35%	3.35
3	The necessity of providing Value Engineering training opportunities for experts and students	5.35%	8.93%	26.78%	58.93%	3.39
4	The necessity of improving the communication and social skills of engineering students during their study	7.14%	8.93%	23.21%	60.71%	3.37
5	The criticality to provide the emergence of a diversity of procurement routes for projects	7.14%	10.71%	19.64%	62.5%	3.37
6	The necessity of making clients more demanding and knowledgeable of the Value Engineering	3.57%	7.14%	21.42%	66.07%	3. 84
7	Essentiality of updating standards and criteria in construction industry in the participants' countries	5.35%	8.93%	23.21%	62.5%	3.42

Table 4. Value engineering utilization needs in Iran

According to the above table and based on the mean index of the participants' ideas regarding the essential needs for value engineering implementation in the context of Iran, three essential factors for value engineering utilization in Iran were: The necessity of making clients more demanding and knowledgeable of the value engineering, The importance of adding value engineering Change Proposals (VECP) clause in the Contract Document, and Essentiality of updating standards and criteria in construction industry in the participants'

countries. So based on the results of the study and due to the participants' opinions regarding the essentiality of the mentioned factors in value engineering implementation in the context of Iran, the mentioned factors should be considered by different people in charge with construction projects of that country.



Graph 2. Needs of value engineering utilization in Iran

As it has been indicated in graph2, and based on the result of second objective, after surveying respondents' opinions regarding the needs of value engineering utilization in the context of Iran, three items have been identified as the most important factors out of the seven items that have been asked from the respondents. The most important factors regarding the needs for value engineering utilization in Iran are: The necessity of making clients more demanding and knowledgeable of the value engineering, the importance of adding value engineering Change Proposals (VECP) clause in the Contract Document, and essentiality of updating standards and criteria in construction industry in the mentioned scope.

5. DISCUSSION AND CONCLUSION

During the current research, researchers attempted to find out different factors that may affect the implementation of value engineering in Iran. Main concerns of the researchers were to find out, hindering factors of value engineering and also essential needs for value engineering utilization in Iran. During the current research procedure, researchers became to this conclusion that still implementing value engineering in Iran has several problems that should be solved in the near future. To this aim researchers has been used a survey method to find out value engineering implementation benefits in the context of Iran, 56 people in charge with the construction management issues, have been participated in this study by answering the related questionnaire. After collecting the required data by means of the version 20 of SPSS software results of the current study has been analysed descriptively. By considering the mean index of the scores related to the first objective of the study, five factors which hinder the implementation of value engineering in Iran and three factors regarding the second objective of the study has been identified.

Based on the findings of the study and according to the participants' opinions the five main factors which hinder value engineering implementation in Iran are outdated standards and specifications, habitual thinking and negative attitude, lack of local guidelines and information, lack of knowledge and practices and change in owners' requirements. So the managers and the people in charge with construction industry and value engineering should try to overcome the mentioned obstacles to make the implementation of value engineering more convenient and also straight.

As the second objective of the current study, researchers attempted to understand the essential needs of value engineering utilization in Iran. Based on the participants' ideas, following factors have been concluded as the three essential needs for utilization of value engineering in the construction industry:The necessity of making clients more demanding and knowledgeable of the value engineering, The importance of adding value engineering Change Proposals (VECP) clause in the Contract Document, and Essentiality of updating standards and criteria in construction industry in the participants' country. It should be noted that to develop value

engineering in Iran, different people in charge should try to approach the mentioned needs as well as using the experience of developed countries in this term to obtain their required goals.

It can be concluded that the most important factor for utilization of value engineering in Iran is to teach different concepts of value engineering for the experts and students to improve their knowledge in this term. Moreover, it is noteworthy that by teaching the principles of value engineering in the universities, we may have more knowledgeable students in the future who can implement several useful projects in construction industry. Additionally by setting different rules of obliging contractors to utilize value engineering principles we would have more optimized resources in the construction sites and most brightening results are likely to be achieved.

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