

# Value engineering compares with the other management systems for construction projects

Behrouz Andalibizadeh\*

Faculty of Civil Engineering University Teknologi  
Malaysia (UTM), Johor Bahru, Malaysia.

\*Corresponding author

[bandalibizadeh@yahoo.com](mailto:bandalibizadeh@yahoo.com)

[bandalibi@srttu.edu](mailto:bandalibi@srttu.edu)

Abdul Kadir Bin Marsono

Supervisor and Information Technology Management in  
Faculty of Civil Engineering University Teknologi

Malaysia. (UTM), Johor Bahru, Malaysia.

[akadir@utm.my](mailto:akadir@utm.my)

Saleh Sedghpour

Faculty of Humanities, Shaheed Rajaei University, Tehran, Iran

[Sedghpour@srttu.edu](mailto:Sedghpour@srttu.edu)

**Abstract—** Recently, industry and infrastructures have the outstanding status in configuring economic, political, cultural, and technological trends. In effect, industry and infrastructures have been changed into the centers of social and economic development and productivity. Basically, the importance of systemic management has been increased for coordinating and managing in order to provide optimum services. Vividly, optimum services required optimum management. In twenty-first century with the main characteristic of lack of resources, optimum management can help the managers for the better measures. Essentially, it propels the managers to use effective method that concludes the highest increase of stakeholders' satisfaction and the lowest decrease of costs. One of the salient methods is value engineering, which is employed in projects and products. Value engineering is treated as the management techniques that can increase the function of projects and decrease the costs of projects at the same time. Broadly, value engineering in all domains has been used. Moreover, value engineering has the highest privilege in comparison with other systems and managerial methods, special for construction projects.

**Keywords-** value engineering; management systems; Optimum management; Management improvement

## I. INTRODUCTION (HEADING 1)

Now the question comes to mind is that you really can reduce these problems? Whether the problem is specific to a country or other countries that are involved with these problems? What other managers have done to solve these problems [1]. By studying many ways to deal with these issues, it can be concluded to solve these problems, they are not expensive and more efficient use of existing conditions have on

The problems facing their defeat. One of the methods that have succeeded in stabilizing or reducing costs while increasing the quality of project proposals is the use of engineered the value of the project [2]. Due to high costs, and the multiplicity of stakeholders and the need for new ideas to solve new problems and overcome the limitations of multiple projects, value engineering can be effective and efficient manner. Using this method can increase the efficiency and quality while reducing costs throughout the life cycle of the project. [3].

## II. METHODOLOGY

Value Engineering systematic approach, systematic and based on creativity and teamwork to solve problems, reduce costs and improve performance and quality of projects, products and processes. Value engineering professionals help a wide range of knowledge and experience and focus on the functions of the project; product or process is implemented to improve the speed of the results [4]. VE (Value Engineering) is defined PMI (Project Management Institute). Value engineering creative approach to optimize life cycle costs, save time, increase profits, improve quality, increase market share, solve problems, and optimal use of resources [5]. First, succinct and concise definitions amplifications of engineering systems compared with the value given to the preparation of the questionnaire, and ask the experts, the result of the comparison together comes in the matrix table. The comparison was made by scoring 1-3 in which the 3 was the most and 1 was the least match to the relevant question.

A. *Fourteen system Management for comparison with Value Engineering:*

- **Benchmarking;** Benchmarking or competitive analysis is a method for producing in the least time possible. In this method, rival products are analysed for assessment of quality and technology. Using reverse engineering as a design method lead to a total imitation. Best advantage of reverse engineering by finding your place among rivals, and accompanied by effort and creativity, you can lead the industry by yourself [6].
- **Design for Assembly (DFA);** DFA of a series of pre-determined tasks to follows distinct questions and designed equations for numerical estimations of a project. This system sometimes combines the study of time and motion with value engineering [3]. In this method, first a diagram determines the time required for achieving the basic materials and then another diagram determines the time for placing the parts. Then these times are transferred to a third diagram where it briefly shows the gathered information [12]. In design for assembly, value engineering is used to creatively decrease all the important time elements. DFA can be the main tool for product design, not only for simplifying the designs, but also for simplifying the construction and production process [11].
- **Failure Mode Effect Analysis (FMEA):** FMEA is a statistical quality based on the method process which is designed for anticipating product or process problems that can be identified during the design development stage. Failure Mode Effect Analysis is a systematic method for identifying modes in which a design, product or a system might fail and its main goal is to make sure that the final design has no aspects that could lead to serious malfunctions. This process is considered one of the main needs of value engineering and the anticipations based on FMEA are the beginning of the study of value engineering in order to decrease the failure risk of a product or process. The major problem of FMEA is the complexity of the process in large systems and also the time limits for analysis, and in these conditions it is suggested the process is divided into functional units to enhance the outcome [14].
- **Just in Time (JIT):** Just in time is a production system in which the real orders determine the production time. Demand makes a company produce the required product in the right time and quantity, and this means minimizing the storage of basic materials, parts and half made and full made products [5]. The purpose of JIT is the elimination of stocked product from production chain which requires a meticulous time schedule and resource flow in production process. Basically, the essence of JIT system is time competition and it's based on waste decrease, simplifying the process, decreasing the system adjustment time and product part size, parallel production instead of series, and re-designing workshop location. Some advantages of this system are : 1- less stocking and consequently decreasing stock size and lowering rent and insurance costs, 2- spending budget in less transactions, 3-decreasing the possibility of waste, 4-preventing production of unsold products because of sudden demand changes. Some disadvantages of this method are: 1- less error control because of minimum products in stock, 2- product dependence on producers and a possibility of delay in the whole program, 3- not having access to the final product replacement because of on demand producing , though JIT is high reaction production process[7].
- **KAIZEN:** KAIZEN is another Japanese system which emphasizes on constant enhancement. This system was invented in Japan after WWII, in 1950. The word KAIZEN is consisted of the words “KAI” meaning change, and “ZEN” meaning good, and its known concept is constant enhancement. KAIZEN system involves everyone from headquarters to cleaning and maintenance crew. In Japanese companies like Toyota and Canon, each of the staff presents more than 60 to 70 enhancement suggestions yearly. Generally, suggested ideas are not meant for major changes and are based on small and constant alterations. KAIZEN looks for small changes in any field or subject, wherever an enhancement is possible. Western ideology says: “if it’s not broken, don’t fix it.”, while KAIZEN says: “make it better, even if it’s not broken enhance it, because if we don’t do this, we can’t compete with those who do so.” The most major drawback of KAIZEN is that it tries to refine the functions but never does anything about the designs. So it is possible that the result leads to the best method of producing a very low quality product [13].
- **Kepner -Tregoe:** This system is generally a decision making process which presents a method for solving problems , doings jobs and condition analysis for finding potential problems and it is classified into problem analysis , system analysis , and potential problems analysis. This system defines problem as a contrast between what we expect and what really happens. In fact if there’s no difference, there’s no problem. This method is based on team work, concentrates on goals, and its information gathering and analysis is time consuming [7].
- **Management by Objectives (MBO):** In the second half of the 19th century, many managers learnt that the administration of large organizations is too complex and difficult, but using results control, the largest companies could be managed too [7]. The Management by Objectives method was born with the assessment development by “George Lodion”. This system enhances the organization’s function by controlling inputs, processes and outputs. First the managers and staff gather together and determine the goals, at the end of the period results are compared to initial goals, revisions are made and the process starts again. This method is very time consuming though [1].

- Quality Function Development:** Quality Function Development is a statistical method for helping production and pre-production processes. This technic was first used in 1972 by Mitsubishi ship factory in Kobe, Japan. Quality Function Development is a very neat and organized system for interpreting the voice of customer in technical words. Originally, Tagoshi methods are part of the Quality Function Development. Quality Function Development reflects customer needs to company and specially to designers. Main features of Quality Function Development are: 1- decreasing engineering alterations 2- shortening the design chain 3-lowering installation costs 4- decreasing complaints on job guarantee 5- increasing customer consent 6-building up competitive aspects 7-simultaneous engineering development [9].
- Simultaneous Engineering:** Simultaneous Engineering is in fact performing team work on a high scale project which involves all management process from design to distribution of the product. This system is consisted of many production teams with different specialities that work with each other during the production period. In some cases the system includes production teams, management and a guiding team that control the system function and try to remove the obstacles on the way of the progress. This committee is usually consisted of high rank managers or vice presidents of the company. In this system, changes are quickly adjusted production process and the result would be lower costs and better validity of the product. Value engineering is not a good replacement for Simultaneous Engineering, but it can be good complementary for it [8].
- Taguchi Methods:** Dr.Taguchi, one of the staff of a Japanese telephone company, invented one of the most successful management methods. The advantage of this system is the combination of engineering and statistical methods for rapid enhancement of cost and quality, accompanied with refining design and production processes. This method is one of the functions of Statistical Process Control which focuses on quality enhancement through identifying and lowering tolerance constants. This idea suggests that design should be so powerful that it would not be affected by production variables. Main purpose of this system is constant decreasing of variables and errors, without having negative effects on production process. Dr.Taguchi says: "All quality deficiencies could be traced through design process". And as quality problems increase costs, so with the correct design costs could be lowered [8].
- TRIZ:** TRIZ is one of the newest management systems that was invented in 1940 by Gnrish Altscholer, head of the Russian army's Patent office. TRIZ idea emphasizes that the technical problems of engineers have solutions that were made before and now they just have to be found. Altscholer tried to classify previous ideas rather than presenting new ones, and using the

analysis of a thousand world-wide inventions finally determined the main keys of new ideas' success. Using a table named contrast matrix, TRIZ presents the most probable ways to eliminate engineering problems. The main steps for solving a problem with technical paradoxes are: 1- analysing the technical system 2- detecting technical paradoxes 3- eliminating technical paradoxes [4].

- Total Quality Control:** Total Quality Control, which is also known as Total Quality management is a higher approach than normal quality control technics [15]. Total Quality Control means full assessment of a product rather than only a limited amount of changeable aspects in the product. Total Quality Control was also invented in Japan, but its original inventor was an American professor named Edward Deming who presented his ideas in America but didn't receive much reception and it was the Japanese that after WWII, looking for a way to reconstruct their country, took Dr.Deming to Japan and learnt his ideas. Nowadays, one of the greatest prizes that a person can win for participating in production is the Deming Prize [9].
- Quality Function Development (QFD):** Quality Function Development is a statistical method for helping production and pre-production processes [6]. This technic was first used in 1972 by Mitsubishi ship factory in Kobe, Japan. Quality Function Development is a very neat and organized system for interpreting the voice of customer in technical words. Originally, Tagoshi methods are part of the Quality Function Development. Quality Function Development reflects customer needs to company and specially to designers [7]. Main features of Quality Function Development are: Decreasing engineering alterations, shortening the design chain, lowering installation costs, decreasing complaints on job guarantee, increasing customer consent, building up competitive aspects and simultaneous engineering development [10].

### III. RESULT AND DISCUSSION

Comparison of the management systems based on the matrix table is shown in Figure 1 and Table 1.



Fig1. Comparison of the management system with VE for construction projects

Based on each of the efficiency systems management (15 management systems) that has been described as one of the scores for each of the methods applied in this study need to be mentioned explanations: 1. Efficiency each system management application, taking into the conditions of the management system, and are certainly worthwhile and effective benefits system. 2. In this study just estimates, and

skilled craftsmen in the construction of collective perspective on the comparison being installed for construction industry, particularly the construction project will be a number of management systems and efficient. 3- Over twenty System management such as Lean, ISO 9001, PMBOK, VM, BIM, ..., have been studied, which are listed Due to the limitations of this study.

**Table 1.** Matrix and comparison system management for construction projects [10] and our work.

Systems Management	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Total	
1 Benchmarking	1	2	2	3	3	2					2		2	2			2									3	22	
2 Design For Assembly (DFA)	1	1	1	2	3	1					3	3					3	3	3						3	3	35	
3 Failure Mode Effect Analysis (FMEA)	1	1	1	2	1	1										2	3				3				4		17	
4 Just In Time (JIT)	1	1	2	3	2	2				2	2						3	3							3		24	
5 KAIZEN	3	1	1	1	1	1		3	2	2	1			3		3	2								2	5	31	
6 Kepner- Tregoe(K-T)	3	1	1	1	1	2		3			1		2						3				1	3	3		24	
7 Management By Objectives (MBO)	2	2	2	3	1	2	3	2	1	3								3								3	27	
8 Quality Function Development (QFD)	1	3	3	3	1	3		2			2		3	2		2	1	1	2	3		2		3	3		36	
9 Simultaneous Engineering	2	2	2	1	1	1	1	2			1	1						2								3	19	
10 TAGUCHI	2	2	2	2	1	2					2		3			3	3		1		3					3	29	
11 Target Costing	2	1	1	2	2	3					3	3					2	2								3	22	
12 Theorya Reshentya Lzobrototlslkh Zadetch (TRIZ)	1	2	3	3	2	2					2		3	3					3				3	3	2		31	
13 Total Quality Management (TQC)	2	2	3	3	2	2							3			3	3	3	2		2					3	33	
14 value Engineering (VE)	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3	2	3	3	3	2	2	3	1	2	1	3	68	
15 Zero- Based Budgeting (ZBB)	1	2	1	2	2	2						2						3								2	3	20

17)Improve the quality of production 18) Improve production functions 21)Improve administrative functions

**I. CONCLUSION**

Regarding to the subjects of the questions (all key questions for construction projects and industrial manufacturing) and comparative tables, it is concluded that total scores of value engineering is higher than other management systems. Therefore application of value engineering has significant impact on the efficiency of construction projects.

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