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Research Article

EVALUATING VALUE ENGINEERING ROLE IN IMPROVING THE CONSTRUCTION PROJECTS OF SOCIAL SECURITY ORGANIZATION

***Mohamad Farahmandazad**
Department of Project Management, Tehran Branch, Construction of Tehran University, Tehran, Iran
**Author for Correspondence*

ABSTRACT
Today, one of the most powerful tools used for reducing the cost, time, quality, and thus improving the performance of projects, especially those ahead of great organizations such as the Social Security Organization is Value Engineering. This study aims at studying and evaluating the role and application of value engineering in construction projects of the Social Security Organization. This research is a case study and is a practical one in terms of objective and the statistical approach applied in it is a descriptive method. The scope of this research is all development projects of Social Security Organization focusing on Design and Implementation of Housing Management Company of Iran which is responsible for all phases of projects from initial design to full implementation of them and in fact, it is considered the development arm of Security social Organization. For Design and Implementation of Housing Management Company of Iran that deals with large construction projects annually and according to many problems that exist in terms of time and cost of development projects for the organization, the application of effective tool of value engineering has been proven clearly.

Keywords: *Value Engineering; Social Security Organization; Construction Projects; Performance Improvement*

INTRODUCTION
Value engineering is a systematic attempt to analyze the performance of projects, systems, equipment, services and institutions in order to achieve real performance with the lowest cost over the life of the project which is consistent with the desired quality and safety. In recent decades, industrialized and developing countries and even the neighboring countries of Iran, have realized the necessitates of using effective methods and techniques for cost savings and have been seriously looking to reduce unnecessary costs [6]. In our country and in the last few years, the Management and Planning Organization as the main responsible for solving the above problems has attempted to promote new approaches to management, and offer suitable strategies in technical and executive system of construction projects. Moreover, cases such as developing some rules, holding seminars, and publishing books in the above aspects can be considered in this line. Accordingly, wide spread attempts have been done for raising Value Engineering method in construction projects of the country. It is not worthy that the mentioned method has been able to cause large savings and revolutions in the developed countries.
Implementation of value engineering and its comprehensibility in terms of using knowledge, and other proposed solutions on the one hand, and the needs and requirements of the country for reviewing proposals to simplify and improve them and lower their cost on the other hand, have motivated many experts familiar with the concepts of value engineering to support the implementation of such methods, and each one facilitate fields necessary to implement them. This research is an attempt in this direction and deals with the application of value engineering system in construction projects of Social Security Organization.
Value engineering is a management solution and a creative approach that uses functional systems approach objectives to find the best balance between cost, validity, and reliability of products or projects (Zaymrmn, 1982). In the other definition, value engineering is among the proposed and succeeded techniques in budget optimal allocation and the project cost savings over the life of the project. Value engineering is a very efficient technique to reduce the costs and time of projects with maintaining the desired quality and utility. Using value engineering techniques, it is possible to simplify and improve

the quality and make affordable the costs of construction project. Value engineering can be viewed as a process of decision-making that considers the following items:
A: a systematic process of "optimizing operating costs."
B: an innovative approach to "Creation of Options" toward the implementation of plans and projects.
C: Orientation towards the satisfactory "performance"
D: Considering "cost" in the "current costs.

The Objectives and Terms of Value Engineering

Value engineering aims at achieving the minimum costs without any reduction in quality, satisfaction, reliability and quality improvement (Jafari, 2000; Monden, 1995).

The central core of this system considers the "Targeted Costing" in order to "cut costs at the design stage" and long-term planning of profits as the target of value engineering .Cooper referring to the marginal utility (Cooper, 1997) believes that the "competition model program for reducing administrative costs, increasing marginal utility of services and facilities, increasing profitability in the competitive market and reducing costs, in line with the objectives of quality improvement are included as the objectives of Value Engineering. Palmer, 2002, considers the optimization of needs and project-oriented products in order to create maximum customer satisfaction by utilizing partial method obtained through the results caused by utilization of value engineering.

Enjoying the creativity in improving the quality, reducing unnecessary expenses, favorable function and optimization of activities can be considered as objectives of this approach (Sami, 2005). About benefits of value engineering factors, items such as risk aversion, improvement of quality, improvement and development of the project, increasing productivity and confidence, transmission of data, utilization of creativity in the affairs, reducing complexity of products and projects, minimizing waste of resources, reducing implementation of costs and improving operational and administrative aspects can be mentioned that provide financial cost optimization and improvement of municipal projects in city development and urban development of cities and increase the quality, reliability and keywords of Value Engineering and Executive credibility of the Projects.

The following words have fundamental concept in value engineering and knowing them allows a better grip of this concept:

1-Function: The role that assists the targeted product in achieving the set goals (Monden, 1995).

A concept through which, value engineering describes necessity for raising the issue to avoid the innovated option to be based on a specific pattern.

2. Performance: Surface, performance objectives, it came into force (Ibid.)

3. Specifications and Features: Features including special shape, dimensions, constituent elements, capabilities, performance, manufacturing test methods for materials and products (Ibid)

4. Value: Value has indicators that make possible the access to the maximum value.

Visibility of Value also becomes possible in response to three questions (Taghizadeh, 2001)

Value Engineering and Architectural engineering in Building Design Process

Value engineering design phase of the building and the commitment of implementing Value Engineering rule Stage of design needs high capability in value studies because while this stage encompasses about 1% of the total life cycle costs of building project but impacts over 70% of the cost of building life-cycle. Recognizing this stage is important because with having enough knowledge over the design process and enjoying a closer look at the way architects act when designing buildings, the shortcomings of values corresponding to this stage will be clarified through increasing their accuracy as well as the turning points that have the potential to realize the added value using them. Value engineering methodology in the design and implementation of housing projects is shown in Table1.

The time for applying value engineering practices is shown in the design process of the new approach in the design and construction of housing projects in Figure 1.

Table 1: Value engineering methodology in design and implementation of construction projects

Preliminary Study
Collecting data regarding the desires of employers/consumers/purchasers Completion of Datasets Determination of apprasal of criteria Determination of study range Making data model Determination of research team members
Studies of Value
Phase of Collecting Data Phase of function Analysis Phase of Creativity Phase of Assessment Phase of Developement Phase of Presentation
Supplemenary Studies
Completion of Changes Implementatio of Changes Audition

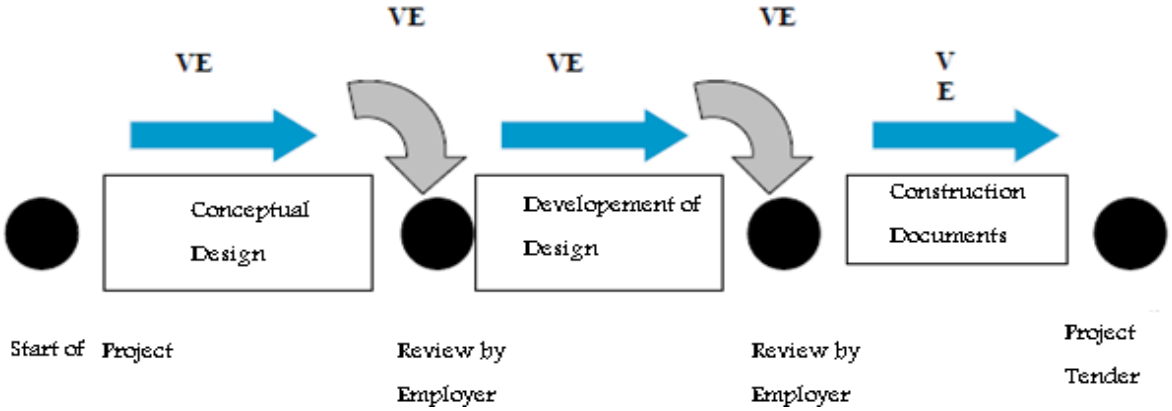

Figure 1: The time of applying Value engineering throughout the design (new approach)

Value Engineering Methodology in the Design Process

Recognizing components of the design phase in a systematic approach, i.e. the schematic design, design development, construction documents and details of the activities performed in each of them, perception and understanding of value engineering affairs will be materialized in the end of each of the sub-steps in terms of step by step and gradual formation of intended facilities and demonstration of some design features in each sub-step. The importance of design phase in the value engineering approach is greatly felt because among four phases: feasibility of projects, design, construction and operation are the most important stages of construction projects on the scale of design phase value that with consumption of only one percent of the costs related to the construction projects, the total costs of project life will be impacted at the rate of seventy percent. In a systematic approach, the design phase is considered as a system that contains inputs of stage design, design order, feasibility studies and architectural conceptions and their

output consist of drawings and construction documents related to the project. In Figure 2, the housing design process while the application of value engineering is shown.

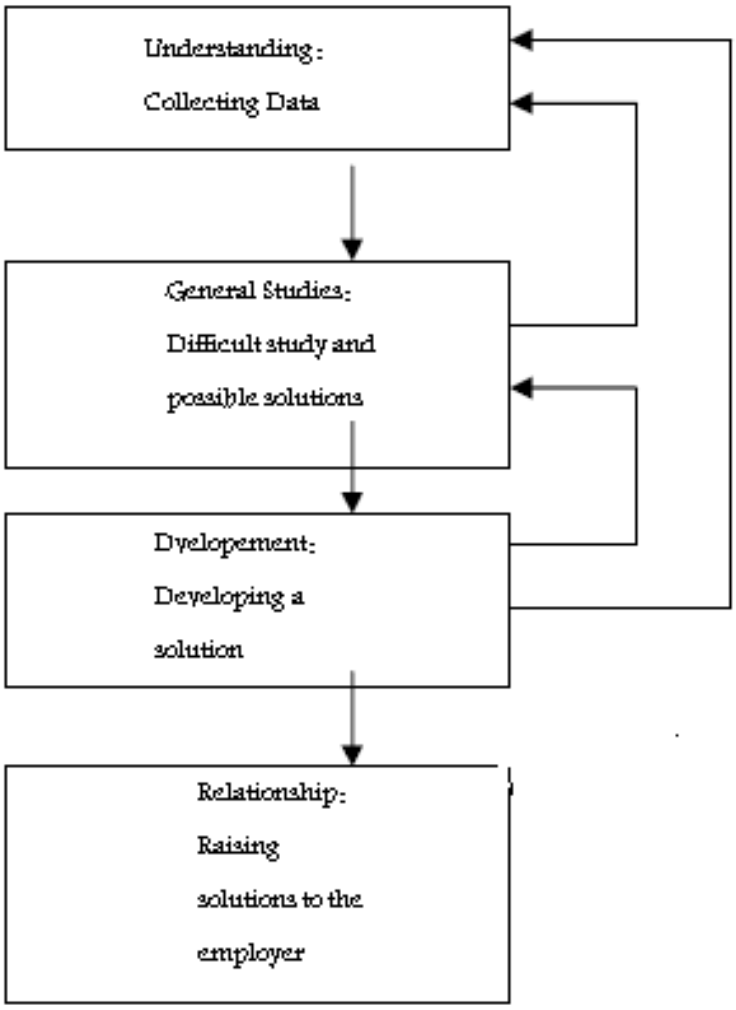

Figure 2: Design Process Methodology

Design phase is divided into three sub-steps and normally at the end stages of conceptual design and design development, a revision will be made by the employer to ensure compliances of design with the expectations of the employer.

In the methodology of designing, theoretical models exist for the explanation of design as a systematic and logical process. However, the architectural design process encompasses various approaches and for example the Architectural Management Handbook explains the design process in the following four steps:

1. Perception Understanding and data gathering.
2. General study of identifying the problem and exploring possible solutions.
3. The development and generalization and development of optimal solution.
4- Exchanging solutions with employer.

Considering the design phase as a system, the reasons for the minimalist of value will be discussed in three parts of system input, output and central processing and hardware and software of the system .The reasons for the occurrence of minimum value (Zaymrmn, 1995) can be sought in cases such as lack of time, lack of information, lack of ideas, false perceptions, manners and customs, norms, value, policy, lack of financial resources and temporal events that are permanent.

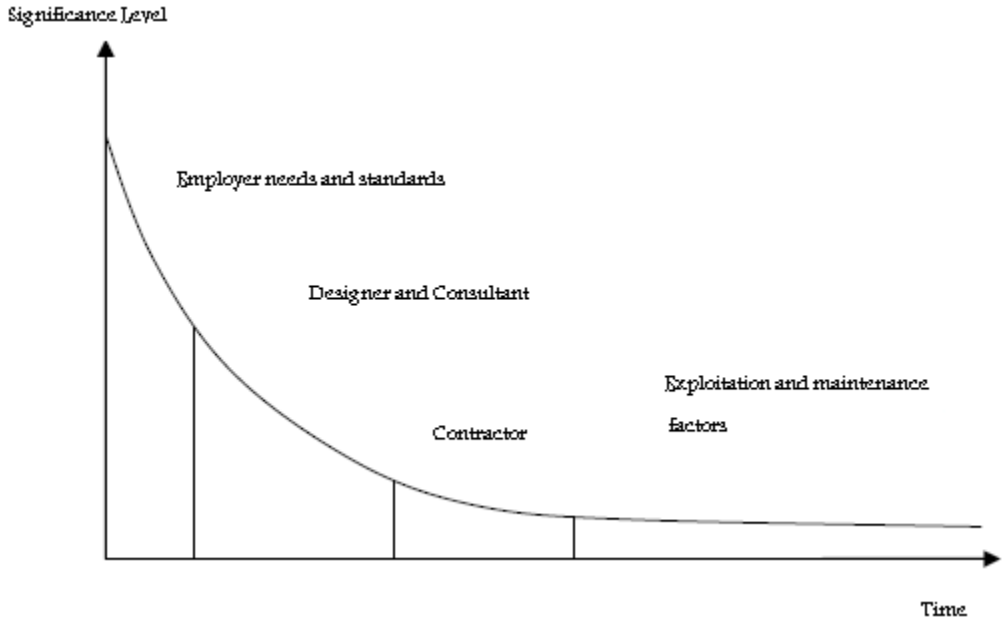

Figure 3: The project factors effect

Looking at Figures 2 and 3 it is clear that, a new approach is considered in application of value engineering that have changes in the conceptual design stages of design development and construction documents that will be referred in the following.

Schematic design or conceptual design:

In this stage, the general forms of the facilities will take shape and if theses general form to be approved by the employer at the end of the process, the project will enter design development phase for examination of details. The outputs of conceptual design stage in each of the sections of 1- Architectural design 2- Structural design 3. Mechanical Design 4- Electrical Design 5- Landscape design 6-The interior design are as follows:

Table 2: The outputs of the conceptual design phase

Interior Design	Landscape Design	Electrical Design	Mechanical Design	Structural Design	Architectural Design
Internal partitioning perspective	Design criteria	Initial plans for ceiling lighting	Design Criteria	Design Criteria	The initial plan for the site
Initial plans for furniture	The primary plan of green space	Power lines and keys	Consumption and maintenance of energy	The primary structural system	The initial plan for floors
Primary Tables of joinery	Piping works related to landscaping	Communications equipment	Standard and type of primary HVAC system	Options for structural systems...	The initial plan for Roof
	Electrical works	Protection against	Types of Pipes	Plans and sections	Primary sections
	Associated with the area	**Fire**	**Recharge and discharge**	**Schematic of Frames**	
	Alternative concepts of	Security systems	Protection against fire	Plans and schematic	The initial external

landscape			sections of frames	heights
	The size of the main electrical equipment	Estimating the space for mechanical equipment in the plan	Schematic foundation plan	The initial internal heights
	Alternative systems	Estimating the required space for mechanical equipment	Schematic structural sections surface	The initial sections of pipes
	Energy conversion and storage rooms	Alternative mechanical systems	Initial Calculations	

Design Development Phas

At this stage, the design will be discussed in detail and the design estimates about the dimensions, sizes and volumes of the previous stage will be converted to the specified numerical values. The outputs of conceptual design stage in each of the sections of: 1- Architectural design 2- Structural design 3. Mechanical Design 4- Electrical Design 5- Landscape design 6-The interior design are as follows:

Table 3: Output of design development phase

Interior Design	Landscape Design	Electrical Design	Mechanical Design	Structural Design	Architectural Design
Landscape of internal partitioning	Landscape Plan	Ceiling lighting plan	Control of vibration and noises	Design Criteria	Plan of Site
Furniture Plan	Piping affairs associated with site	Power lines and keys	Type and standard of HAVC system	Structural Network	Plan of Floors
Tables joinery		Fire detection and alarm systems	System of protection against fire	Sections of Structural Frames	Sections
		Security Systems	Standards of charge/discharge pipes	The initial plan of foundation	Exterior Heights
		Communication Systems	Equipment placement location	The approximate dimensions of structural members	Sections of Walls
		Duct dimensions and location	The size and placement of ducts	Calculations	Interior Heights
		Rooms for conversion and storage of electrical energy	Calculations (HAVC)	Building materials tables	
			Equipment and Materials Tables		

Construction Documents

At this stage of design, the last changes and modifications required reaching definitive specifications for the preparation of construction documents and drawings will be applied .The outputs of conceptual design stage in each of the sections of 1- Architectural design 2- Structural design 3. Mechanical Design 4- Electrical Design 5- Landscape design 6-The interior design are as follows:

Table 4: The outputs of construction documents phase

Interior Design	Landscape Design	Electrical Design	Mechanical Design	Structural Design	Architectural Design
Landscape of internal partitioning	Landscape Plan	Ceiling lighting plan	Control of vibration and noises	Design Criteria	Plan of Site
Furniture Plan	Piping affairs associated with site	Power lines and keys	Type and standard of HAVC system	Structural Network	Plan of Floors
Tables joinery		Fire detection and alarm systems	System of protection against fire	Sections of Structural Frames	Sections
		Security Systems	Standards of charge/discharge pipes	The initial plan of foundation	**Exterior Heights**
		Communication Systems	Equipment placement location	The approximate dimensions of structural members	Sections of Walls
		Duct dimensions and location	The size and placement of ducts	Calculations	Interior Heights
		Rooms for conversion and storage of electrical energy	Calculations (HAVC)	Building materials tables	
			Equipment and Materials Tables		

The Input of the System

In addition to design orders and feasibility studies, the architect attempts to collect information for understanding and explaining the problem, also he observes the tools for this understanding and inform the employer in this regard, and he interviews with employers and stakeholders of the project. Moreover he forms minimalist of value in the input section of the incorrect communications that contains the misinterpretations and misunderstandings which is considered the foremost factor of minimalist.

The reasons for this incorrect communication should be sought in the educational background of education level and training but misinterpretations are inevitable in any case.

The Hardware Part of the System

The architect's mind is considered as the central processor that is intended to get input and clarify it in the issue deals with explaining the design response. Value deficiencies of the hardware section can be for this

reason that the mind of the architect such as the minds of all human beings has weaknesses and disadvantages that will be briefly mentioned in the following parts:

A. Lack of Information

Lack of information, arises because of lack of access to accurate facts and details relating to costs, and product characteristics as well as misunderstanding and providing incorrect definition of needs and the problem. Lack of information on advances in technology through which the development of processes, products and materials often make possible the performance of functions with less cost and more effective ways is among other things that include the misperception of the design process.

B. Lack of Creative Ideas

The lack of new and creative ideas arise due to lack of use and adequate application about existing information, technical knowledge and the specialized skills of the company standards and creative thinking time opportunities.

C. Incorrect Common Beliefs

Incorrect common beliefs may occur due to lack of ideas and accepting the beliefs, rumors, heard cases, the speculations and theories without any justification and reasoning

D. Habits, Attitudes and Mental Obstruction

Human is a creature that obeys habits easily and experiences, beliefs and traditions of the past develop certain patterns in his/her behavior and thinking manner in a familiar way.

So that they make him/her solve similar problems in a similar manner and resist change for achieving new solutions.

E. Risk Aversion

Any architect or urban planner engineer and urban development expert knows that there is no inevitable issue. And with all these circumstances it is deemed that what has repeated many times in the past is less likely to face failure compared to what is new or unknown.

F. Designing and Estimating More than What is Required

Typically, designers, rather than a detailed analysis designed implement the design by enhancing the safety factors.

The Value Engineering and Implementation of Housing Projects

This building has 8 floors and its total area is about 8043.24 square meters. The total estimated cost of the project was 95 Lech. The structure of the building was created by reinforced concrete and the columns were located on successive discrete foundation at distance of 6 m c/c. The original approach was based on the implemented plan of the building, and accordingly, the existing construction system which was a one-sided 12 x 12 meter panel with reinforced concrete panel evaluated at establishing the roof using one of the following options:

Table 5: Cost of Project (USD)

Total Cost	Executive Expenditures	Building Materials	Option
103,600	12,100	91,500	Available Plan
34,784	11,670	23,114	Corrugated sheet
43,118	16,091	27,027	Membrane roof
42,557	10,670	31,887	Bilateral roof slab
30425			Metal roof system

After the initial assessment and developing evaluation matrix, the corrugated sheet was considered as the proposed system that yielded a savings as much as 68,816 $.

RESULTS AND DISCUSSION

Increasing expansion of value engineering in architectural projects in the world can show the high potential of this approach for reduction of cost and improving the quality of development projects and specifically Housing Projects. If housing projects constitute more than 60% of the value engineering application. In the meantime, considering systematic value engineering procedure in the design process of housing and the next step that is the construction phase of the housing seems to be important. If the design phase is accounted for three parts of conceptual design, design development and construction documents, the more we go ahead from the conceptual design section to the construction documents, modifications cost will increase. And the potential to reduce costs is decreased and therefore the net potential of savings is reduced continuously. So value engineering in the early stages of design, or in other words, production of design options in the stage of conceptual design and before the plan is engaged into detailed phase will create more value saving .

REFERENCES

Becker RF (1974). *A Study in Value Engineering Methodology, Performance* **4(**4) 24-29.
Bytheway CW (1971). FAST diagrams for creative function analysis, *Journal of Value Engineering* 6-10.
Cooper Robin and slagmulder Region (1997). *Target Costing and Value Engineering* (Productivity press).
Crouse RL (1975). Function and Worth, Proceedings, *Society of American Value Engineering* **10** 8-10.
Drozdal SC (1978). Crotiteria for the selection of Value Engineering projects, *Proceedings, Society of American Value Engineering* **13** 102.
Groneneveld l (1972). Value analysis and the marketing concept, *Industrial Engineering* 24-27.
Miles LD (1961). *Techniques of Value Analysis and Engineering*, (McGraw-Hill) New York.
Mudge Arthure E (1971). *Value Engineering – A Systematic Approach*, (McGraw hill) New York.
Palmer Angela and McGuire Denny (2002). *Construction Management, New Directions*, (Black well science) Linden.
Qolipur Yaqub and Biraqi Hamid (No Date). *The Value Engineering Principles* (Tarmeh Publications) Tehran.
Rabbani Masoud (2000). Rezai, Kamran., management / Value Engineering according to Standards EN 12973: 2000, Tehran.
Ravanshadnia Mehdi (2004). Developing the system of prioritization of infrastructural projects of urban transport using Value Engineering, Master's Thesis of Construction Management Engineering, Civil Engineering Department of Amirkabir University of Technology.
Sami Elias EG (1998). Value engineering: *A Powerful Productivity*, (Computer and industrial ENG) New York **25(**3) 381 – 393.
Stevens SS (1966). A metric for the social consensus, *Science* **151**.
Taghizadeh Ali (2011). Value Engineering system, Tehran, *Ravesh Monthly Journal* 75.
Thurs Tone LL (1954). The measurement of Value, *Psychological Review* **61(**1) 47-58.
Valentire RF (1970). *Value Analysis for Better Systems and Procedures*, (prentice-hall) New York.
Yasahir and Monden (1999). *Cost Reduction Systems*, translated by Syed Hessamedin Zagerdi, Tehran, SAPCO.
Yasuhiro Monden (1995). *Cost Reduction Systems*, Target Costing, Kaisen Costing, English Edition (Productivity press).
Zimmerman Larryz, Glen PE and hart D (1982). *Value engineering – A practical Approach for Owners, Designers, and Contractors* (CBS Publishers) New Delhi.