THE RIGOROUS EXAMINATION OF VALUE ENGINEERING WHICH IS A NEGLECTED MANAGEMENT TECHNIQUE IN TERMS OF ITS THEORETICAL FOUNDATIONS

Altan AYAN* 
Güner KAHRAMAN**

UNUTULAN BİR YÖNETİM TEKNİĞİ OLAN DEĞER MÜHENDİSLİĞİ’NİN KURAMSAL TEMELLERİ AÇISINDAN İRDELENMESİ

Abstract

Value engineering is seen as a management technique. Thanks to value engineering applications, costs can be reduced, and accordingly quality can be improved. In this study, first of all, value engineering technique is discussed. Secondly, the elements of value engineering technique are emphasized. Lastly, the present and future of the researches on value engineering are carefully evaluated. Thus the importance of the issue has been exhaustively examined via giving a major dimension to the theoretical foundations of value engineering. Last but not least, this study sets out to highlight the need for more research on the subject value engineering, along with being consulted as a guide.

Key Words: Value, Value Engineering, Function Analysis, Function, Value Methodology

Öz


* Öğr. Gör., Trakya Üniversitesi Keşan Yusuf Çapraz Uygulamalı Bilimler Yüksekokulu, e-posta: altanayanyan@gmail.com
** Sofya Üniversitesi Yeni İletişim Teknolojileri Yüksek Lisans Öğrencisi
1. Introduction

The use of different applications and different management techniques could be advantageous for business enterprises in today's competitive world. Value engineering is one of the applied management techniques to provide for competitive advantage to enterprises. Today, application of value engineering is widely used due to being an effective technique that can provide both cost saving and quality improvements. Accordingly, some business activities might be done through the implementation of value engineering. Moreover, value engineering is a major factor in business enterprises and its importance lies at the root of the pursuit of both cost reduction and quality improvement.

In this study conducted, firstly, value engineering technique has been expressed detailly. Secondly, the elements of value engineering technique are introduced. Next, function analysis and value engineering job plan are discussed as the elements of value engineering technique. Thirdly, the present and the future of researches on value engineering are systematically evaluated.

Thanks to this study, it became clear that more research on value engineering, should be carried out. In addition, a better understanding of the importance of this issue can be explored more fully with this study.

2. Value Engineering Technique

2.1. Historical Development of Value Engineering

The first emergence of value engineering (in the following days of Second World War) stems from the problem of scarcity of materials occurred in the manufacturing industry due to excessive consumption during Second World War. Lawrence D. Miles, an electrical engineer working in the sales department of General Electric (GE) Company, started searching for solutions to alleviate the problem of scarcity of materials in the company (Cheah and Ting, 2005: 151).

Accordingly, meagre resources are more valuable and the main goal here is to find alternatives for conserving these resources, along with making
the most efficient use of them. The function of a product (analyzation of fulfilling its functions) leads to the development of different materials and production methods, according to Miles. Unlike the other cost reduction techniques used in business enterprising, value engineering has the possibility of the implementation for all business units such as planning, design, R & D, purchasing and quality (Ayan and Kahraman, 2011: 224).

2.2. Definition and Scope of Value Engineering

Value is defined as the lowest cost to provide a function. According to the opinion, which involves monetary-based comparison, value is expressed as the ratio of function to cost (Park, 1999: 96-97). Value can also be expressed as objective (of a different nature) or subjective (aesthetic) or a combination of both. First, the alternatives providing the same functions are evaluated, then value is obtained by selecting the one with the lowest cost (Jergeas, Cooke and Hartman, 1999: 25). Usually, according to the point of view, which is popular in many places, value refers to the meanings, such as ‘quality at fair price,’ or ‘quality at appropriate price.’ (Desarbo, Jedidi and Sinha, 2001: 846).

As for value engineering, it can be expressed as an application of product design together with marketing at least cost for provided functions that meet the customers’ expectations for a product, or service. To put it simply, value engineering is the activity of reducing costs without compromising on quality. Value engineering is a function, product, process, service and system-oriented technique, which is being applied for almost half a century in order to increase the success, improve the existing products, put out new products, avoid unnecessary costs and reduce the risk (Altunbay, 2006: 147).

Value engineering can be expressed as a technique that can increase profitability for the company. It is able to find common usage in industrial organizations and takes great attention as a new method reducing the costs successfully. Value engineering is an approach to the functional analysis of the requirements of products or services in order to obtain the necessary functions, bringing down the total costs to the lowest level. Value engineering sets out to improve the quality in conjunction with the elimination of unnecessary costs, focusing on the function-based business methods. Retrospectively, value engineering is a method that can provide excellent results in reduction of costs (Marzouk, 2010: 596).
Value engineering can be expressed as a management tool that allows the fulfilment of essential functions by providing the lowest cost to the product, service, or project. Value engineering is a tool that contains standard applications adopted by many private engineering companies since the 1950s (Zhang, Mao and AbouRizk, 2009: 777).

It is worth bearing in mind that value engineering is not an alternative method for traditional cost calculating methods. The purpose of this method is to keep the costs on the calculated level, rather than calculating the cost. This means that taking advantage of various management and engineering techniques, leads to striking an appropriate balance between the supplier and customer regarding cost reduction efforts. While cost accounting does not follow the product design in traditional methods, cost effective design or redesign based on customer preferences play a crucial role in value engineering. A large part of the total life cycle cost of a product (roughly 80-90%) is finished in the design and development stages as a result. Value engineering includes the information about the functions of a product and its feedback from the customers. Value engineering is based on cost management, along with encouraging teamwork (Acar and Alkan, 2003: 63-64).

Value engineering is the provision of a commodity at the lowest cost regarding its functionality, reliability and applicability. Value engineering is an approach to produce cost-cutting ideas without a delay in the product development process and impairing the product quality wanted by its consumers. Value engineering focuses on the functions of products. Functions are analyzed, and accordingly the product or service suitability for customer needs and the product quality achievements are investigated. Value engineering applications deal with the increase in function value, cost minimizing and value maximizing as a result. In order to enhance the value, the functions are stabilized, thereby reducing costs, or keeping costs down result in increase value (Urhan, 2004: 52).

According to the definition offered by The Japanese Value Engineering Association in 1971, value engineering can be expressed as an application of a systematic technique, which is based on the provision of the lowest cost. And yet this systematic technique, firstly, provides alternatives within the scope of functions; secondly, it sets the value in the functions; and lastly, it defines the functions of products or services via multidisciplinary team working (Gupta, 2009: 55).

Value engineering is a technique used in order to achieve a series of goals. Quality is enhanced through value engineering. Hence the length
of time is shortened; costs may be lowered; reliability, maintainability and performance can be achieved as well. The elimination of unnecessary or excessive costs can be achieved without compromising the quality and performance by using value engineering application (Dell'Isola, 1997: 19).

Value engineering is an interdisciplinary systematic activity, which questions the factors affecting the cost of design that is required to produce a specific product up to reliability standards, along with an appropriate cost and acceptable quality. Effective ways are explored through the application of value engineering. A case in point is the main characteristics of essential function achievement, including product design analysis as well. The essential function is the importance of the product, depending on the consumer’s level of consciousness. Therefore the main characteristics are the other factors such as quality, reliability, and sustainability as well (Cooper and Slagmulder, 1997: 80).

Value engineering shows an interest in considering the consumer’s product meaning, rather than products’ presence. The term value engineering is often used to describe the process of functional analysis. Functions are defined as the basis for value engineering. Value engineering technique is an application, which is designed for transcending the mental limitations aimed at expounding the fresh strong ideas for the project (Park, 1999: 26-27).

When compared with other cost reduction techniques in today’s world where cost is more important than before, value engineering is not a method, which aims only at cost reduction but also aim at finding alternative methods of getting the function. The main purpose of value engineering is to find the answer to the question: “How else can I get this function?” Unlike other methods, regarding comparisons between alternatives, value engineering is a method implemented with the result that it works towards creative solutions by generating new ideas through brainstorming. From this perspective, value engineering can be defined as the organization of activities, which are done to produce the commodity by maximizing its true value, while performing its function at low cost (Dönmez, 2003: 3).

Value engineering is a method, which is put into practice as a combination of technical information, and reasonable activities together with eliminating unnecessary costs. The principles of value engineering bring about remarkable reductions in costs, while value is increased (Chen, Chang and Huang, 2010: 514). The traditional perspective of
value engineering methodology involves a value-raising increase in the commodity. Except in an increase, there is an improvement in the costs of existing functions as a result (Ibusuki and Kaminski, 2007: 462).

Value engineering is a technique, in which all the efforts are concentrated into maximizing the created value. The main idea of this technique is to successfully combine manufacturing processes with human factor. Value engineering is a technique based on teamwork (Beşorak, 2005: 354). The first method to be considered when we recall the concept ‘design’ is value engineering. The implementation of value engineering technique places more value for the project, customers and environment (Busch, 2010: 84).

Value engineering focuses on the analysis of the products to find ways meeting the essential functions and features. Value engineering can be applied to other processes such as business enterprise, production, planning and design. Value engineering applications do not impair the overall product quality, but it ensures the results of costs met for the accepted appropriate value instead. One of the aims of the Japanese Value Engineering programs is to reduce the cost of a new product at a certain level, rather than lowering it to the lowest level (Yalçın, 2009: 293).

Value engineering is based on an approach to design and re-design of goods or services to achieve the same functionality at a lower cost, or to achieve added capabilities at the same cost. Value engineering technique can be summarized as follows: 1) determination of the product or service functions, 2) determination of the value of each function, 3) developing alternatives under the direction of creative thinking, 4) a reliable choice of the alternatives through the fulfillment of the essential functions at the lowest cost without compromising quality and safety. Value engineering is a technique usually implemented by a multidisciplinary team working (Hill, 2012: 376).

3. The Elements of Value Engineering Technique

3.1. Function Analysis

Function analysis is the cornerstone of value engineering management system. There is no disputing the fact that value engineering differs from other management systems. The reason for this is that value engineering contains some fundamental elements, including function and function analysis. The traditional definition of function is the characteristics of
something that can be purchased. Function is defined as the request for the satisfaction of a need. Function is the result of customer’s requests. Function is a product that can be afforded to pay. Function is a requirement: ‘a goal’ and ‘a target’, to name but a few. Function is fulfilled under prevailing conditions, such as customer satisfaction with the product or service, product weight, product practicability or other psychological factors (Park, 1999: 74-76).

Value engineering creates the functions that perform the desired quality features of a product, including the lowest cost to provide a given function. Accordingly, this function research is called function analysis or functional analysis in value engineering. Function analysis is the starting point of the value engineering activities. Value engineering is a technique that specifies its objective as maintaining functions and quality, while reducing costs - even improving functions and quality dramatically as a result (Urhan, 2004: 56).

The focal point of function analysis is pertinent to the features, on which customer needs are mostly focused, and what functions are important regarding customers’ willingness to pay the price for the product. Inessential functions of a product, as a result, cause increase in cost. These inessential functions do not have a significant contribution to sales as well. Hence the primary and secondary functions of a product is identified by functional analysis. Primary functions are the reason for the presence of product itself, while the secondary functions arise from the choice of the primary functions and provide support to these functions accordingly (Acar and Alkan, 2003: 65).

Primary functions are the key factors in value, along with the required performance characteristics, comprising the all components that users need. Most of the time, it can be explained by two words such as a noun or a verb. For example, the function of a pen relates to writing or drawing with ink. Similarly, the function of a chair relates to a seat for one person. In addition, a product’s reputation can be built on its primary functions. This is shown by the product design being fit for market. For example, the primary function of a three-dollar hairpin is to hold part of the hair in the desired position, but it can also be provided by a ten-cent hair clip. The difference in price arises from the degree of reputation each product has. This is the aesthetic appeal to the users. This may explain why it covers the area of interest for value engineering. Nevertheless, giving primary functions to studies is the major priority (Kuhn, 1971: 13). The secondary functions can be expressed as elements, which support the
primary functions of the products or services available in the design (Schwarz and McConkey, 1974: 30).

The purpose of functional analysis is to find out the function of the specific part of a commodity and the unit cost, including the total customer cost. In this analysis, the function of each part of the product is determined by disassembling the product. Function analysis is customer-oriented because it is the process of design, development and production at the lowest cost. Accordingly, it inquires if the functions are in accordance with customer wishes. The function may undergo a far-reaching change, mainly owing to a small change in customer demands. Thus customer wishes should be monitored carefully, and the functions should be replaced in accordance with these changes. Function Analysis System Technique (FAST) is used in the determination of functions. According to this technique, the questions: ‘Why?’, ‘How?’ and ‘When?’ are put in relation to the functions. The costs of the sub-stages, that serve the functions are determined by these questions. Considering the stipulation that the total cost of a function must be minimum, the sub-stages should be included at optimal costs as a result (Urhan, 2004: 58-60).

Functional approach is the main point that separates value engineering studies from other cost-cutting techniques. Cost reduction methods put the question: ‘How can this commodity be produced for less money?’, whereas in value engineering, it is attempted to find an answer to the question: ‘how can the desired function be implemented for less money?’. The function is the intended use of an object or its own goal. To put it another way, it is a characteristic that meets the essential needs of the user, including the product performance and generating profits. Functions that make up a product can be classified into two groups. The first is the ‘primary function’, which is, the main function that contains the necessary attributes of a product. A case in point is the design, or the product that must be met to ensure the user’s needs. Other function is called ‘secondary function’. In order to fulfill the primary functions, the secondary function is a non-mandatory one, and therefore it does not contribute to the other functional factors. Secondary functions seek an answer to the question: ‘What else does?’. The principal objective of FAST diagram is to make value engineering team detect problems in an easy way and provide solutions to these problems through specifying the functions that relate to each other (Dönmezer, 2003: 15-17).
3.2. Value Engineering Business Plan

In value engineering application process, at first, the functions of a product or service are described, secondly, the monetary value of the functions are determined, and thirdly, crucial functions that ensure the lowest total cost are provided. These steps should be applied with a well-defined value engineering business plan. Value engineering business plan is one of the most important parts of the implementation process of value engineering (Park, 1999: 195-196).

A formulated value engineering business plan is an element that greatly helps the product evaluation and value determination. Value engineering business plan should be used when the value is not within its desired range, and needs to be determined accordingly (Younker, 2003: 23).

Value engineering business plan is conducted by the multidisciplinary team working and it is a process, in which distinct stages are available to be entered. Firstly, it can be dealt with the process of obtaining information. In the process of obtaining information, in order to achieve the project, the resources related to the major topic are attempted to be achieved, and accordingly a draft of the cost of the project is created. Next, the functions are analyzed and then the relationship among functions is revealed by means of FAST diagram. The costs of various functions defined in the FAST diagram are determined, and it is continued with the implementation. In the next stage, the team working allocates resources by separating the functions on the basis of their importance. Accordingly, the team working develops ideas to optimize the costs of various functions. The ideas are considered and the best ones are selected. According to the process of Value Engineering Application, the roles of functions are defined and the team working strives to provide the best solution to the final design as a result (Omigbodun, 2001: 41).

Value engineering business plan is an approach that is applied step by step. Value engineering business plan consists of the following six steps: a) Information Acquisition Phase, b) Creativity Phase, c) The Evaluation Process, d) Planning Phase, e) Reporting Process and f) The Implementation Phase. After taking all the factors into consideration, the design of each step is carried out in accordance with the systematic solution to the problem (Yang, 2005: 132).
4. The Present And Future of Value Engineering Studies
Value engineering is a management technique commonly used in areas such as railway projects, road projects, construction, automotive industry, environmental projects, energy projects, decorating projects, public administration and transportation projects. Value engineering activities have opened up a major field of application. Necessary arrangements can be made by using value engineering technique, especially in large-scale projects, and the overall cost trend can be declined dramatically as a result.

Although researches on value engineering are available in our country, they haven’t been up to par yet. Researches directed towards value engineering in our country have got off to a fresh start in areas such as construction and automotive.

Understanding the theoretical foundations of value engineering plays a crucial part in drastic cost reductions. The use of value engineering in various studies is of great importance in our country as well. Cost reduction will be possible to be achieved through Value Engineering Applications, along with the enhancement of quality. Customer needs will form the basis for value engineering application, and therefore a competitive advantage for companies will be provided as a result.

Upon this study carried out, it is held out much hope of increasing the relevant researches and activities, which are pertinent to value engineering and giving an update on this powerful management technique.

5. Conclusion
In conclusion, value engineering rests on two foundations. First is the functional analysis, which is an application of differentiating value engineering from other methods as the basic element. FAST analysis technique is performed, while the implementation of function analysis in value engineering is achieved. Second is the development of value engineering business plan. The important thing is to be able to carry out the teamwork, while the development of value engineering business plan is in progress. Accordingly, the team should be consisted of people who exercise effective disciplines. This team must be ran on a working principle that is based on innovation, along with a collective effort. The main conclusion to be drawn from this discussion is that value
engineering team should act on the basis of innovation in order to improve quality, while reducing costs.

To sum up, it is carried out a rigorous examination on the theoretical structure of value engineering with the aim of discussing value engineering practices and activities. Accordingly, this study can serve as a guide for further studies regarding theoretical foundations of value engineering. As outlined earlier, value engineering activities are an area of cost saving together with the enhancement of quality. This study set out to show how theoretical foundations of value engineering were shaped, hence a better understanding of value engineering applications. Ultimately, this study can explore potential strategies to increase research activity in value engineering practices, and it can be consulted as a guide on further research in this field of study.

References


