



# **THE USE OF VALUE ENGINEERING TECHNOLOGY IN QUALITY PLANNING AND IMPROVING PRODUCT PERFORMANCE (AN APPLIED STUDY IN THE BAGHDAD COMPANY FOR PACKAGING MATERIALS INDUSTRY)**

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<b>Received:</b> 8 <sup>th</sup> July 2023 <b>Accepted:</b> 6 <sup>th</sup> August 2023 <b>Published:</b> 6 <sup>th</sup> September 2023	The research aims to clarify how to apply the value engineering program, which leads to quality planning and improve product performance while reducing its cost, in addition to clarifying the importance of identifying the dimensions of product quality that the customer prefers and adding them to the priorities of the economic unit to improve the quality of service because it facilitates the process of applying engineering technology. the value . The research community is represented by the Iraqi industrial companies, while the research sample is represented by the Baghdad Company for the manufacture of packaging materials for the data of the year 2021. The research reached a set of conclusions, the most important of which was that the use of value engineering technology can help in quality planning and improve product performance by training workers in order to be able to achieve sympathy with customers in order to determine what the customer desires and needs in terms of products to work on satisfying them. Value engineering technology works to improve efficiency and search for the best balance between cost, functionality, quality, reliability and performance of the product, as well as completing operations as quickly as possible at the lowest cost and highest quality.

## **Keywords:**

### **INTRODUCTION:**

The history of value engineering technology dates back to the middle of the last century in the General Electric Company at the hands of engineer Lawrence Miles, and its steps and procedures, as well as the means and tools used in it, developed. Each project or product has objectives defined by the owner, sometimes called owner requirements or project objectives. But how does this project or product achieve these goals and what is the target percentage of achieving this project or manufacturing this product? Therefore, the use of this technology enables the project to achieve its objectives at a lower cost and high quality. Cost reduction is achieved only by deleting unimportant and unnecessary costs, or those that have no significant function or impact on improving or achieving the project's objectives. The required quality is achieved or better than it, as it is not possible and not allowed in value engineering to reduce or approach the level of quality except by improvement and addition only without negatively affecting it. Thus, every investor or economic entity must know about value engineering and what it can achieve for him in his steps, decisions, operations, and economic projects, and many may not know about its advantages and its improvement and economic benefits.

### **THE FIRST TOPIC: RESEARCH METHODOLOGY AND PREVIOUS STUDIES**

#### **1-1 Research problem:**

The research problem lies in the low quality of products produced by Iraqi companies compared to competing products at a time when international organizations producing goods and services in a business environment that is characterized by its continuous development and intense competition tend to use modern methods and applications as much as possible to reach the optimal cost and high quality at the same time and obtain On customer satisfaction, the value engineering method is one of the most important modern programs that reduce costs and increase quality.



The research problem can be expressed through the following question: Does the use of value engineering technology help in planning quality and improving product performance? .

#### **1-2 Research importance:**

The importance of the research lies in finding good solutions and methods in order to plan quality and improve the performance of the product, and thus the economic units can enter the market and compete with other units and maintain their market position and attract customers.

#### **1-3 Research objectives:**

The research aims to clarify how to apply the value engineering program, which leads to quality planning and improve product performance while reducing its cost, in addition to clarifying the importance of identifying the dimensions of product quality that the customer prefers and adding them to the priorities of the economic unit to improve the quality of service because it facilitates the process of applying engineering technology. the value .

#### **1-4 Research hypothesis:**

The research is based on the following hypothesis: The use of value engineering technology can help in planning quality and improving product performance.

#### **1-5 Research community and sample:**

The research community is represented by the Iraqi industrial companies, while the research sample is represented by the Baghdad Company for the manufacture of packaging materials for the data of the year 2021.

## **THE SECOND TOPIC: THE THEORETICAL SIDE OF THE RESEARCH**

### **2-1 The concept of value engineering technology:**

The concept of value engineering technology works to increase the value of the product through the improvements it adds to the existing functions without increasing its costs. In other words, it is a job oriented, organized team oriented towards providing value to a product, system or service. Value engineering is a very effective technique in reducing costs, increasing productivity and improving quality (Kalluri, 2016: 1).

Value engineering is seen as an integrated program with a sequential and accurate plan of action to solve all problems related to cost, quality and performance. It is managed by an organized group of individuals with different specializations called the Value Engineering Team to analyze information related to the project, product or service, as well as to make the accurate and appropriate selection of optimal functions with low cost and high performance and at the same time get rid of functions that do not add anything to the product, project or service from Finally, the solutions and the performance of the value engineering team are evaluated and an action plan is developed that helps create solutions that lead to cost reduction and higher quality and performance at the same time (Dhillon, 2012:194). Thus, it is an integrated function of problem-solving management by adopting the design of alternatives, cost estimation, project-oriented project objectives, and an organization that takes the form of appropriate selection criteria. It uses quantitative methods and informed decisions to improve job satisfaction for owners while helping to reduce unnecessary cost (Ranjbaran, 2014:1606).

Value engineering or value management are two sides of the same coin, as they work to improve the quality of products and services from the beginning of the project or production, while value analysis is applied during the production process. Therefore, the changes brought about by value engineering in jobs, changing raw materials, or changing plans and designs are of low cost compared to value analysis. Miles and Fard defined it as an integrated system to identify and deal with factors that do not contribute effort or cost to products, processes, or services. This system uses all technology, knowledge and skills available to efficiently determine all costs and efforts that do not contribute to fulfilling or satisfying the needs, desires and requirements of the customer (Fard, et.al., 2013:431).

Many researchers, including Smith, indicated that any organization or giant economic unit that seeks to achieve optimization or excellence in its work must include the principle of achieving more with less, so it is a tool that greatly helps to achieve this (Smith, 1999:2).

### **2-2 Value Engineering Technology Objectives:**

Value engineering technology is an integrated program that aims to solve all problems related to cost, quality, and performance. The objectives of this technology can be clarified through the following: (Kumar, 2015: 32-34), (Taghipour, et.al., 2015: 319), (Kalluri). (2016:1-2).

1. Improving quality by increasing the functionality of the product (the level of performance that the customer gets from the product) while making the resources fixed (which are raw materials, human resource, price and time) or by reducing the resources and making the function fixed or by increasing the function and reducing the resources at the same time.
2. It can be used mainly to improve efficiency and search for the best balance between cost, functionality, quality, reliability and performance of the product or service, as well as completing operations as quickly as possible without raising costs or reducing the quality of work.



3. Its efficient and logical use, together with collective wisdom and experience, can reduce the potential risks involved in the implementation of any project.
4. Determine the function of the product or service by determining what that function is worth, generating alternatives through creative thinking, providing the required functions, providing the required functions necessary to achieve the original goal of the project, reliability and the lowest cost without sacrificing the project requirements of safety, quality, operations, maintenance, and the environment.
5. Investing all available technologies, knowledge and skills in determining costs and efforts that do not fall within the desires and needs of the client. Its effect works to help the good achieve the best.

### **2-3 Stages of Implementation of Value Engineering Technology:**

There are a set of stages to implement the value engineering technology in the economic units, and these stages can be clarified through the following:

- 1. Preparing for the study:** This stage is represented as the basic rule for applying the value engineering program. At this stage, the process of forming a value engineering team takes place, which will study the commodity or service, solve problems that will face the production process, and present ideas that will help improve the quality of the service or commodity provided. In the first step of this stage, the process of selecting a value engineering team takes place, which must consist of various disciplines and experiences from the organization, and the size of the team should not exceed (10) individuals and not less than (5) people according to the size of the organization and the need (Torelli, 2011:59).
- 2. Information collection:** In it, a basic information base is formed necessary for designing and knowing basic matters about the personality of the target customer category, the special nature of their needs, and the entitlement value for them. A summary is also provided about the value engineering process and data collection related to needs and desires in order to reach a better understanding of the project. Information is collected from several sources such as customers, suppliers and employees within the organization, and during the information collection process there are four steps that are followed to complete the information collection process correctly (Rachwan, 2016:4-5).
- 3. Job analysis:** One of the most important steps that distinguishes the value engineering program from other programs used to improve quality in the products or services sector. There are several steps followed to carry out the job analysis process, which are identifying jobs, classifying jobs into basic, secondary, required secondary, undesirable jobs, linking jobs among themselves, and then selecting jobs that can be improved (Al-Mousawi, 2010: 31).
- 4. Innovation and brainstorming:** This stage requires that team members have the skill of creative thinking. Which revolves around developing alternatives, finding solutions, and finding more cost-effective ways to accomplish the core job. At this stage, there are no restrictions on the value engineering team, as they can use many recognized techniques to generate ideas, including brainstorming and the Gordon method, as creative problem-solving techniques are an indispensable component of the value engineering program in order to reduce costs and improve quality (Rachwan, 2016: 5).
- 5. Evaluation and selection:** During the stage of innovation and brainstorming, several alternatives and ideas were reached to address the existing problems. It was not permissible for the team members to judge the ideas put forward, in order not to affect the creative process and the team members, and thus reduce the productivity of the team members, and this does not mean that all the ideas presented good or workable. Therefore, at this stage, a serious evaluation of the ideas takes place in order to approve their application. The aim of this stage is to prune useless ideas and confine them to ideas with the greatest potential for improving the quality of products, processes, services, or the optimal solution to the problems presented (Christos, 2007:27).
- 6. Research and Development:** During this stage, the ideas that were identified in the evaluation stage are developed and analyzed. So that an in-depth study is done for each chosen alternative and whether the alternative provides savings in the expected initial costs. In addition to that, the life cycle costs of each alternative are analyzed, including capital costs, operational costs, and maintenance costs, taking into account the maintenance or improvement of quality (Al-Shaya, 2009: 31).
- 7. Implementation:** The practical ideas that were produced and developed and turned into proposals in the research and development stage come in the form of preliminary decisions. These preliminary proposals are classified as feasible, verifiable, and cost-effective. These proposals, in addition to the recommendations, are subsequently presented through decision-making meetings to the decision-makers in order to be approved, and thus an implementation strategy is established. After reaching the decision-making process, the decision is divided again into parts in order to identify follow-up tasks and opportunities for further development (Christos, 2007:27).



#### **2-4 Quality planning and improving product performance using value engineering technology:**

Quality planning is seen as an organized process for product development that ensures fulfillment of customer needs, and planning tools and methods are included with technological tools for a specific product that is being developed and delivered to the customer (Juran & Godfrey, 1998: 1-3).

It is possible to plan quality and improve product performance by using the value engineering technique through a set of steps, which are as follows: (Joseph, 2013: 45), (Juran & Godfrey, 1998:4).

- 1. Establishing the project:** The process of quality planning is an organized and necessary process for any organization that wants to compete in the market and wants to offer a new product of high quality, so it must follow the steps related to quality planning precisely because it is the basic rule from which the reputation of the organization and the quality of its products arise.
- 2. Defining the customer:** The customer means everyone who is affected by the quality objectives or everyone who has a role in achieving them. Therefore, we find that there are two types of clients, the internal client and the external client. Internal customers are those working in departments that are related to achieving quality goals, such as workers in material management, personnel management, and production management. As for external customers, they are those who are outside the organization, such as suppliers, customers, or consumers. However, it is necessary to pay attention to identifying clients who have a significant impact on achieving goals, and they represent a small percentage according to the Pareto principle.
- 3. Determining the customer's needs:** Determining the needs and requirements of each of the internal and external customers of the product has a great impact on developing a correct and accurate planning for quality. When carrying out the process of designing the plan that the organization will work on, two aspects related to the product production process must be taken into account: first, the electronic elements of the product's features and the things that the product can actually do, and second, the human elements of the product, i.e. the benefits that customers will get from using the product.
- 4. Product development:** After a full understanding of customers and their needs, the organization will be ready to design products or services that will meet customers' needs. As the product development job is not a new job for companies, as most companies have special processes for finding and designing new products to bring to the market. This step will combine technical aspects and appropriate designs. Within this step, product design can be considered an innovative process based largely on technological and technical expertise.
- 5. Operations development:** It is a set of activities that are used to identify specific means used by operating personnel in order to achieve quality goals. In order for the process to be effective in its application, it must be goal-oriented, with specific measurable results, as well as be systematic with the sequence of activities and tasks defined completely and clearly, and that all inputs and outputs are specific, efficient and able to meet the goals of product quality and under operating conditions, with Clear accountability for its work.
- 6. Developing process controls:** In this step, the planners set up process controls and arrange the process of transferring the entire production plan to the workforce, and verify that the transfer process is properly and correctly implemented.

### **THE THIRD TOPIC: THE APPLIED SIDE OF THE RESEARCH**

#### **3-1 An introductory profile of the Baghdad Company for the manufacture of packaging materials:**

Baghdad Packaging Materials Industry is a public company, listed on Iraq Stock Exchange since July 2004. It operates within the materials sector focusing on paper packaging. The Baghdad Company for Packaging Materials Industry is based in Baghdad, Iraq, and was established in May 1962. The plastic products produced by the company provide great advantages compared to other materials used in the packaging industry, however we must take into account the environmental impact of these products, especially since the awareness of the environment And the impact on it has become an important global issue, so the company not only works to reduce the impact on the environment through efficient operations, But also by participating with the concerned authorities in order to effectively promote the recycling of our products, and the company can achieve these goals through disciplined work, persistence, promotion of innovation and maintaining business compliance with environmental requirements, in cooperation with shareholders and stakeholders.

#### **3-2 Applying value engineering technology in the Baghdad Company for the manufacture of packaging materials for quality planning and improving product performance:**

In order to apply the value engineering technology in the Baghdad Company for Packaging Materials Industry, data collection is started on the product of this company and the problems related to it are analyzed with regard to each of



its performance, quality, and high costs of its components and functions. The components and functions of the product of Baghdad Company for Packaging Materials Industry during the year 2021 can be clarified through the table the following:

Table (1): Components and functions of the product of the Baghdad Company for the manufacture of packaging materials during the year 2021

No.	Components	Functions	Category
1	Unbleached kraft	Moisture resistance	Basic
2	bleached kraft	Sunlight resistance	Basic
3	glacin	Oil resistance	Basic
4	parchment	Package consistency	Basic
5	cellophane	Giving a shiny appearance to the packaging	Basic
6	polymer	Increase the life of the packaging and the strength of its cohesion	Basic
7	Acrylic compounds	Heat resistance	Basic

Source: Prepared by the researcher based on the research and development department in the company.

It is clear from the above table that there are seven components of the product of the Baghdad Company for the manufacture of packaging materials, which are unbleached kraft, bleached kraft, glacin, parchment, sulfan, polymer and acrylic compounds. The packaging, its cohesion strength and heat resistance.

After determining the components and functions of the product, the functional analysis will be conducted in order to determine the value indicator for each job. Therefore, the functional cost must be calculated, then the functional benefit, and then the value indicator is calculated by dividing the functional benefit by the functional cost.

The percentage of the functional cost of the product of the Baghdad Company for the manufacture of packaging materials during the year 2021 can be clarified through the following table:

Table (2): Functional cost percentage of the product of the Baghdad Company for the manufacture of packaging materials during the year 2021

No.	Functions	Functional cost (IQD)	Functional cost percentage (%)
1	Moisture resistance	12825413	22.17%
2	Sunlight resistance	18896455	32.66%
3	Oil resistance	5233208	9.05%
4	Package consistency	8216402	14.2%
5	Giving a shiny appearance to the packaging	3225118	5.58%
6	Increase the life of the packaging and the strength of its cohesion	2665904	4.61%
7	Heat resistance	6787500	11.73%
	Total costs of functions	57850000	100%

Source: Prepared by the researcher based on the costs department in the company.

It is noted from the above table that the functional cost ratio for each function of the product of the Baghdad Packaging Materials Manufacturing Company, the research sample, and these functions are moisture resistance, sunlight resistance, oil resistance, packaging cohesion, giving a bright appearance to the packaging, increasing the life of the packaging, its cohesion strength, and heat resistance was (22.17%), (22.17%) 32.66%, (9.05%), (14.2%), (5.58%), (4.61%), and (11.73%), respectively.

After calculating the job cost percentage, the job entitlement percentage will be calculated, as (30) questionnaires were distributed to the engineers and technicians in the company to indicate the degree of relative importance of each job, and here the team members must have the skill of creative thinking. Which revolves around developing alternatives, finding solutions, and finding more cost-effective ways to accomplish the basic function through which the needs and requirements of customers can be met. At this stage, there are no restrictions on the value engineering team, as they can use many recognized techniques to generate ideas, including brainstorming, the Gordon method, Whereas, creative techniques in solving problems are an indispensable element in the value engineering program in order to reduce costs and improve quality, and the job eligibility percentage for the product of the Baghdad Packaging Industry Company during the year 2021 can be clarified through the following table:

Table (3): The percentage of functional maturity of the product of the Baghdad Company for the manufacture of packaging materials for the research sample during the year 2021



Functions	The degree of relative importance			Weighted arithmetic mean (1)	Relative importance (2)	Conversion rate (3)	Functional maturity percentage $2 * 3 = (4)$
	Agree	Neutral	Disagree				
Moisture resistance	15	8	7	106	13.62%	1.14	15.53%
Sunlight resistance	17	11	2	120	15.42%	0.96	14.8%
Oil resistance	14	9	7	104	13.37%	1.22	16.31%
Package consistency	18	8	4	118	15.17%	1.03	15.63%
Giving a shiny appearance to the packaging	11	9	10	92	11.83%	0.99	11.71%
Increase the life of the packaging and the strength of its cohesion	20	8	2	126	16.20%	0.92	14.9%
Heat resistance	16	9	5	112	14.39%	1.18	16.98%
Total	111	62	37	778	100%	7.44	105.86%

Source: Prepared by the researcher.

It is clear from the above table that the functional entitlement percentage for each function of moisture resistance, sunlight resistance, oil resistance, packaging cohesion, giving a bright appearance to the packaging, increasing the life of the packaging, its cohesion strength and heat resistance were (15.53%), (14.8%), (16.31%), (1%) 15.63), (11.71%), (14.9%), and (16.98%), respectively. The reason for the discrepancy in these percentages is due to the fluctuation in the performance and quality of production processes due to the frequent power outages. Which leads to a varying effect on the performance and quality of each function of the product, so it requires improving the functional benefits of the product by improving performance and quality and making the product conform to specifications and standards and better suited to the needs of customers than what competitors offer in the market. After calculating the job cost percentage and the job merit percentage, the value index will be calculated for the company's product, the research sample, during the year 2021, as shown in the following table:

Table (4): The value index of the product of the Baghdad Company for the manufacture of packaging materials, the research sample during the year 2021

Functions	Functional Cost percentage (1)	Functional maturity percentage (2)	Value Index $2 \div 1 = (3)$	Functions that Need Improvement
Moisture resistance	22.17%	15.53%	0.700	Need to improve
Sunlight resistance	32.66%	14.8%	0.453	Need to improve
Oil resistance	9.05%	16.31%	1.802	-
Package consistency	14.2%	15.63%	1.101	-
Giving a shiny appearance to the packaging	5.58%	11.71%	2.099	-
Increase the life of the packaging and the strength of its cohesion	4.61%	14.9%	3.232	-
Heat resistance	11.73%	16.98%	1.448	-
Total	100%	105.86%	1.059	-

Source: Prepared by the researcher.

It is noted from the above table that the value index for each function of moisture resistance, sunlight resistance, oil resistance, packaging cohesion, giving a bright appearance to the packaging, increasing the life of the packaging, its cohesion strength and heat resistance were (0.700), (0.453), (1.802), (1.101), (2.099), (3.232), and (1.448), respectively. It is also noted that the function of moisture resistance and the function of resistance to sunlight has



decreased in the value index from the correct one, so it needs improvement by reducing the cost in addition to improving performance and quality.

Accordingly, the focus will be on jobs in which the value index is less than the correct one, so the focus will be on reducing the cost of direct materials through the use of cheaper materials or fewer components. The cost of the moisture resistance function has been reduced to (6,500,000) dinars, after it was (12,825,413) dinars. And the cost of the sun protection job was reduced to (10,000,000) dinars, after it was (18,896,455) dinars, and this means that the amount of reduction in the cost of these two jobs was (15,221,868) dinars.

The cost of the Baghdad Company for Packaging Materials product jobs during the year 2021, before and after applying the value engineering technology, can be clarified through the following table:

Table (5): The cost of the Baghdad Company for the Manufacturing of Packaging Materials product jobs before and after applying the value engineering technology during the year 2021

Functions	Before applying the VE technique		After applying the VE technique		Cost reduction
	Cost (IQD)	Percentage	Cost (IQD)	Percentage	
Moisture resistance	12825413	22.17%	6500000	15.25%	6325413
Sunlight resistance	18896455	32.66%	10000000	23.46%	8896455
Oil resistance	5233208	9.05%	5233208	12.28%	-
Package consistency	8216402	14.2%	8216402	19.27%	-
Giving a shiny appearance to the packaging	3225118	5.58%	3225118	7.57%	-
Increase the life of the packaging and the strength of its cohesion	2665904	4.61%	2665904	6.25%	-
Heat resistance	6787500	11.73%	6787500	15.92%	-
Total	57850000	100%	42628132	100%	15221868

Source: Prepared by the researcher.

After that, the alternatives and ideas proposed for the product of the Baghdad Packaging Materials Industry Company will be tested and evaluated to ensure that they are applicable on the ground and that they help in maximizing the value of the product by improving its functional benefits and reducing its costs. The problem is with defining the entities that can implement this alternative, and the report must include a breakdown of the cost savings through a comparison between the current situation and the proposed one, as well as improvements in the value of the product through quality planning and improving product performance, and thus it can be said that the technology of value engineering It can help plan quality and improve product performance.

## THE FOURTH TOPIC: CONCLUSIONS AND RECOMMENDATIONS

### 4-1 Conclusions:

The research reached the following conclusions:

1. The value engineering technology is an integrated program with a sequential and accurate plan of action to solve all problems related to cost, quality and performance. It is managed by an organized group of individuals with different specializations called the value engineering team to analyze information related to the project, product or service.
2. The value engineering technique improves quality by increasing the product function (the level of performance that the customer gets from the product) while making the resources fixed (which are raw materials, human resource, price and time) or by reducing the resources and making the job fixed or by increasing the function and reducing the resources in same time.
3. The Iraqi industrial units have employees and cadres who have not long job experience, which confirms the lack of job stability in the Iraqi industrial units, and therefore the difficulty of relying on long job experience to develop the hotel sector dynamically.
4. There is a weakness in finding innovative and new alternatives for design solutions based on the use of the innovative method as a first step for applying value engineering, which works to open the way for employees and officials to put forward creative ideas and choose the best one.



5. The use of value engineering technology can help in planning quality and improving product performance by training employees in order to be able to achieve empathy with customers in order to determine what the customer wants and needs in terms of products to satisfy them, and the technology of value engineering works to improve efficiency And the search for the best balance between cost, functionality, quality, reliability and performance of the product.

#### **4-2 Recommendations:**

The research recommends the following:

1. The need for the Iraqi industrial units to build a strategy to reduce work turnover to preserve their employees, taking into account the achievement of living sufficiency and instilling in them the spirit of belonging to the organization, since the increasing rates of abandonment and appointment burden the institution and drain its efforts and focus on the efficiency and quality of work.
2. Staff must be trained in order to be able to achieve empathy with customers in order to find out what the customer desires and needs in terms of services in order to satisfy them. Therefore, the hotel must take into account when preparing the value engineering program paying the cost of the job of training employees to acquire communication skills with customers.
3. Enhancing the step of preparing the work team with increased care in selecting the value engineering team and their leader on the basis of professionalism, experience and skill because of their important role in guiding, building and implementing the comprehensive action plan at the level of an organization.
4. In order to address the research sample's reluctance to provide facilities for completing the deal with customers, it must reconsider analyzing all jobs related to providing these facilities and open the door to those who wish to submit suggestions and benefit from the experiences of others, taking into account the continuous improvement processes to develop and improve performance.
5. Work hard to improve the value of the product from the point of view of both the company and the customers, in addition to providing a product with the lowest cost, the highest quality and the shortest time, better than what competitors offer in the competitive market.

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