TechHub Journal Vol. 7, pp.218-236 (2024)
ISSN: 2810-2800
www.techhubresearch.com

The role of value engineering in reducing the costs of failure and achieving competitive advantage

Sundus Fadhil Jazzaa

College of Administration and Economics / University of Baghdad

Abstract. Modern technological developments and their impact on the modern manufacturing environment led to the emergence of intense competition between international companies, which was followed by the development of accounting systems and the information that these systems produce, and the increased need for this information by its users, as accounting plays a more vital role in determining the information that management needs in Economic unit. To keep pace with modern developments, the management moved towards thinking about new trends such as customer satisfaction and focusing on success factors represented by using modern methods of cost management such as the just-in-time (JIT) production system, activity-based costing (ABC), value engineering, and process re-engineering or reverse engineering. Hence, cost accounting and management accounting played a major role In translating these systems into financial and non-financial measures, including the financial and administrative accounting information they contribute to assist management. Value engineering is one of the most important modern administrative and technical methods appropriate to keep pace with developments and changes in the business environment to achieve the main goal that organizations seek today, which is to meet the requirements and desires of customers by achieving two goals: the first is to reduce the cost of the product, and the second goal is to improve the value of the product to achieve customer satisfaction. It is the basis for the success of organizations, in addition to dividing the product into functions, analyzing and studying them. This is done through the use of value engineering technology in accordance with modern scientific methods.

Keywords. Engineering, costs, failure, competitive

The first section: research methodology

1- The importance of research:

The importance of the research lies in the importance of reducing the high costs of failure, which have negative repercussions on the reputation of the economic unit, loss of market share, and exit from the circle of competition, as value engineering is one of the modern approaches to strategic cost management that the economic unit pursues, which is reflected in increasing the value of the products provided by the unit. In order to achieve its survival in the competition circle

2- Research problem:

The technological progress and development witnessed in the contemporary business environment has led economic units to constantly seek to implement new methods aimed at

preserving their customers and providing what they consider valuable in a way that ensures their survival within the circle of competition.

Accordingly, the problem of the research is embodied in the high costs of failure due to the lack of use of modern cost techniques in strategic cost management or the weak use of such techniques, which represents value engineering as one of the most important techniques used to reduce the rise in these costs .

3- Research objective:

The research aims to highlight the role of value engineering in reducing the costs of failure through analyzing functional performance and excluding unnecessary functions that do not add value to the product while maintaining the quality of the products .

4- Research hypothesis:

The research is based on the hypothesis that using value engineering according to sound scientific methods, represented by analyzing jobs and determining the value of these jobs through knowing their costs and job benefits, which ultimately reduces the costs of failure.

Section Two: The Theoretical Framework of Value Engineering

1- The Concept of Value Engineering:

A- Value:

Values are essentially a moral concept related to determining what a thing deserves or its intrinsic ability to satisfy, which is the basis of its value. It has been defined as (the lowest possible cost to obtain the best possible functional performance and the highest possible quality) (Al-Samarrai: 2019: 193) and it has been defined as a personal perspective of the customer's desire and ability to pay for the performance received from the product (Kandori: 2006: 52),It can be said that the definition that says that value is the ability to satisfy is the most appropriate of the previous definitions.Value can be classified into four main types, which are: (Al-Youssef: 2000: 28)

A- Cost Value: It is the total monetary cost of producing something, whether it is direct, indirect, maintenance, operation, etc.

Aesthetic Value: These are the aesthetic qualities or features that the customer desires. Aesthetic value may be called Esteem Value.

Use Value: It means the total benefit of the product, whether it is a good or a service.

H- Exchange Value: It expresses the purchasing power of the product.

The purpose of classifying value in this way is to facilitate the classification of the features of each product, whether a good or a service, according to these types. For example, had it not been for the existence of these classifications, it would have been difficult to determine the value of water, which is of great benefit to humans, compared to diamonds, which are of little benefit. With these classifications of value, it has become possible to find foundations for classifying value in order to achieve additional features of the product that work primarily to increase customer satisfaction and meet his requirements. As for measuring value, it is measured Through the following equation:

Value measure=(functional performance + quality)/total cost(Al-Yousifi, 2000: 20)

A- Functional performance: It is the work performed by the product or unit

B- Quality: is the user’s needs for the product

C-Cost: It is the cost of the product’s life cycle

B- History of value engineering:

The Second World War (1939-1945) had a major impact on the industrial and production process. Strategic materials were greatly scarce, and this prompted the American company General Electric (General Electric), whose symbol is (G.E.), to search for alternatives to its

strategic resources that perform the same functional performance as these resources. .In order to obtain these resources, General Electric assigned Lawrence Miles to search for alternatives to resources. Miles was then an electronics design engineer at the aforementioned company in New York. During his search for new alternatives, Miles discovered that analyzing functions, not analyzing parts, is the best way to obtain alternatives to replace resources. Original, improves value and reduces cost. As a result, General Electric was ahead of its competitors from other companies in an increase Production and profit ratio. Due to the successes achieved by the aforementioned company after applying this method and due to the intense competition between American companies in that period, the value analysis method remained a secret of General Electric for more than ten years.After that, the US Department of Defense used this method in the early fifties, specifically in the year 1954. They called it Value Engineering instead of Value Analysis, which is the name that has become common now. After that, it was co-opted by many American companies, and then this technology spread to many countries in Europe, South America, Japan, Australia, and India.Now, value engineering has become widely applied and held in most parts of the worldAnnual international conferences are held, and there are many consulting offices specialized in the field of value engineering in America, Europe, Japan, South America, and the Gulf countries.
(Al-Samarrai, 2019, 195)

C- The Value Engineering:

Many researchers have defined it with different definitions. Horngren defined it as a cost reduction technique that is mainly used during the design stage and takes advantage of all information about all functions of the value chain to achieve customer satisfaction through cost reduction. (Al-Samarrai: 2019: 196) It is also known as an organized collective effort carried out by a work team of specialized individuals who have a sense of creativity in order to reach a functional balance between quality performance and cost (Al-Moussawi: 2010: 29).

As for Dhillon, he defined it as an organized attempt directed towards analyzing the functions of the item or product with the aim of achieving the specified function at the lowest possible cost (Dhillon, 2002, 194).

Miles defined what he calls value analysis or value engineering as a system for solving problems and is implemented by using a set of special techniques and a set of smart skills. It is an organized creative method whose goal is to identify unnecessary costs that do not add value and are not concerned with the customer's requirements in terms of use or appearance (Miles, 1961). :3), while it is known as a systematic method that starts from the beginning of the design and accompanies the design phase.Horngren sees value engineering as the systematic evaluation of all aspects and activities of research and development, product and process design, production, marketing, distribution, and customer service, with the aim of reducing costs while meeting customer needs. Value engineering can lead to improving product design, changing specifications and properties of materials,and modifying methods.Operation(Horengren,et.al,2018: 428).It has been defined as (systematic collective work with sequential steps aimed at analyzing the functions required of a procedure, product, or project, then working through creativity and innovation to propose alternatives that achieve that function or functions with the required quality and performance and at the lowest cost overall) (Al-Samarrai: 2019: 196). It is a method or an organized collective effort whose goal is to obtain the best performance at the lowest cost through analyzing jobs and then working to create and innovate alternatives to perform those jobs while maintaining the level of quality and quality or working to improve it. Value engineering works to eliminate unnecessary costs and costs that do not add value to the product, and these costs are eliminated during the design

phase. This is what makes value engineering occupy the position it occupies now. Studies show that 70% - 90% of the cost of the final product is determined .

In the design stage, and most importantly, the quality of the product is determined during this stage. It also turns out that once production begins, more than 90% of the product costs become uncontrollable.From the above, it is clear that the philosophy of value engineering is built on the basis of job analysis by specialized individuals to reach a job balance between quality performance and cost.

Value engineering and cost reduction:

When talking about the process of reducing costs carried out by value engineering, it is not meant to be an abstract reduction of costs. Reducing costs usually occurs through segmenting the product or project and eliminating some of its parts, in contrast to the value engineering method, which works to reduce costs through analyzing the functions of the product or project. Then find alternatives that perform the functions that the product is required to perform, but the alternatives are less expensive. That is, maintaining the quality of the product and working to improve it will be done, but at a lower cost. Thus, value engineering will work to add value to the product and will increase customer satisfaction with the product, which is considered the most important goal that the economic unit seeks to achieve. (Al-Shaya, 2009, 57).As an example of the difference between value engineering and cost reduction in the field of buildings and construction, if what is required is to build a building consisting of ten floors and it becomes clear that the budget is not sufficient for one reason or another except to build eight floors, then using the cost reduction method will lead to reducing the size of the building or canceling some of the project's functions.

As for value engineering, it will search for less expensive alternatives to the project systems, such as the construction method, the air conditioning system, the insulation system, the electricity system, etc., without canceling or reducing any of the project functions. (Al-Yousifi, 2000, 25).

Sources of savings in value engineering

Value engineering achieves savings through the following: (93, 2000, Hill)

1- Excluding parts without reducing the functional properties contained in them.

2- Merging two or more functional parts through redesign.

3- Expanding the concept of stereotyping.

4- Incorporating many of the above savings works to reduce the cost of wages by simplifying the completion of the process and eliminating unnecessary operations that do not add value to the product.

Value Methodology (V.M) Value Methodology

The term value approach refers to the techniques combined, which are the value engineering technique, the value analysis technique, and the value management technique, which are as follows: (Al-Samarrai, 2019, 199)

1-Value Engineering

Or what is called value engineering, which is a study that often aims to improve quality and reduce project costs. It is applied during the presentation of the project idea or after the completion of its general concept.

2-Value Analysis

This technique describes studying the value of a product that has actually been produced or designed, and analyzing the product to see if it can be developed, and this means reducing costs during production.

TechHub Journal Vol. 7, pp.218-236 (2024)
ISSN: 2810-2800
www.techhubresearch.com

3-Value Management

It is a comprehensive concept of how to manage programs for value studies and how to prepare for and follow up on them, as the value engineering or value analysis workshop is part of this process and this concept is applied in management in general, whether it is an administrative system, a maintenance and operation system, an accounting system...etc. Value management is sometimes called value control, value development, or value insurance.

The importance of value engineering:

1- Benefits of value engineering: The value engineering method achieves many benefits for the economic unit, and these benefits are:(Horengren,et.al,2018: 442)

A- Improving product performance and reliability

B- Increasing modularity leads to developing maintenance and reducing repair costs. Modularity means the use of common parts for various products. Thus, value engineering will achieve one of the quality considerations, which is the ability to service or maintain.

C- Reducing the overall life cycle costs of projects or operations.

D- Reducing waste in the design and manufacturing process by removing the stages that cause waste.

E- Identify potential dangers and create solutions to avoid and prevent them.

It works to improve the ability to manage projects, solve problems, and continuous creativity

G- It helps employees know the necessity of working to develop and improve the value in any product, project, or process.

2-Features of value engineering: Value engineering as a technique and approach to solving problems has proven successful in all fields in which it has been implemented. The value engineering method is distinguished from other methods in that it achieves the following:

A- Job analysis technique.

B-Multiple specializations of the collective work team.

C- The quality of coordination between the parties concerned with value engineering for the project.

D-The quality of creativity to develop a number of design alternatives.

E- The principle of not reducing the required performance.

F- Reducing costs to perform each job.

The role of value engineering in general competitive strategies

General competitive strategies are the strategies prepared at the level of business units and focus on improving the competitive position of the products provided by these units, so they are called competitive strategies.

They are called general strategies because they can be implemented by all economic units of all types

(Industrial, commercial, service) These strategies are: (Al-Samarrai, 2019, 201)

1-Cost Leadership Strategy

2- Differentiation Strategy

3-Focus Strategy

The role of value engineering in achieving each of these strategies is as follows:

1-The role of value engineering in cost leadership strategy

The most important risk of this strategy is that the unit will run into problems when it attempts to reduce the different shapes, types and features of the product in an effort to reduce costs, as this will lead to the economic unit being unable to compete, which represents the first advantage of following this strategy. To avoid these risks, the unit must follow sound and studied methods, such as value engineering, as this technology will help the unit reduce costs without

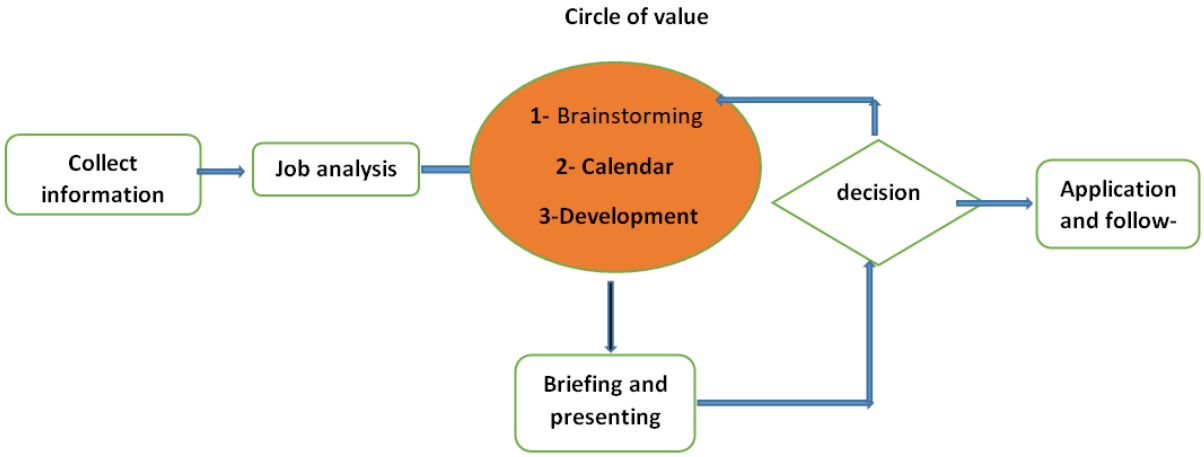
TechHub Journal Vol. 7, pp.218-236 (2024)
ISSN: 2810-2800
www.techhubresearch.com

compromising the quality of the product, but rather work to improve it and add value to the product, which will increase customers' demand for it, which will increase the unit's economic market share, and thus the unit will occupy a position Distinguished among competitors and will increase its ability to confront any new and potential competitors in the market.

2-The role of value engineering in differentiation strategy

The economic unit's pursuit of differentiation may lead to the production of products whose costs exceed customers' purchasing power. This will lead to a shift in demand for these products due to the comparison that customers will make between the price of differentiated products. Here value engineering plays a role in working to introduce new methods of performance, production, distribution and marketing, which will lead to the production of distinguished products.

Figure (1)
Value engineering steps



Source (Al-Yousifi, 2009)

3-The role of value engineering in focus strategy

The focus strategy includes the previous two strategies in its application, so it benefits the most from the use of value engineering. Value engineering is a technique whose goal is to find distinct alternatives at low prices. Therefore, even if the economic unit uses the two strategies together, it will rely on value engineering to find distinct products at competitive prices through which it can control the market, especially since in this case it is represented by a single economic sector or geographical area, which is easier to control than the economic unit that operates according to the value engineering method. Which is a method to reduce costs scientifically and to achieve excellence and uniqueness through the process of creativity.

Value Engineering Job Plan

Value engineering is a systematic method that follows specific work steps in its application. These specific steps are stages in which value engineering is applied, and these steps are logically sequential. Researchers have differed in determining the number of stages of the value

engineering plan. The action plan may have four, five, seven, or eight steps, and it is usually seven steps, according to what most specialists in value engineering follow. The following is a sample seven-step action plan as follows: (Journal of Saudi Studies / Third Edition, 2016, 21)
1- Collecting information.
2- Job analysis.
3- Innovation and creativity.
4- Evaluation and selection.
5- Research and development.
6- Summary and presentation of recommendations.
7- Application and follow-up.
We find that the difference in the number of stages of value engineering business plan models is due to differences in uses of this technology and to differences in the opinions of researchers in this field. Although the business plan is an approach adopted by projects when applying value engineering, it must take into account the difference in projects and the difference in the environment in which it is applied. Below is Figure (1) showing the steps of value engineering

First Stages of applying value engineering
Value engineering generally goes through three stages, meaning that the aforementioned seven steps can be divided into three sections or three stages: (Shtwan and Schlak, 2020, 250-252)
1- Preparation and investigation stage
2- Job analysis stage
3- Investigation and follow-up
The first stage: the preparation and investigation stage
This stage may include the following preparations:
1- Choosing the work targeted for the study: The scope of the work targeted for the study is selected and determined, whether it is the entire project or one of its stages.
2- Selection of the study team: The work team is selected to conduct the value engineering study and the leader of the study team is chosen, who is required to be a specialist in value engineering and hold an accredited certificate.
3- Establishing the basics of the study: A meeting is held with the team leader, the owner, and team members, and the value engineering team charged with preparing the study is named, mentioning their specializations and the work assigned to them. A timetable for the study plan is also set and a date is set for submitting the final report of the study.
The second stage: value studies
Value engineering at this stage is represented by the following:
1- Collecting information: and data related to the project or product, including maps, drawings, specifications, design, quantities, etc Conducting field visits to the project site and meeting the project manager, owner, workers and technicians, while making visits to similar projects.
2- Functional analysis: This is the second step after the data collection stage, where the basic functions are analyzed and sorted at the lowest possible cost and described in the form of a map that is arranged according to importance and the cost of implementing it. This map is called the functional map, in which the functions that each activity performs are determined and the benefit of each is determined. Function and its importance to the project. This stage is considered the basic foundation of value engineering.
3- Proposing ideas and alternatives: This step is considered the essence of the study, in which creative ideas are created, possible alternatives that perform the primary and secondary

functions are found, and redundant functions are eliminated and reduced in a way that is more effective in performance and lower in terms of overall cost.

4- In this step, ideas, criticism, and arbitration are evaluated, and unnecessary details that are not based on scientific foundations and concepts are deleted. This step is called the constructive thinking stage, during which a decision is reached to exclude, reduce, or delete unnecessary or undesirable jobs. Which leads to reducing costs as a result of eliminating these defects that represent additional costs.

5- Developing alternatives and proposed ideas: This step represents transforming the ideas and proposals approved in the previous step into an integrated work plan and a comprehensive study carried out by the elected work team, each according to its specialty. This step also includes the practical application stage and financial estimates of costs and the amount of savings resulting from the application of the study.

6- Submitting the final report of the study: This report is the final result and a summary of the effort expended by the work team in charge of the study, and it is presented to decision-makers for the purpose of application and reviewing its contents, results, and the approach that was followed to reach these results.

The third stage: investigation and follow-up

At this stage, the feasibility of using value engineering in project management is verified and the changes that have occurred for each activity as a result of the use of alternatives and proposals are monitored, as well as the overall evaluation of the use of value engineering in terms of aspects (total cost, required quality, time programme).

The third section: The theoretical framework of quality costs

Quality costs:

In light of the many changes that have accompanied the modern manufacturing environment in terms of scientific and technological development, the information and communications revolution, globalization, the emergence of economic blocs and global organizations, the changing tastes, needs and behaviors of customers, and the increasing intensity of competition between.Economic units and others. The activities of these units have become directed towards the customer to meet his needs and expectations and pay attention to quality as it is a strong competitive weapon that achieves a set of advantages, the most important of which are reducing costs, increasing and improving both productivity and profitability, enhancing the competitive position, obtaining customer satisfaction and loyalty, increasing market share, and others.Since quality is a strategic goal that economic units must pay attention to and strive to achieve, and this requires spending the costs of comprehensive quality, as it was previously believed that high quality requires more costs, but it has been realized that high quality will lead to reducing the costs of quality and thus reducing The total costs of manufacturing products, which requires attention to comprehensive quality costs) Identifying the main elements that make up the costs of prevention, evaluation, internal failure, and external failure, and paying attention to them in terms of definition, measurement, and disclosure.

Elements of total quality costs Elements of total quality costs .They have mostly disappeared from the costs of comprehensive quality, and they consist of the costs of prevention, internal evaluation, failure, and external failure. They differ from one smart unit to another due to the different nature of its activities, and they are as follows:

1- Prevention costs (prevention costs):

The pioneer of quality costs (Juran) takes the costs of preventing them as the costs achieved to maintain the costs of evaluation and failure as low as possible. Therefore, the most effective

way to reduce the costs of comprehensive quality and maintain quality over achievement is to avoid.

The occurrence of quality problems from the beginning, and this is the goal of prevention costs, as these costs relate to activities that reduce or exclude the production of a defective good or the provision of services that are below the standard level. Economic units have found that the cost of prevention is less than the cost of repairing defects after they occur, and therefore they are the costs that occur to prevent Producing products that do not conform to specifications, or they are the costs associated with preventing the production of defective products that do not meet the needs and expectations of customers. Therefore, prevention costs are those costs that the economic unit spends to achieve a number of goals, including reducing the costs of comprehensive quality by reducing the costs of evaluation and failure of both types, given that the costs of prevention are linked Quality activities that add value

2-Appraisal Costs:

For the purpose of discovering products that do not conform to specifications, evaluation costs must be spent, which represent the costs of maintaining the quality level through means of formal evaluations of the quality of the product, or they are the costs of inspection and testing in order to ensure that the process or product is acceptable in terms of conformity with the specified quality standards, according to Krajewski. And others say that evaluation costs are (those costs achieved when evaluating the level of performance achieved for the quality of the economic unit's operations and products. Therefore, evaluation costs are (those costs that the economic unit spends to achieve a number of goals, including discovering products that do not conform to the required quality specifications, identifying the reasons for this, and working to avoid them. errors in the future.

3- Internal Failure Costs:

Internal failure costs occur when a product does not meet its design specifications
(Juran) that these costs disappear if there are no defects in the product before it is shipped to the customer. Therefore, these costs are related to errors or defects that occur within the economic unit. Therefore, they are the costs that occur to discover the defective product before it is shipped to the customer, and these defective products are It does not conform to quality standards, so that the customer may reject it if he receives it, and this defect is discovered during production or after its completion and before delivery to the customer. These costs are often related to Scraping, remanufacturing, re-examination, internal failure analysis, and other costs that occur within the economic unit and before the defective product is delivered to the customer.Therefore, the costs of internal failure (are those costs borne by the economic unit when the product does not conform to its design specifications, and these costs occur before shipping the product. Through these costs, management can be given a clear picture of the internal defect and how these causes can be avoided in the future.

As for the elements of internal failure costs, they consist of a group of paragraphs through which the following can be achieved:

1- Scrap: These are the costs related to defective products that cannot be repaired

2- Remanufacture: These are the costs of repairing products that do not match the quality characteristics.

3- Retest: These are the costs of re-examining products that have been remanufactured and include all costs related to operating inspection equipment and devices and other costs related to that.

4- Failure Analysis: These are the costs of analyzing the causes of internal failure in order to identify these causes for the purpose of avoiding them in the future.

TechHub Journal Vol. 7, pp.218-236 (2024)
ISSN: 2810-2800
www.techhubresearch.com

5- Product Downtime Costs: These are the costs associated with repairing, adjusting, or changing production equipment, changing or training operators, or removing materials that cause poor quality in the economic unit's products.
6- Price-Downgrading Costs: These are the costs that arise from selling defective, damaged, or poor quality products at less than their price.

4- External Failure Costs:

The costs of external failure occur in the event that the customer receives a product that does not conform to the specifications so that it cannot meet his needs and expectations. Juran confirmed that these costs disappear when there is no external defect, and since these costs arise after the customer receives the product, they are related to his service, and thus they are The costs that arise when the defective product has been delivered to the customer. This means that the costs of external failure occur as a result of the delivery of a product that does not meet the specifications to the customer so that it cannot meet his needs and expectations.

Therefore, the costs of external failure are those costs that the economic unit bears as a result of delivering defective products to customers. If these products conform to the specifications, these costs will not occur, and these (defective) products have negative effects on customer satisfaction, the economic unit's sales and reputation, and thus on its market share, and this This means that even if the economic unit replaces the defective product or repairs it and returns it to the customer, it will lose part of its credibility and reputation among customers.

(Al-Samarrai, 2019, 266) When the economic unit calculates the costs of comprehensive quality, it must separate the costs of internal failure from the costs of external failure, because not separating them will lead to not benefiting from the information provided by these costs in the desired manner, as the costs of external failure have the greatest impact on the economic unit's reputation, sales, and market share. Because the product has left it and is in the hands of the customer. It is worth noting that the costs of failure (of both types) are linked to quality activities that do not add value to the product and that They must be removed in order to reduce the total quality costs and thus the total manufacturing costs of the products. Also, the most important elements of the total quality costs that have an impact on the economic unit are the costs of external failure, because the product has been received by the customer and he has a good or bad image of the economic unit and thus has major impacts on its sales and share. Logistics.

The fourth topic: The factors provided by value engineering by reducing the costs of failure and achieving competitive advantage

1- Quality dimensions:

Most definitions of quality have made it a means of obtaining customer satisfaction, which is the goal of all economic units. Therefore, Garvin set dimensions of quality, and when these dimensions are achieved, the economic unit will have achieved to meet the consumer's requirements and obtained his satisfaction. These dimensions are:

A- Performance: Refers to the operational specifications of the product.
B-Features: Refers to characteristics that complement or support operational characteristics.
C- Reliability: the ability to perform the required work under specific operational conditions in a specific period of time (Al-Azzawi, 2002: 22).
D- Conformity: refers to the degree to which the product design and its operational characteristics meet the standards and specifications set for quality. Deviation from these specifications can be permitted within certain limits. Accordingly, the product is considered to meet quality if it falls within these limits.

E- Durability: It is the amount of use that the consumer gets from the product before disposing of it or replacing it (Al-Samarrai, 1998: 1). Durability can be measured by the number of maintenance times or the amount of use of the product before its expiration.
F- Serviceability: This means speed, good treatment, and efficiency in dealing with the customer when he tries to repair the product, as well as the ease of repairing it when it breaks down.
G- Aesthetics: This means how the product looks in terms of shape, texture, sound, taste, smell, etc.
H- Perceived Quality: The reputation of the economic unit that manufactures the product has a significant impact on customers' preference for its products on the assumption that the quality of its products will continue today as it was yesterday, which caused its fame.
Researchers believe that the service has qualitative dimensions that differ from the qualitative dimensions of the product, which were previously mentioned in: (Al-Azzawi, 2002: 22), (Russell & Taylor, 2002: 20).
A- Waiting period Time: represents the period during which the customer waits for service.
B- Timeliness: Is the service available or available at the time the customer requests it?
C- Completeness: Complete completion of all aspects.
D- Courtesy: This dimension represents how the economic unit treats the customer.
E-Consistency: the extent of consistency in providing the same level of service at all times to every customer.
F- Availability or accessibility: means the ease or simplicity of obtaining the service.
G- Responsiveness: means quick interaction from employees in the economic unit to solve unexpected problems that arise among customers.
H- Accuracy: This means providing the service correctly to every customer from the first moment.
The dimensions of quality, whether for the product or service, represent the maximum that a product or service can achieve in order to satisfy the customer on the one hand and achieve the highest level of profits and the largest market share on the other hand. Just as quality has dimensions whose goal is to meet customer requirements, value has similar meanings to some dimensions of quality.
The aesthetic value, which means the aesthetic qualities or features that the customer desires, is similar in concept to some of these dimensions. The aesthetic dimension, which means how the product looks and the feeling it arouses in the customer, such as its sound, shape, taste, color, smell, etc. (Al-Samarrai, 1998: 1) There is also a dimension of features that indicates secondary functions that complement the primary function of the product (Al-Sheikhili, 2006: 20)
Another dimension of quality is durability, which is defined as the amount of use that an individual gets from a product before disposing of it or replacing it (Al-Samarrai, 1998: 1). This dimension is similar in concept to the meaning of use value, which is the total benefit of the product.
The quality of similarity between the types of value and the dimensions of quality indicates that the goal of both is to work to improve the product and give it better qualities, which creates an incentive for customers to choose this product, as well as to create qualities for the product that meet the needs of customers in order to reach the largest percentage of customer satisfaction, which increases the share. The market value of the economic unit.
2- Reasons for applying value engineering technology to achieve competitive advantage:
The application of value engineering requires a specialized work team, and this procedure will work to bridge the competitive gap that occurs during the traditional design process, which

depends on the individual work of each specialty separately. The competitive gap can be defined as the differences between these rates or ratios and those of the economic units that compete in The same economic sector or a similar sector. (Al-Tamimi, 2005: 292) Likewise, value engineering will add a competitive advantage to the company that will apply it, and the concept of competitive advantage refers to the ability to produce products Or providing services to customers individually or distinct from what other competitors offer, and through the organization's exploitation of its sources of strength to add value to its products in a way that competitors are unable to implement. Individual work tends to set the maximum safety and performance factors for each individual design, and thus the project ends up being designed according to systems that are not the least expensive relative to the basic function of the project.

3-Value engineering and cost reduction technology:

The process of cost reduction carried out by value engineering is not the abstract reduction of costs. Cost reduction usually occurs through segmenting the product or project and eliminating some of its parts, in contrast to the value engineering method, which works to reduce costs by analyzing the functions of the product or project and then finding alternatives. The product performs the functions it is expected to perform, but the alternatives are less expensive. That is, maintaining the quality of the product and working to improve it will be done, but at a lower cost. Thus, value engineering will add value to the product and will increase customer satisfaction with the product, which is considered the most important goal that the economic unit seeks to achieve. As an example of the difference between value engineering and cost reduction in the field of buildings and construction, if what is required is to build a building consisting of ten floors and it becomes clear that the budget is not sufficient for one reason or another except to build eight floors, then using the cost reduction method will lead to reducing the size of the building, canceling some parts of the project, or reducing the number of Of the floors, the building consists of eight floors, which naturally results in the cancellation of some of the project's functions.As for value engineering, it will search for less expensive alternatives to the project's systems, such as the construction method, the air conditioning system, the insulation system, the electricity system, etc., without canceling or reducing any of the project's functions (Al-Yousifi, 2000: 25).

4-Sources of savings in value engineering:

Value engineering achieves savings through the following: (Hill, 2000: 93)

A- Excluding parts without reducing the functional properties contained in them.

B- Merging two or more functional parts through redesign.

C- Expanding the concept of standardization.

D- Incorporating many of the above savings works to reduce the cost of wages by simplifying the completion of the process and eliminating unnecessary operations that do not add value to the product.We conclude from the above that the relationship between quality costs and value engineering is through prevention costs, which are considered one of the most important quality costs, and if applied correctly, they will lead to reducing costs.Evaluation and failure of both types, thus reducing quality costs, as prevention costs include planning and design processes, development and calibration of equipment, review and verification, continuous improvement programs and other processes that lead to reducing defective or zero products or reducing them to the minimum possible extent, and this is what value engineering technology achieves in addition to maintaining the level of Quality products and doing the right thing from the first time. Therefore, there are no costs of failure in quality and a reduction in total costs because there are no defective products or to reduce these costs to the lowest possible level.

TechHub Journal Vol. 7, pp.218-236 (2024)
ISSN: 2810-2800
www.techhubresearch.com

The fifth topic: Practical application of the value engineering curriculum in the Ministry of Education building (renovation of the Ministry building)

A brief overview of the Ministry of Education building:

The building of the Ministry of Education is located in Baghdad, in the Bab al-Sharji area, near the White Palace and adjacent to the building of the Ministry of Higher Education and Scientific Research, so this site is called the Educational Complex. The building consists of two towers, with elevators in two of them, in addition to service facilities. The building consists of ten floors in addition to An underground floor (basement) containing the cooling system, some service facilities, and engineering and maintenance rooms

Reasons for restoring the Ministry building:

The need to renovate the Ministry building was due to a defect in the sewage and sanitary system that caused water and moisture to leak into the walls, which required their complete repair, i.e. the sanitary facilities and sewers, as well as damage to the secondary ceilings of the building and replacement of the wallpaper, as well as damage and aging of the carpet covering the floor.

The traditional method for restoring any government building:

The building is inspected by a technical committee formed pursuant to a ministerial order to determine the damage and parts that need restoration. The committee submitted its report stating that the building needs complete restoration of plumbing and sewerage, replacing the wallpaper and flooring, as well as covering the roof of the building with sticker and flange material. After that, a tender was announced. To restore the Ministry's building (headquarters in Bab al-Sharji), in addition to the old Ministry's building in the Adhamiya area and the Ministry's stores in the Al-Nahda and Ziyouna areas, at a total cost of (ten billion and one hundred and eighteen million Iraqi dinars), and it will be completed.

The focus in applying the value engineering approach is on the process of restoring the headquarters of the Ministry of Education in Bab al-Sharji for the purpose of brevity and not prolonging the research paragraphs, at a cost of (seven and a half billion), since the Ministry's headquarters has the largest share of the tender value as it is the largest in area among the buildings attached to the Ministry of Education. The tender was awarded to one of the engineering companies within the private sector, and the contract was concluded with the aforementioned company within certain paragraphs, conditions and specifications for the materials used in the restoration process and within a specific time limit. The building is received after the completion of the restoration process according to a receipt and handover report by specialized technical committees after they inspect it. On the building, it must conform to the specifications that were contracted under the aforementioned tender.

Followers of value engineering in the restoration of the Ministry of Education building:

Following the value engineering approach focuses on all aspects of the value chain and before starting the restoration process. Therefore, it requires applying the steps of the value engineering approach, which are in several sequential stages, which are:

1- Collecting information: by specialized committees that undertake the process of collecting information and data about the building, preliminary maps of the building, designs and materials that were used in the finishing operations, as well as collecting information about each of the elements included in the restoration. Through research and investigation, it became clear that the causes of the damage to the building were due to... A defect in the sanitary facilities and bathrooms also led to a malfunction in the electricity system due to water leakage. These committees are responsible for providing the quantities and prices of materials that will be used in the process of restoring the building. Each team

TechHub Journal Vol. 7, pp.218-236 (2024)
ISSN: 2810-2800
www.techhubresearch.com

A work report is submitted according to its specialization, as well as determining the most appropriate time limit for completing the work. According to the committees' opinion, the most appropriate time for completion is one year.

2- Function analysis: This process concerns the analysis of the functions of the materials used, labor wages, and the possibility of reducing costs to a reasonable extent without compromising or dispensing with the necessary functions of these materials. It is also carried out by a specialized team with experience in the prices, quality, and type of materials used in restoration.

3- Finding alternatives: The tender or contract concluded with the implementing agency may guarantee that the materials used in the restoration of the building, within certain conditions and specifications, are of high quality. A specialized work team can be sought to undertake the task of investigating the most appropriate prices for the materials used and conform to the required specifications, as There are materials such as wallpaper that can be obtained at reasonable prices, high quality, and ease of installation. The same applies to the floor of the building. It is possible to obtain (carpet) for the floor that matches the required specifications. It is resistant to fire and moisture and at a reasonable price. It performs the same purpose stipulated in the contract. It is possible to reduce costs for these two elements. Of the materials needed for restoration while maintaining the required quality.

4- Work wages: It is possible to employ workers with a high degree of skill, even if the wages of the skilled worker are high compared to the unskilled worker, because errors in the work if unskilled workers are used in the restoration process lead to failure in costs, the result of which is repeating the work again and burdening The item to be restored has additional costs resulting from failure of the work the first time.

5- Removing rubble: This work requires removing rubble as a result of removing the old building's roof floor and disposing of it for the purpose of cleaning the place and covering it with flange and sticker material, as well as getting rid of old wallpaper, removing old carpet, breaking down bathrooms, and raising.

The rubble is for the purpose of completely repairing the sewers and completely re-coating the walls with ceramic and rehabilitating them completely. These works must be done in a sequential manner and within a record time, and all the rubble is completely removed and then the restoration process begins. One of the mistakes that was noticed by the executing company is that it threw the rubble from the roof of the building. Directly to the ground, which led to damage to some of the building's glass, in addition to the dust that covered the building's walls. This process is considered one of the reasons for cost failure, which led to additional work in repairing window glass and cleaning dust from the walls and floor, in addition to wasting time. It means burdening the restoration element with additional costs that could have been avoided by doing the right thing from the first time, as it was possible to use another means for the purpose of throwing waste and rubble from the roof of the building, such as drums with (200) liters emptied from both sides and formed together from the top of the building to the bottom. In which rubble is thrown from the top of the building to the bottom without causing any collateral damage to the building. This was suggested to the implementing agency and it carried out this experiment, but after the expected damage had occurred.

6- Planning the work: The time limit must first be set for completing the entire restoration process, which is one year, and in light of the information collected from the work team that submitted its report to the implementing agency, a budget must be set for the costs for all its details, which are the necessary materials.

For restoration and work fees, identifying obstacles and finding solutions to them, as well as determining the time limit for each stage of restoration so that the timing of completion of the

TechHub Journal Vol. 7, pp.218-236 (2024)
ISSN: 2810-2800
www.techhubresearch.com

work is within one year and avoiding wasting time so that the delivery of the building is within the specified time. Implementing the work through the application of value engineering requires setting a budget for the costs of materials and wages necessary for the restoration process, as well as determining the time required for the steps to start the work, which must be sequential to avoid the occurrence of failure costs and completing the restoration process within the optimal time specified for implementation, which is one year. Therefore, we will explain through the table Listed below is the mechanism for implementing the work according to sequential steps, as well as the costs for materials and wages:

Table (1)

Implementation steps	specified time	Work wages	Cost of needed materials	Cost of materials according to the traditional method	Savings
1-Raising the old flooring of the building's roof and removing the rubble, as well as removing the old wallpaper and carpet	One month	36 million dinars	-	-	nothing
2-Covering the building's roof with flannel and sticker material	Two weeks	30 million dinars	The Flancoat material is priced at two million dinars, the Schnitker material is at a price of twenty million dinars, in addition to the sand material at a price of five million dinars.	Thirty million dinars	nothing
3- Secondary ceilings were made for the ninth floor, then the eighth, and so on down to the ground floor	Two weeks for the first floor	Forty million dinars	The secondary roofs were Turkish-built at a cost of 32 million dinars	Secondary roofs according to German construction, built at a cost	118 million per floor * 11 floors = 129800000

			per floor, so the cost of 11 floors equals 352,000,000.	of 150 million dinars and labor costs of 80 million dinars	Labor wages are 40 million dinars per floor * 11 = 44,000,000 and the total savings = 173800000
4-Packaging including wallpaper starting from the ninth floor down to the ground floor	Two weeks for the first floor	Ten million dinars	Wallpaper from an Indian manufacturer, Coplan type. The price per square meter is 7,000 dinars for an area of 1,792 square meters. Wall area per floor = 12,544,000 for the first floor * 11 floors = 137,984,000	Spanish type wallpaper, price per square meter: 15,000 for an area of 1,792 square meters = 26,880,000 per floor	The difference in cost per floor is 14,336,000 * 11 = 157,696,000
5- Covering the building's floor with carpet	Two weeks for the first floor	Eight million dinars per floor	Carpet from an Egyptian manufacturer. The price per meter is (10) thousand dinars for an area of 2000 square meters per floor = 20000000 * 11 = 22000000	Carpet is a Turkish type. The price per square meter is (18,000) thousand dinars * 2000 = 36000000 per floor * 11 floors = 39600000	The difference in cost for each floor is 16,000,000 * 11 floors = 17,600,000, representing the total difference.
the Total savings					1805496000

Source: Prepared by the researcher

Also, the work can sometimes be simultaneous to shorten the implementation time, such as when the installation of secondary ceilings on the ninth floor is completed, and work begins to install the secondary ceilings on the eighth floor simultaneously with the beginning of work on

installing the wallpaper on the ninth floor, and so on. We notice from following the value engineering approach that there are cost savings in the prices of materials as well as labor costs, as the German-origin wallpaper stipulated in the specifications under the contract requires additional materials and additional work to install it. It is also of a thickness that does not suit the walls of the building and is of high cost and can be dispensed with. In another way, it is of high quality and less expensive in terms of work and materials, thus saving costs while preserving the functions performed by the materials needed for restoration.

Conclusions

1- Value engineering is a technique or method that is implemented through an organized collective effort, the goal of which is to obtain the best performance at the lowest cost. Through job analysis, work was done to create and innovate alternatives to perform those jobs while maintaining the level of quality and working to improve it. Therefore, value engineering is the realization of value, and its means for that is job analysis and the creation or innovation of alternatives, or what is called creativity, and (job analysis and creativity) are the essence of value engineering.

2- Value engineering helps in implementing a cost leadership strategy, as it will reduce costs without compromising the quality of the product. It also helps in applying the differentiation strategy, as it will protect the economic unit from the possibility of producing products that do not suit customers. The ability of customers to cancel or reduce the value of functions that do not add value to the product, and that the advantages of integrating Cost leadership and differentiation strategy together will help the economic unit create distinctive products at competitive prices.

3- Quality costs include two types of costs. The first section is called the costs of good quality, which is represented by the costs of prevention and evaluation. The second section is the costs of poor quality, which is represented by the costs of failure of both types, internal and external. External failure is more damaging to the company's reputation than internal failure, and it has (i.e., external failure) Visible costs

They can be calculated and hidden costs cannot be calculated. External failure occurs as a result of defective products reaching customers, thus losing customers and losing market share.

4- There is a similarity in the dimensions of quality and types of value, which indicates that the goal of both is to work on improving the product and giving it better qualities, which creates an incentive for customers to choose this product, as well as creating qualities for the product that meet the needs of customers for the purpose of reaching the largest percentage of customer satisfaction, which increases the market share. For the economic unit.

5- Value engineering has a role in reducing costs in general and in reducing the costs of failure in particular through research, development, design and innovation processes and finding alternatives that achieve lower costs while maintaining the quality of products, follow-up and review processes after implementation, and reducing errors and failure before starting the production process and doing the thing. It is true from the first time that these value engineering processes begin before the start of the production process and end with delivering the product to the customer free of defects and at a high level of quality at the lowest possible costs and at competitive prices, which gives the economic unit a competitive advantage in the presence of similar products that are of lower quality and higher in cost than It leads the economic unit to impose its control over the market with its product with distinctive characteristics.

Recommendations:

1- Following modern cost techniques, the most important of which is the value engineering technique, has positive effects on the policy of the economic unit, whether it is profit-oriented

or not, which supports its continuation and progress towards achieving its goals, whether they are in reducing costs to the lowest level or in achieving high profits and a competitive advantage.
.
2- Increasing scientific and practical awareness in following modern technologies to reduce costs, develop and increase products, by holding seminars and meetings for capital owners, businessmen and major companies operating in all fields of service, industrial, commercial... etc. and abandoning the old traditional methods of cost management.
And developing the work method to improve the economic situation in the country, reduce the waste of resources, and make optimal use of these resources.
3- Encouraging administrators and people with specializations to obtain accredited certificates in the field of value engineering. Obtaining these certificates will make them leaders in the field of value engineering to build a broad base of value engineering implementers who can be benefited from in both
the public and private sectors.

Sources

First - Arabic sources:

1- Al-Azzawi, Muhammad Abdel-Wahab, "Quality and Environmental Management Systems," first edition, That Al-Salasil Printing, Publishing and Distribution, Kuwait, 1990.
2- Al-Samarrai, Manal Jabbar Surur, "Strategic Cost Management," second edition, Al-Jazeera Printing, Publishing and Distribution, Baghdad, 2019.(80)
3- Al-Yousifi, Abdul Aziz Suleiman, "Value Management: Concept and Method," third edition, Kingdom of Saudi Arabia, 2000.
4- Al-Sheikhili, Raghad Hashem Jassim, "The role of quality costs in reducing the competitive gap, a field study in the General Company for Battery Manufacturing," Master's thesis in accounting sciences, College of Administration and Economics, University of Baghdad, 2006.
5- Al-Mousawi, Abbas Nawar Kahit, "Integration of the techniques of target costing and continuous improvement and their reflection in competitive strategies for the economic unit," Doctor of Philosophy thesis in accounting, College of Administration and Economics, Al-Mustansiriya University.
6- Kanduri, Imad Muhammad, "The role of cost management in improving the value of the product using the value engineering method, an applied study in the General Company for Leather Industries," Master's thesis in accounting sciences, College of Administration and Economics, University of Baghdad, 2006.
7- Al-Samarrai, Manal Jabbar Sorour, "Quality Cost System... Evaluating the efficiency of quality control and their impact on reducing costs, an applied study in one of the laboratories of the general facility for the manufacture of batteries, Babylon Laboratory (2)," Doctor of Philosophy thesis in Accounting, College of Administration and Economics, University of Baghdad, 1998.
8- Al-Tamimi, Iyad Fadel Muhammad, "Total Quality Management and its Impact on Employees' Job Performance, A Field Study in a Sample of Jordanian Commercial Banks," Second Scientific Conference, College of Management, Economics, and Administrative Sciences, Applied Sciences Private University, Amman, Jordan, 2006.

Second: Foreign sources:

1-Dhillon , B.S., Engineering and Technology Management Tool and Application Artech House , 2002 .

2-Hill, Terry , Operation Management Strategic context & Managerial Analysis 2 nd . ed , Macmillan presstd , 2000 .
3-Horngren , Charlest T. Foster , George , & Srikant M.Dater, Cost Accounting Amanagerial Emphasis , 10 th. ed prentice Hall , Inc. 2000 .
4-- Horngren,Charles,Datar,Srikant M,,Rajanm,Madhav V._,2018,"**HORNGREN S COST ACCOUNTIG AMANGERIL EMPHASIS**" 16th Edition, Global Edition L.E.G.O. in Italy.
5-Milles , Lawrence D. Techniques of Value Analysis and Engineering 3rd ed . Eleanor Milles Walker , 1961 .
6-Russell , Roberta S. Taylor III , Berrard W. Operating Management 3rd ed . prentice Hall – Inc. USA . 2000 .
7-Juran ,J.M . Gryna, Frant .M & Binghan , R.S. , Quality Control Ltandbook 3rd , Mcaraw – Hill 1974 .
8-Hilton , Ronald W. Managerial Accounting :Creating Value in Dynamic Business Environment 8th ed , Irwin Mc Graw –Hill , New York ,2009 .