



Impact of Applying Methodology Value Engineering (VE) in sustainable in industrial project: A case study ENJAZ Maintenance and Training Company / Basra / Iraq

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Abstract

The value analysis stage is considered one of the most important stages of the project to find available alternatives in the project environment to complete the project at the lowest cost, highest quality, and in the shortest possible time and according to the implementation schedule.

The industrial project is one of the most important projects that achieve a competitive advantage in terms of cost, quality and time, as the value engineering methodology is considered one of the most important modern technologies to save costs and focus on function.

Value Engineering(VE) is six successive stages defined and defined for each stage a group of operations that are carried out through a professional and multidisciplinary team and under the guidance of the owner or investor and through a clear sequence chosen as a result of previous experiences and results and depends mainly on improving quality and performance and eliminating unnecessary costs necessary to achieve sustainable competitive advantage from the environmental, economic and social aspect to achieve market demands and according to consumer desires.

The concept of comprehensive maintenance is maintaining machinery, equipment, buildings and industrial networks in good condition and suitable to cover the required production with the necessary efficiency and quality, at the lowest possible costs.

Case-Study stage: (Enjaz Company) It is the stage in which the results of the previous stages are achieved and implemented, as well as follow-up of what is being implemented, verification of expected results, overall evaluation of the experiment and keeping and recording everything related to the study.



Maintenance of machines and machines is one of the most important alternatives to the industrial project, where the training of workers works according to a planned approach to save costs and achieve high quality and in the shortest time.

Keywords: VE, CLC, FAST, LED, NDT.

أثر تطبيق منهجية الهندسة القيمة (VE) في المشاريع الصناعية المستدامة دراسة حالة شركة انجاز للصيانة والتدريب – بصرة - العراق

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المستخلص

تُعد مرحلة تحليل القيمة من أهم مراحل المشروع لإيجاد البدائل المتاحة في بيئة المشروع لإنجازه بأقل تكلفة وأعلى جودة وفي أقصر وقت ممكن ووفقاً للبرنامج الزمني للتنفيذ.

يُعد المشروع الصناعي من أهم المشاريع التي تحقق ميزة تنافسية من حيث التكلفة والجودة والوقت، حيث تُعد منهجية هندسة القيمة من أهم التقنيات الحديثة لتوفير التكاليف والتركيز على الوظيفة.

هندسة القيمة (VE) هي ست مراحل متتالية، تُحدد فيها لكل مرحلة مجموعة من العمليات التي تُنفذ من خلال فريق عمل محترف ومتعدد التخصصات وتحت إشراف المالك أو المستثمر ومن خلال تسلسل واضح يتم اختياره بناءً على الخبرات والنتائج السابقة، وتعتمد بشكل أساسي على تحسين الجودة والأداء وإزالة التكاليف غير الضرورية اللازمة لتحقيق ميزة تنافسية مستدامة من الناحية البيئية والاقتصادية والاجتماعية بما يُلبي متطلبات السوق ووفقاً لرغبات المستهلكين.

مفهوم الصيانة الشاملة هو الحفاظ على الآلات والمعدات والمباني والشبكات الصناعية بحالة جيدة ومناسبة لتغطية الإنتاج المطلوب بالكفاءة والجودة اللازمين، وبأقل التكاليف الممكنة. مرحلة دراسة الحالة: (شركة إنجاز) وهي المرحلة التي يتم فيها تحقيق وتطبيق نتائج المراحل السابقة، بالإضافة إلى متابعة ما يتم تنفيذه، والتحقق من النتائج المتوقعة، والتقييم الشامل للتجربة، وحفظ وتسجيل كل ما يتعلق بالدراسة.



تُعد صيانة الآلات والماكينات من أهم بدائل المشروع الصناعي، حيث يتم تدريب العاملين وفق منهجية مدروسة لتوفير التكاليف وتحقيق الجودة العالية وفي أقصر وقت.

الكلمات المفتاحية: هندسة القيمة، المعهد الدولي لمهندسي القيمة، دورة حياة الكلفة، مخطط فاست، الأنشطة المشاريع المستدامة، المعهد الأمريكية للمعايير

1. Introduction

The Value Engineering (VEM) methodology is one of the most important and latest techniques that have achieved synergy of knowledge between the engineering and management disciplines for its effective contribution to improving the value-added indicator of the project through improving quality and reducing cost, which means improving the added value. It has been implemented rapidly by many international organizations in many from the technologically advanced countries, it is “an organized collective effort to analyze the functions of the project and its conformity with the objectives and requirements of the owner and the beneficiary and then create alternatives that perform these functions and achieve the objectives at the lowest possible costs without compromising the quality and basic functions.” It is a modern technology and a well-known methodological science that has proven its position because it helps projects reduce costs Improving quality and achieving sustainability at the same time.

The value engineering method is a well-studied scientific method that has become used effectively by many international and local engineering companies and institutions, and its success is due to the fact that it makes it easier for the project to make decisions and helps it obtain the largest financial return and at the same time achieve the required goals and tasks, taking into account obtaining the jobs it desires. Owner such as beauty, environment, safety, flexibility, sustainability and other important factors that meet or exceed the expectations of the owner and the beneficiary. Value engineering during the design phase of new construction projects can contribute to achieving project sustainability, and ultimately the cost of operating projects and their sustainability during the project life cycle.

A project is a temporary effort to produce a unique service, product, or outcome. A project document is a brief description of what is required

The concept of value analysis appeared during the Second World War, specifically in the year 1947 by the engineer (Larry Miles) who works in the American company (General Electric) and his mission or preoccupation was - as it is said, is to provide alternatives as a result of the scarcity of spare parts for some devices



and equipment in The company because of the war, and began to focus on the function (Function) for each product, hence the emergence of the method of "value" based on Function for each product, hence the emergence of the "value" method based on Function Analysis, which distinguishes it from other management techniques. In the year 1954, the application of this method (or Value Engineering) moved to reflect the nature of the engineering work of this technology to the design stage, and then the American Society of Value Engineers (save) was established in 1958 and after that it spread at the level of the United States, especially in the field of engineering and construction That was in the year 1963 AD.

Study stage: This stage consists of the real and actual body for the study of value engineering, which are six stages, as mentioned above, according to the International Institution of Value Engineers (SAVE International), which will be detailed later.

To study any engineering project or product for the purpose of improving performance and raising the level of quality, it is necessary to follow the so-called (Job Plan), which usually consists of five logical sequential steps. [1][2][5][30][29].

2. Scientific Research Methodology

2.1. Research problem

There are a lot of mistakes that occurred and occur in most projects in all stages, especially in the early stages, and it is rare to get an integrated project work that satisfies the owner and the beneficiary.

Will value engineering succeed in achieving an integrated team to collect information and find available alternatives in our Iraqi society so that costs are reduced and quality is achieved where the primary goal is the function of each stage of the project.

Many Questions that looking for answers:

1. What need for full knowledge of the stages of value engineering?
2. Studying the project environment to provide alternatives to reduce costs (product/maintenance/training alternatives), can do that?
3. Providing spare parts (industrial assembly, recycling), can do that?
4. Alternatives to products using the local product or maintenance of equipment and machines to reduce the cost of the project, can do that?



5. Realize a good quality lower cost and time in any project?

2.2. Importance Research

Project cost management and project quality management are among the most important processes and basic requirements for project success. Cost planning in parallel, quality planning and making adjustments in cost to suit the expected project quality, especially service projects. Quality management is the process of translating the quality management plan into executable quality activities that integrate special quality policies in the project, the main benefit of this process is that it increases the possibility of achieving quality objectives, as well as identifying ineffective and unnecessary processes, canceling some of them, finding the necessary alternatives, and identifying the causes of poor quality.

The importance of the study stems from the importance of the value engineering methodology and process engineering and the link between the project environment, which is one of the important topics in modern management as it plays an important role in the success of industrial projects at the lowest cost, customer satisfaction and competition in the market.

Industrial maintenance is one of the most important alternatives to reduce project costs, train workers, and at the same time maintain project quality and reduce time. Where creativity and brainstorming achieve an important step in the achievement and success of the application of value engineering in the maintenance of equipment and the training of human resources in maintenance in order to achieve cost reduction for the project.

2.3. Objectives Research

- ❖ Structured review for value improvement using multidisciplinary teams of specialists knowing different aspects of the problem under study.
A function-oriented approach to identifying the essential functions of the system, the product or service under consideration and the cost associated with those functions.
- ❖ Creative thinking using recognized techniques to explore alternative ways of performing jobs at lower cost, or improving design
Remove or modify unnecessary items for required functionality.
- ❖ Adding elements that achieve the required functions that have not yet been achieved.



- ❖ Change items to improve quality or performance to meet desired levels set by the owner/user.
- ❖ Using the weight matrix for various materials with standard specifications, whether construction, electrical materials, or industrial raw materials to choose the best alternative that achieves the success of the project.[5][16]

3. The Theoretical Side

3.1. Value Engineering

Value engineering as: “An analytical study with a specific approach, conducted by a multidisciplinary team on a product, project or service to identify and classify the functions performed by the project to achieve those functions in better ways or lower total cost or both through innovative alternatives without compromising the basic requirements and quality.” Value engineering is a broad concept and does not mean engineering.[2][3][15]

3.2. Value Engineering Methodology

Value engineering or value management is an effective method of problem solving (Problem Solving Methodology) that has proven its feasibility in most of the developed countries of the world, as it initially focuses on effectiveness by analyzing the function or functions.

(Life Cycle Cost, LCC)

(Effectiveness) by analyzing the function or the jobs to be achieved and determining the goals, needs, requirements and desires, (Goals functions to be achieved, Needs, Requirements and Desires), and then looking at the efficiency (Efficiency) by defining the quality standards that make It is the most acceptable product, and finally strives to obtain it at the most cost-effective possible. And costs here mean the total costs, not just the primary. [1][17]

3.2.1. Value Analysis

Value analysis, value engineering and value management are the names of a single concept and a specific approach aimed at finding practical and useful solutions that raise quality and reduce cost at the same time. These are conventions that have been agreed upon by specialists in the field of value.



3.2.2. Value

Value is the achievement of benefit and benefit for the beneficiary and the user. The main purpose of the studies is to improve the value, which means obtaining higher quality at the lowest possible costs. Since each person has a special interpretation of the meaning of value, some confuse the meaning of value with the meaning of price or cost, and the value is often measured on the basis of cost only, although the increase in cost does not necessarily mean an increase in value. What is functional? In order to obtain a true measure of value, all of the following elements must be taken into account: function It is the main purpose or goal for which the product, project, or administrative process was found.[3][18]

3.2.3. Quality

It means fulfilling the requirements, expectations and desires of the beneficiary with their suitability for the job total life cycle cost (LCC):

It means all costs incurred during the life of the product or project, including operating and maintenance costs. And often the initial costs attract the customer, although forgotten usually ranges between 10-30% of the total cost in engineering projects.

If the measurement of the value can be found in the relationship between these elements. It is obvious that raising the efficiency of performance and improving quality while reducing costs can obtain the highest value. The following equation shows the purpose.[13][9][21]

3.2.4. Value Engineering workshop

The value study (workshop) usually takes five days to conduct at a rate of (40) working hours, and this does not include the preparation period or the application, knowing that the duration of the study depends on the size of the project and the availability of information and ease of obtaining it, and it also depends on the stage of the project. The design on which the study is carried out, and the duration must be determined in the light of the project's circumstances and data.

1. Stage of collecting information.
2. Stage of job analysis.
3. Stage of creativity and brainstorming.
4. Stage of evaluation and development of ideas.
5. Presentation and follow-up phase.
6. The stage of application and implementation.[1][4][10][12]



3.3. Alternatives

1. The importance of maintenance for the equipment and machines used in the project in the success of value engineering for the project environment and how to train workers to maintain it contributes to reducing the cost of the project.
2. The importance of training workers on all equipment contributes to the completion of many projects as a result of acquiring skills and technical ability to maintain equipment.

The trainee should be able to:

- Knowing the basic principles and terminology of maintenance.
- Knowing how to plan and implement the maintenance plan.
- Knowing the types of maintenance commonly used.
- Knowing how to choose the right number, spare parts, and labor.
- Knowledge of management and implementation of maintenance work using computer programs.
- Knowing the methods of theoretical tests and methods of implementing practical exercises.[5][11][4]

3.4. Contents of the Training Unit

1. Theoretical knowledge.
 - ❖ Basic principles and terminology of maintenance.
 - ❖ Types of maintenance commonly used.
 - ❖ Planning, organization and implementation of maintenance work.
 - ❖ Planning and implementing a preventive maintenance plan for a facility.
 - ❖ Management and implementation of maintenance work using computer programs.
 - ❖ Measurement of work and monitoring of maintenance work.
2. Theoretical knowledge questions and their typical answers.
3. Practical exercises.

Given the paramount importance of maintaining electrical and mechanical systems for machines and equipment, we will talk and address in this unit the facts, vocabulary and information about maintenance, its types and applications.

The trainer will present the unit through the use of various educational and practical means.



The trainer will present the unit's goals and the procedures by which students are divided into equal groups, taking into account individual differences. He will define for each group the goals that you will work on, and a time period will be set for completing the required.[6][4][3][13]

3.5. The Relationship between maintenance and production

Production officials try to maintain the level of production in quantity and quality without stopping or malfunctioning in machines that exceed the planned limit in the production unit, as any emergency stop leads to:

- ❖ Decreased production.
- ❖ It does not meet the required specifications.
- ❖ Breach of engagements and contracts.
- ❖ Loss as a result of rejections.
- ❖ Fines for breaching delivery times.
- ❖ The unit has a bad reputation.

And in order for the unit to make a profit at the end of the year, this depends at first on choosing the least productive and economic unit that meets the purpose and making major modifications to it in the design to suit its conditions, with the aim of reducing the price of the product and competing with the markets, and therefore these goals are linked to maintenance operations and determined accordingly It has its goals and needs.[7][1][12][19]

3.6. Maintenance Responsibilities

- ❖ Full readiness to carry out emergency maintenance work that was not planned before.
- ❖ Executing the planned operations according to the specified program without hesitation or interference by those responsible for production.
- ❖ Operating the main and subsidiary maintenance workshops economically in the sense of relying on them only in cases where it is not possible to obtain spare parts.
- ❖ The ability to operate the factors and causes that reduce production efficiency.
- ❖ Carrying out sudden and periodic inspections and organizing historical records of machines and equipment.
- ❖ Supervising spare parts and raw materials and controlling the balance.



- ❖ Carrying out modifications and installation works for new equipment with the knowledge of the department or assigning it to external contractors.
- ❖ Preparing research and technical studies that raise the productive efficiency of the project while reducing maintenance costs.
- ❖ The training process: Training is represented in the reality of an integrated and continuous process that includes four basic stages that should be understood and absorbed by the project's human resources management, which are identifying training needs, planning training, implementing training, and evaluating training.

The stage of training implementation is considered one of the most important, dangerous and most decisive stages of the training process, as it transfers it from the reality of concepts and perspectives to the reality of field work, as well as showing the extent of good and safety of identifying training needs and setting the appropriate plan that is reflected negatively and positively in the entire training process. [8][9][1][18]

3.7. Sustainability Principles

1. Separating industrial and economic growth from environmental degradation.
2. Achieving integration in all environmental, social and economic sectors and setting sustainability policies in the design.
3. Flexibility with the environment and its preservation and enhance the ability to adapt to the design system.
4. Spreading awareness of industrial products and community participation
5. Recycle industrial materials, glass and food waste into agricultural fertilizers.[10][11][9][31]

4. Case Study

(Case Study) for Enjaz International Company for Services and Training conducts maintenance

4.1. Value Studying



It is a comprehensive value-analytical study of administrative work in organizations, bodies and associations, such as studies that are conducted for the purpose of improving the performance of institutional work by raising the productivity of human performance, reducing lost time, simplifying work methods, legalizing and activating management at all levels of daily business values administrative. [21][6][30]

The most important actions

1. Value engineering methodology (VE) for all types of construction and industrial projects to ensure cost reduction and quality assurance by finding modern technical alternatives and using computer programs to achieve project success and maintenance alternatives for machines and equipment and training workers.
2. Strategic dealing and improving partnership with suppliers.
3. Applying the value engineering methodology to achieve alternative energy alternatives for a clean environment free of emissions.
4. Finding alternatives that achieve cost reduction, ensure the quality of the value index, and develop creative thinking and innovation for all value engineers.
5. Orientation to environmentally friendly projects, the green belt, and the alternative photovoltaic energy technology LED (light –emitting diode) such as solar cells for lighting that consume little power, meet the basic requirements required and achieve full specifications for the beneficiary.
6. Achieving the social, economic and environmental sustainability of the projects.

The need to develop and formulate intensive training development programs for the development of employees and to ensure the reduction of costs.

7. Restructuring the supply system to ensure the creation of integration between networks of value chain activities.
8. Applying the FAST scheme to cancel or reduce all unnecessary activities in the project.
9. The value engineering methodology must be prepared with the economic feasibility study of the project and included in the project document and applied in the design phase of the project to achieve the success of the methodology by achieving positive results and achieving the project objectives at the lowest cost and highest quality, Time specified for the project by integrating the engineering and management concept and the



successful application of the methodology by choosing the alternatives that achieve the objectives The project .

all machines, machinery and electrical and mechanical equipment.[2][3][11]

- ❖ An international company specializing in the field of engineering training, the company was established to provide engineering training services in the fields of

NDT, API, CWI, CSWIP, ASME, PMP, ISO.

- ❖ NDT - Non-destructive testing

Detecting defects in materials (welding) and according to the specifications in force in international standards.

- ❖ API American project International
- ❖ CWI Welding Certificates International
- ❖ ASME (American of standards and specifications for engineering designs).
- ❖ PMP project management professional.
- ❖ ISO International Organization Standardization.
- ❖ OSHA Occupational Safety & Health Administration
- ❖ AQ, CQ (Assurance Quality, Control Quality)

Enjaz International Company for Training an Engineering Services provides an environment for the project at the lowest cost through the maintenance of machinery and mechanical equipment for oil projects and the training of professional, technical and engineering cadres on various skills.[25][32]

The following questions to determine the success of implementing the standards of the PMBOK project environment and finding alternatives through maintenance (for all equipment and machines) that work in the project at the lowest cost and available in the project market and training that meets all the skills and capabilities of the cadres working in the project.[22][23]

- ❖ Maintenance.
- ❖ Training of human resources (workers) from technicians and engineers for all specialties.
- ❖ Occupational Safety Courses for Workers (OSHA)

Occupational Safety & Health Administration lessons more hours to Explain Important Safety part in work.

4.2. Goals of Enjaz Company



Importance of industrial maintenance:

Industry is one of the main components of the economies of developed and developing countries, and our country has invested very large sums in it. However, these industries and what they contain of machines, equipment, buildings and other properties are exposed to a lot and always to damage, stopping and disappearing, and were it not for industrial maintenance It has continued to maintain its operational position quickly and efficiently because this industry has stopped and which has resulted in a significant decrease in the level of the products and services it provides and has caused a loss of money invested in it.[17]

The concept of comprehensive maintenance is:

Maintaining machinery, equipment, buildings and industrial networks in good condition and suitable to cover the required production with the necessary efficiency and quality at the lowest possible costs.

- ❖ Receipt of the operation request.
- ❖ Detailed job description.
- ❖ Determining the work needs of tools, pieces of dust and materials.
- ❖ Arrange operations in a sequence.
- ❖ Estimate the time needed to work.
- ❖ Determine the time to complete each client.
- ❖ Determine the responsibility to complete the work.
- ❖ Review scheduled times and take appropriate decisions to eliminate work disruption.[11][19]

4.3. Alternatives (maintenance and training)

1- The importance of maintenance for the equipment and machinery used in the project in the success of the value engineering methodology for the project environment and how to train workers to maintain it contributes to reducing the project cost according to the value engineering methodology in the face of economic, environmental and social changes.

2-The importance of training workers on all equipment contributes to the completion of many projects as a result of acquiring skills and technical ability to maintain equipment The training reduces costs as a result of acquiring knowledge for the trainees on devices and machines and to identify the aspects of frequent holidays and the required.[20][30]

4.4. Sustainability



Sustainability is an environmental term that describes how biological systems remain diverse and productive over time, and sustainability in general is the ability to preserve the quality of life we live in the long term, and this in turn depends on the conservation of the natural world and the responsible use of natural resources.[2][10]

The three main pillars:

4.5. Practical procedures for value engineering methodology

1. The necessity of working with the value engineering methodology (VE) for all types of construction and industrial projects to ensure cost reduction and quality assurance by finding modern technical alternatives and using computer programs to achieve project success and maintenance alternatives for machines and equipment and training workers.
2. Applying the value engineering methodology to achieve alternative energy alternatives for a clean environment free of emissions.
3. Finding alternatives that achieve cost reduction, ensure the quality of the value index, and develop creative thinking and innovation for all value engineers.
4. Going to environmentally friendly projects, the green belt, and the alternative photovoltaic energy technology LED, such as solar cells for lighting that consume little power, meet the basic requirements required and achieve full specifications for the beneficiary.
5. The need to develop and formulate intensive training development programs to develop employees and ensure cost reduction.
6. Training considered part of the application of the value engineering methodology and one of the goals of value engineering, and does the training achieve a reduction in project costs.
7. Maintenance considered a main objective to find alternatives (value engineering) by reducing the costs of materials used.
8. The project environment, the project manager and his team are looking to find the available alternatives. The company work to provide those alternatives.
9. The information available to the company useful in the success of the project.
10. The courses offered by the company for the technical aspect.
11. There is an occupational safety course



12. PMP project management programs their multiple courses for project management.
13. The company works to develop human resources in projects through courses. The rate of response to the employees of the companies.
14. There are practical exercises.
15. Company provides a successful environment for a successful project at the lowest costs.
16. The principle of value engineering by finding alternatives through equipment maintenance reduce the cost of the project.
17. Computer courses provide a scientific and practical information base for the success of the computer operations needed by the project.
18. Training programs offered by the company modern according to international standards.
19. A great demand for companies' affiliates for the programs of the Enjaz Company for Services and Training.
20. Curriculum of the courses modern according to international standards.
21. Quality courses (AQ, CQ) [24][25][30][31]

5. Conclusions

1. The industrial project is considered high-cost. The important thing in achieving the project's functions is to reduce the cost of the maintenance project by providing alternatives to achieve jobs as quickly as possible and with high quality.
2. Maintenance is one of the most important alternatives in the industrial project, and through it the process of assembling spare parts at the design stage ensures the reduction of project costs.
3. Maintenance training for equipment and machinery is one of the most important steps to achieve the value methodology in finding alternatives for maintenance, saving time and reducing unnecessary jobs in the industrial project.
4. Specialized maintenance companies have achieved great success in applying the value engineering methodology for the best alternatives: maintenance, industrial training, maintenance assembly, spare parts and parts recycling for the purpose of successfully reducing costs, achieving jobs, achieving a sustainable competitive advantage for the industrial project, achieving low economic costs and in less time, and achieving the



social aspect of any satisfaction project. The society for which the industrial enterprise is established.

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