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VALUE AND QUALITY IN ARCHITECTURE: A STUDY OF THE PRINCIPLES OF VALUE ENGINEERING

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ABSTRACT

Value Engineering is an analytical study of a specific method. Its processes are conducted by a multidisciplinary working groups in order to come out with a certain product, design, project, or service, with the aim of identifying and classifying functions performed by that product, project, or service. All that is for the purpose of the betterment of the execution of those functions, or the reduction of the total cost, or both, through the search for innovative alternatives without compromising the basic requirements, on the bases of the principles of functional budget between the three elements of production; performance, quality and cost, Cooper, R. et al (1997). This methodology has proved highly efficient in solving problems based on its ability of functional analysis, and makes the best investment out of the available resources in a way that does not affect the purpose or function of the project, besides that it rapidly helps in giving results and proposals. All what mentioned above makes *Value Engineering* to be able to improve the tasks and actions, and the generation of creative ideas, and upgrading products or projects, as well as increasing its functional and aesthetical aspects. This improvement relies on a work methodology or a roadmap, where such approach boots its performance and productivity development based on the idea of combining the targeted investigation productivity and the savings in costs without compromising quality and basic functions expected by customers and producers on the other hand. The qualitative upgrading of projects and services is possible and available, that could be achieved by raising its value by improvement and development, while reducing their total cost, without affecting the necessary requirements and needs, and the optimal exploitation of resources is as well increasingly demanded day after day, since they are mostly considered as depleted resources.

For the application of *Value Engineering* production processes, the execution of projects and other aspects *Value Engineering* urgently demands the survival in a severe global competition. In areas related to the applications of architecture, the achievement of quality is not only limited to design processes, construction and the trial of transforming the design into reality. With respect to the quality of equipment and materials employment the achievement of quality extends to include all of the above in addition to trying to achieve quality through the way the building is used and the quality of the method of operation and maintenance. hence the significance of *Value Engineering* in achieving a comprehensive quality through the stages of design and execution, as well as the achievement of that during the operation phase, an issue which the study is aiming to explain, Donald E. Parker,(1998).

Key words: Value, Quality, Architecture, Value Engineering. Projects, function

1- Value Engineering; Introduction and prelude:

1-1 The notion of value engineering:

Value Engineering is considered a distinctive Engineering methodology in studying, analyzing, evaluating projects, and offering suggestions necessary for uplifting the performance, increasing the value and reducing the cost. *Value Engineering* is a new technique and a methodological science that proofs its efficiency since it reduces cost as well as improving quality at the same time. Engineering does not only mean the already known technical notion, but also it extends to have a broad meaning and notion, Donald, E. et al (1998). *Value Engineering* is a functional engineering that aims to re-study the performance of the function or purpose of a certain product, project or service, and the much the role assigned performed better and at the lowest cost. Linking this concept with Engineering arose due to its relationship to quality and its operations, which mainly depends on Engineering and good specifications such as tolerance, strength and quality of materials used. *Value engineering* also an organized collective work performed by a specialized team through a scientific methodology aiming at analyzing the functions of the project or product and its components. *Value engineering* costs and conforms to the objectives and requirements of the product or the owner and the beneficiary on the other hand. It then offers proposals, appropriates alternatives that ensure the achievement of these functions at the lowest overall cost, without compromising the level of quality and performance, targeting quality first then performing required work at its fullest form, and eventually saves a lot of money that may be wasted. *Value Engineering* applied as well in the methods of operation and maintenance of the projects completed. *Value Engineering* also characterized by a certain and clear field of work that facilitates the work of the team and helps to focus on achieving the goals that fulfill the public interest, these goals are namely the optimum benefit of the costs and, therefore, the optimum utilization of resources and capabilities, Khudair, (2010). Employing *Value Engineering* aims at raising the value of what is to study by finding the subtle balance between function, performance, and cost - or price, and quality. *Value Engineering* focuses on functional analysis that distinguishes it from other already known traditional methods employed in the understanding of the functions of the product element or project. To see the performance required of it, to identify those basic functions in order to find alternatives that could lead to the same functions at the same level of performance or even better. To eventually come out with the lowest possible cost without compromising quality standards, Beauty or any other basic requirements.

Value Engineering is based on the analysis of the actual value of the product or project before starting implementing the sequential stages of the production, including the overall costs, production stages and execution through the operation programs and the budgets actual costs, as well as alternatives, which are employed in case of compelling obstacles when starting the execution process. *Value Engineering* considered an effective mean that depends on creative solutions in solving problems without affecting the quality and performance. Value Engineering considered a real indicator for the progress of the production processes, execution and careful follow up to preparation and execution cases. They also control value by careful analysis of the elements of the components of that value. Out of all that the much benefit of *Value Engineering* could be appreciated, as it relies on its method on particular issues through an integrated action plan, aimed first and foremost to achieve the highest rates of production and execution pending on the strategic prepared for this in advance, that included the first design stages, Makhlouf, (2007).

1-2 Value engineering goals:

Value Engineering aims to study, analyze and evaluate the performance of the factors of production or project by a team of professionals, architects and engineers with different specialties appropriate to the nature of the product or project, in order to identify and understand the basic functions of each element. To find innovative alternatives that could perform the same functions and have the same quality of performance or even better with the lowest possible cost without affecting the quality standards and other considered standards. When studying *Value*

Engineering focusing during the setup and design process on what is required when performing an element required. Whether it is a product or a project, from the point of view of the user, as well as the goal to which the element is found, so as to neutralize elements that do not add anything new to the performance or the target or that do not lead to an increase in functional capacity. Instead raise the cost; in this case, such elements cancelled or modified by offering alternative or alternatives that perform function or purpose in a better way, Shinnar (2000).

2-Value:

2-1 Value and its relationship to Value Engineering:

Value Engineering aims to undertake value studies; in order to improve value at the lowest possible cost, due to the various interpretations regarding the meaning of the term value. Many tend to get confused between the meaning of value and the meaning of price or cost. Value is often measured on the basis of price only, although the increment in price does not necessarily mean an increase in the value, so first start by studying the notion of value, and then study how to determine or measure it, and study improvement methods instead, Elyousofy (2009).

2-2 The notion of value:

Value is the level that reflects the performance of the product or project for the job required of it compared to its cost, given the cost paid by the beneficiary or the user, who could perceive whether that product or item is of good value or it is not. The level of performance of a particular commodity would be of a good value fulfilling the function to which it manufactured for, only if that level of performance is at a reasonable cost, and vice versa, Elsalmy (2006). Value in the viewpoint of *Value Engineering* defined as the relationship of function or performance to the price, as that represented by the following equation:

Value = Function or performance / cost or price, Alishesh (1997).

2-3 Value and benefit:

All what needed by human is of benefit, but not necessarily, that all what is of benefit would be of value. Goods and free items or goods and non-economic items are available goods enough to satisfy all who demand them, such goods are, therefore, not rare, since they acquire benefit and interest, but without value. The air, for example, has a great benefit; but has no value economically unless paid for to get it. Whoever asks for air gets the quantities he wants, while a commodity such as gold has little benefit to the public, however, it has great value because it is rare and not easy to get only in little quantities, Elyousofy, (2009). Therefore, it can be said that utility is a phenomenon linked to the need, while value is associated to scarcity, and if needed it creates benefit, and if benefit is what makes value to the commodity, this value should, therefore, depend on the abundance or scarcity of commodity, Abdel Meguid, (2010).

2-4 Value and Price:

Many consider *value* and *price* are synonyms, using one for the other, but this is incorrect. Price is one the criteria of *value*, but *value*, does not necessarily mean the same thing to many people, everyone body has his own understanding to *value*, influenced by several factors, including: location, time, resources, supply and demand situation, and some other factors, as what is of a *high value* to someone may have a *lower value* to the other. Value is what is deserves by something for the cost to get it and own it from the standpoint of the buyer. The *quality of value* measured by the relationship between the *paid price* and the *payable price*, expressed in the following equation:

Value denotation= Price or Cost/Worth price, (Alishesh 1997).

The result of this equation is an indicator to the level of value. The more the result approaches the number one (1), the better it is indicating a *high value*. That is to say, the closer the result between the *cost* and the *payable price*, it becomes an indication to *value quality*, and whenever the result increased it becomes an indication to *weakness in value* and the lowering in level. This is what focused on by value studies where the *weakness in value* and the *value lifting* tackled through cost cutting. *Payable price* lifting by the increment in jobs performed by the item

through the development and improvement processes during the design stages and in design decision-making cases, Shinnar, (2000). What is meant by value here is the economic or material value, and this what could be divided into four categories:
1 - The value of cost price.
2 - Use value benefit.
3 - Exchange value or barter.
4 - The value of consideration scarcity.

2-4-1 the value of cost price:
The value of cost price is the total amount paid to get goods or services or items or products, which includes all direct and indirect costs, spent in order to own them during acquisition period. This includes the cost of research, development, raw materials, labor, services, administrative expenses, handling, storage and all that endures expenses for production for the owner of the building. That includes the price of land, construction costs, and the preparation of drawings, operation and maintenance expenditure to other costs, Alishesh (1997). The *value of cost price* could also be defined as the total amount spend to get something and possess it; meaning to say it is the sum of the total amount of money required to obtain goods or services, whether these amounts are directly or indirectly, over the whole lifespan of the commodity, Shinnar, (2000).

2-4-2 Use value benefit:
Use value benefit is the full benefit resulting from the possession and use of something through the afforded capabilities and the functions performed by owners or efficient users, Alishesh, (1997), or it is full benefit resulting from the possession and ownership of something through capabilities it provides to its user or owner, Shinnar, (2000).

2-4-3 Exchange value or barter:
Exchange value or barter is the value resulting from the containment of the product to properties, capabilities and functions that makes it useful and beneficial, which in turns makes it viable to exchange either to a product or cash, depending on the extent of its usefulness to exchange, Nabeeh (2004). *Exchange value or barter* is as well a value resulting from the containment of something to properties and capabilities making it useful for others; thus viable to exchange, Alishesh (1997).

2-4-4 The value of consideration or scarcity:
The value of consideration or scarcity is the property or feature of something, as scarcity, aesthetical appearance, psychological or historical relationship; which makes owning it an objective and an element of attraction to impress others. An exemplar of this, the value of a painting for a famous artist, or the value of a rare souvenir postage stamp, or other similar things, Nabeeh (2004).

2-5 The payable price:
The payable price is the lowest price or cost that can be paid for getting a performance or a desired function, which is the desired price from the standpoint of the client for this service or that performance, and in the field of *Value Engineering* synonymous in meaning to the goods or high value. *The payable price* is the desired price or the price the element or item deserved from the standpoint of the buyer to meet the performed service. If the goods *payable price*, for example, according to the buyer is less than the purchase price; it could, therefore, be considered undervalued, and vice versa if the *payable price* is higher; and this indicates that it is of high value. The *payable price* is one of the value indicator of the formula variables, Alishesh (1997).
The *payable price* identified through the alternative price that does the same functions and achieve the same goal, for example, the use of a light bulb to light up a certain space to a achieve a specific quality of light for a specific period of time; this could be achieved by using many types of bulbs at the lowest price. For these alternatives, the achievement of the same level of illumination for the same period is the payable price for the job, Shinnar (2000). **2-**

6 Value and Worth relationship:

The term *worth* known as the quality of something that makes it to be useful or valuable, therefore, this term indicates the material or market value for something, figure (1). Therefore, *worth* defined according to the *value*, and vice versa, in other words if the *value* of something is decided, then the *worth* is determined, and if the *worth* of something is established its *value* would, therefore, declared. For practical purposes the two words would be changeable, Nabeeh, (2004).

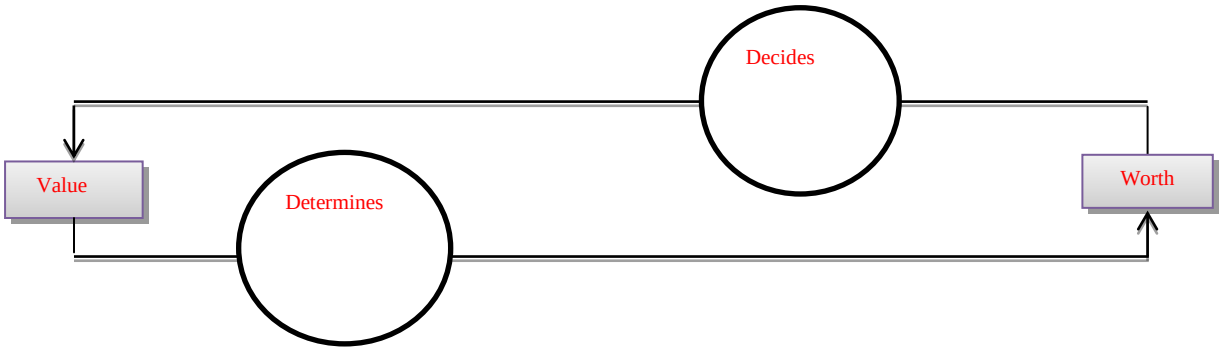

Figure (1) the exchangeable relationship between Value and worth, (Nabeeh, 2004)

2-7 Value setting:

Value setting is an analytical study conducted at the early stages of study works and special designs of products and projects in order to determine the cost of execution, as well as determining the level of quality at certain limits. It starts at the preparation phase of the work field to achieve optimal investment within the available capabilities and expressed as *value indicator*. Alishesh (1997).

2-8 Value measurement:

Value based on three basic elements:

1- Functional performance: which is the primary purpose for which the product, project or administrative process made or found.

2- Quality: which means the amount of achieving the requirements, expectations and desires of the beneficiary, which inclusive of aesthetic values, durability , and others.

3- Total cost: which is the amount spent on work as effort, money and time.

Value measurement lies on finding a relationship between the elements of , Functional performance, Quality and Total cost, Figure (2), where raising the efficiency of the performance and improving quality while reducing cost helps in getting the highest value, and that translated into the following equation:

Value Indicator= Quality + Function/ Life Cycle Cost, Elyousofy (2009)

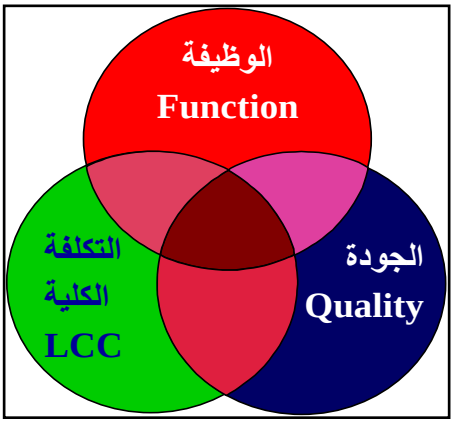

Figure (2) Value measurement elements, Elyousofy (2009)

There are various Value measurements exemplars of such are:
Value= Function/Cost=Usage/Cost=Performance/Cost

The more *Cost* increases the less *Value* becomes, unless function improves, though it is not correct to assume that the improvement of a product or service may make it possible to increase the *value*, especially when the *costs* are high, Nabeeh (2004). This means that the improvement of *Quality* and lifting up of *Functional Performance* and *cost* reduction leads to getting the highest *Value*. Taking into account that this equation is for the measurement of material value only, that contains variables, which incorporated into the equation, because it is difficult to give real numbers for *value* such as beauty, self-influence qualities as heritage values, or others, Daoud et al. (2009).

3- Quality:

3-1 The concept of quality:

Quality is known as: the achievement of the desired level of performance or functions through the properties and possibilities offered by the product or service efficiently throughout its life span, if used for purposes for which it is created for, and according to operation principles, Alishesh (1997). *Quality* is how to meet the requirements and objectives of the design or planning, whether it is a product or project. Some people usually relate quality to shape and performance on the other hand; they measure quality according to a specific small function. *Quality* could relate to a certain concept existing in the mind of the individual. It is a self-assessment, which could change in accordance with the role played by the observer or user, the quality of the product or the building is the sum of all the qualities and characteristics that help the product or building to perform its main mission successfully. It is the achievement of the client's needs in a satisfactory manner at a suitable time at which the service performed, Nabeeh (2004).

3-2 Quality and Value:

The product must achieve what is expected of it from the consumer, and it must be available when it is needed at an affordable price. *Value* is the best quotient of performance, as performance as well called or termed *Function*. Function is the performance of what expected from the consumer against the *cost* paid. For the product, *cost* is the sum of materials, labor, and changing burdens required to get the product, but for the client *cost* is price after adding the percentage of profit and other elements until the product delivered to the consumer, Thiry, M (1997).

Even though the expression mentioned describes the relationship of *Value*, but it may be for every consumer a different value system, and because of this, it is difficult to determine the thing that the consumer considers as a good *value*. There is method that seeks to achieve the *best value* with the provision of *less expensive* for the job, if we provide the *best value* or the *maximum performance* at the *lowest price*, we would have then take the right direction and this would, therefore, be considered as *Value Engineering*.

It is here where the formula modified and Function, therefore, defined as the sum of the *performance* and *quality* when needed, and that represented in the following equation:

$$Value=Function/Cost=Usage/Cost=Quality+ Performance/cost$$

The *performance* considered as the satisfaction necessary to meet the special expectations of the client as to what the product offers him, and emphasizes the level of *quality* on the *performance* or decreases *performance*. The product must be, of course, available whenever needed by the customer at an acceptable price, and that as well shown in the same equation that Quality considered as a component of *performance*. Poor performance reduces the quality, and high quality uplifts performance and, in some cases, high quality leads to the improvement of performance and adds good unexpected elements.

When *quality* rises, *performance* reaches its maximum; and price factor and availability become important factors in the equation, and cost element increases. The relationship of *Value* to *Quality* is of a close relationship. Quality requires the removal of all defects found in the product, and quality must emphasized in order to meet all the requirements and expectations of the consumer.

By the removal of the defects, these expectations met, and then the product or project meets the required designed expectations. However, it is important to note that *quality* that exceeds expectations not necessarily work to improve these expectations; it could threaten the balance of the same function. It may be unnecessary to agree on this matter because it would be a waste of money, Nabeeh (2004), and must realize that the goal of achieving *quality* for the sake of *quality* in itself not considered a significant economic goal.

3-3 Quality Engineering:

This term describes procedures used to confirm that the stages of the design and execution of a product or project, progress according to the recommended technical standards, or depending on the criteria of finance developed by businesses or professional institutions, or that developed by the producer or owner, or developed by the state authorities (the government). Many of these standards stipulated by a number of laws and regulations governing such operations relating to production, with regard to both the industry or construction and building fields or others, and that many of them are continuously changed. The designer being either an engineer or an architect must be well cultured and of a high knowledge, and should be familiar with the new of the standards that are applied, Nabeeh, (2004).

3-4 Quality Control:

The process of controlling quality requires several steps as follows:

1- Setting standards of performance for the required fields. Either industrial or whatever that has to do with the fields of construction, building otherwise.

2- Measuring comparisons and differences between standards and special rules necessary for the organization of the production process.

3- Taking decision or behaving in order to correct or reduce disparities between standards.

4- Planning for the improvement of the standards themselves.

For example, when engineers and architects, set special buildings standards, quality control confirms that work conforms to the standards and rules already set.

3-5 Quality Assurance:

Although this term has no specific measurement, but it includes applications, standards, rules and procedures to make sure that the product or service meets and exceeds the wanted performance standards. This term exceeds both concepts of *quality control* and *Quality Engineering*, as in the first stage it includes design product of high economic quality under the goal of using it, and the second stage includes the development and application of procedures at the economic level to assure the achievement of already designed and established quality, Nabeeh (2004).

3-6 quality elements:

The basic elements of quality include the following elements:

1- Characteristics and quality features.

2- Quality of design.

3- Congruence quality.

And this is as follows:

3-6-1 Characteristics and quality features:

There are many ways in which we evaluated the description of any product, and this term is used for one or more of the characteristics and qualities that define the nature of the product and its purpose and objectives of quality control. The characteristics and qualities of quality also includes the following aspects: color, power, temperature, etc.
They represent the same qualities that are relevant to the quality of the product.

3-6-2 The quality of design:

It is known that there is no product or project design that achieves perfect results that are completely full, therefore, required standards and norms must be specified in order to achieve the characteristics and qualities of acceptable standards and quality. When studying the design of a product or project we must be aware of the impact of quality high standards and limits the

potential costs. The significant increment in the cost of the product or project may occur in consideration to the norms and standards of quality, which is not required in this project or the one that not felt by the user or owner.

3-6-3 Congruence and uniformity quality:

Congruence and uniformity quality is the level at which the matching assurance of quality to the already set quality and specific rules standards met. It is the case with the quality of the design, where found that there is a relationship between the standards and rules of quality and the congruence quality and the cost of achieving these standards. Therefore, cost criteria and quality control procedures considered, and for the improvement of congruence quality effectiveness, the investor seeks to reduce the direct cost of production and the cost of quality control.

3-7 Quality achievement methods:

3-7-1 Quality achievement in the design stage:

Quality achieved at the design stage by taking into account the following, Kaufman, J. et al (2002):

1- The original report of the project necessarily checked out.
2- The information used, as a basis for the design process and its alternatives, specifications and details checked out.
3- The quantities of the required materials and cost of required labor should be determined, as well as additional works and the anticipation of any unforeseen circumstances that may occur.
4- The calculation of the ratio between cost and benefit.
5- The experience of the producer or the designer in judging estimated total cost of the product or project and its reasonableness, and the much the product or project fulfills the requirements of the client.

3-7-2 The achievement of quality at execution and production stage:

Quality can be achieved at the execution and production stage by taking the following into account:

1- To ensure design, requirements availability, the skills of technicians and workers required for execution and organizing supplies process.
2- The consideration of the suitability of specifications of materials required in the execution process with design specifications, as well as with the price of the contract.
3- To ensure the safety of production and execution equipment and their continuous updating and maintenance.
4 The consideration of the methods of finishing, packing or packaging, as well as storage and appropriate transport methods.
5- Taking into account the special quality product that meets the special requirements for either product type or customer's requirements.

3-7-3 The achievement of quality at the post-execution and production stage:

Quality can be achieved at the post-execution and production stage by taking the following into account:

1- To ensure maintenance programs.
2- Finding a system to follow up the post-production and execution stage.
3 - To ensure that the management system includes the possibility of replacing or addressing any invalid equipment necessary for the achievement of the required quality, Ball. H. (2003).

4 Architecture and Value Engineering:

There are several applications that has to do with *Value Engineering* in the field of *architecture*, which is the best exemplar as an applied field in which clearly the basic role played by the *design stage* could be shown. *Design stage* supplemented by the *execution stage* of the architectural project; in order to obtain distinctive an architectural product evidenced in the diversified and difference buildings, the significance of *maintenance* vividly shown in order to maintain efficient operation of the architectural product in a consistent aspect necessary for carrying out its functional duties, Kaufman, J. (1990).

4-1 Areas in which values of architectural projects are improved, depending on the method of Value Engineering:

1- Investing all the privileges that can be provided by the project site.

2- Optimal investment of buildable spaces.

3- Searching for solutions to reduce the cost of construction and the provision of alternatives to make architectural construction less expensive while maintaining its values, Dell'Isola, A.J. (1982).

4- Trying to merge between the three architectural values; *beauty*, *function*, and *durability* into a single entity, in order to enable any element in the design to achieve these requirements by itself, without the need to add supplements to fill the shortage in one of these values.

5- Focusing on the design aspect by giving it the key role in terms of the search for the outstanding designer, choosing the most efficient and distinctive design, and providing enough time to complete the design. All that performed by providing all the information required for the designer to complete the project, then the multiplicity of disciplines involved in the design, Daoud et al. (2009).

4-2 Determining the appropriate time to apply studies of Value Engineering on architectural projects:

Value Engineering applied on architectural projects at any projects stage, starting from the initial studies, preparation and planning stages, going through the various stages of design and then execution, ending at the stage of operation and maintenance. The best application to the studies of *Value Engineering* are at the project programming stage after the completion of the basic information and determining the main requirements and objectives by the owner, because during this stage it is easier to accept the proposals that will result from the study of *Value Engineering*. As the amendments at this stage are minimal, its impact on the time schedule is very little, so the chance of acceptance of proposals by the decision-makers is better at this stage compared to later stages; due to the fact that time, effort and cost of implementing the proposals is almost negligible compared to the desired benefit from the study. Looking at the factors affecting the cost of the project, design is the most influential element on the cost and quality of the project by up to 50% compared to other elements. As the cost of design does not exceed 3% of the total cost of the whole project, it is necessary to take good care of the project design stage by taking care of whatever concerning the quality of the design and the overall costs control through that stage. Figure (3) represents the relationship between cost and time of application according to the different stages of the project, Gamar (2005).

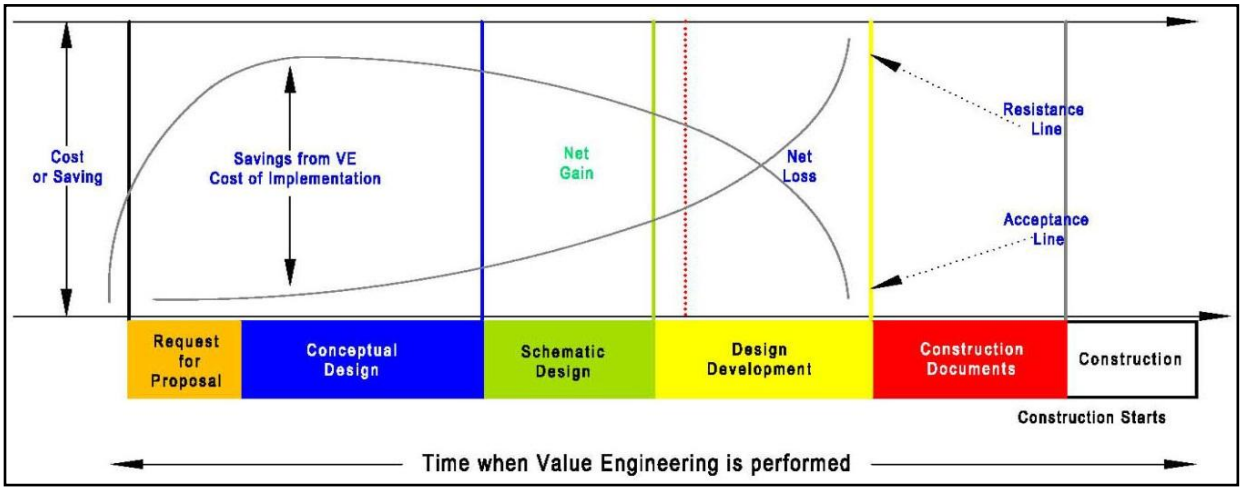

Figure (3) The relationship between cost and time of studies application of *Value Engineering* according to the different stages of the project, Elyousofy (2009)

4-3 The reason behind the application of Value Engineering on architectural projects:
availability of high standards quality.
2- Usage of these projects to expensive materials.
3- The containment of these projects to various components and items
4- When the design developed a long time ago or in exigent circumstances.
5- When there are problems and defects in the design and the possibility of improvement and savings.
6 - In case of increment in the initial cost and annual costs.
As the application of *Value Engineering* considered important, even at the late stages of projects to solve existing problems due to increment in costs, or lacking the achievement of the desired level of performance and quality, due to the fact that *Value Engineering* basically a tool and a method of solving problems. This is a proof that its role is not limited to achieving financial savings only.

4-4 Criteria for necessary qualification in the application of Value Engineering:
For the study of *Value Engineering*, the practitioner is required to be belonging to the sphere. For qualification to the specialty there are two study programs offered through (SAVE International) Society for the Advancement and promotion of the *Value Engineering*, the first program offers qualification certificate (CVS) Certified Value Specialist. This certificate entitles the holder to lead in value studies, as well as trains and teaches courses certified by (International Organization of Value Engineers), which qualifies whoever specializes in this area.
The second program offers qualification certificate as an associate value specialist (SVS associate value specialist), the certificate qualifies the holder to lead in value studies, without exercising education or training, and without contributing to assist others in the specialization.

At the level of the Arab world, the application of such qualification standards has begun in many Arab countries, especially the Gulf States, including the issuance of (Saudi Ministry of Finance) in the year (2001) to a special circular concerning the application of *Value Engineering* in the Kingdom of Saudi Arabia. The circular carries the number 10/2 / 35 269, dated 07/20/1422 H corresponding to 21 October 2001, Alyousfy (2009).

4-5 The economic feasibility of the application of value engineering in architectural projects:
There are many visions of feasible possibilities of applying *Value Engineering* in architectural projects, as well as the possibility of accepting its application, and the usefulness of results after application. The factors and elements of the economic feasibility of the application of *Value Engineering* reviewed through architectural projects, as follows:
1- *Value Engineering* increases the size of the projects in general, as they increase the amount of projects, or any other project that will be decided for savings account similar to the project that has been saving in it.
2- Many have become accustomed to extravagance in the size of the project with little interest, faced with ill-use projects and failure to regulate this use.
3- There is much waste in building houses, such as the increment of iron that does not increase the bearing of the building. There are as well unnecessary increments of cement, and the increment in many things as building materials and finishing, and other materials and equipment, which possibly get rid of or replaced, Makhlouf (2007).

4-6 The ability of design to raise value:
A group of statistical studies in U.S.A and Saudi Arabia concluded that there is about 49% of the cost of the architectural project depends on the type of design, Daoud et al, (2009). Noting that the owner has little influence on the cost of the project, that equivalent to only 10%, figure (4). This means that a good design could raise the value of the project much more than any other factor, especially if we know that design is the cheapest stage in terms of cos. It could, therefore, be realized the much loss in the value of any project due to rush in choosing an efficient designer or choosing an outstanding design, or both. Loss and wastage could result from negligence of a lot of design capabilities and technicalities due to the need to reduce the cost of production at the

short term. Even though this will lead to high costs at the long term, as the total cost of the project, measured by *value* resulting in the cost of the project over the whole period of use, which includes the pre-construction and post-construction costs, the cost of the removal that necessarily calculated.

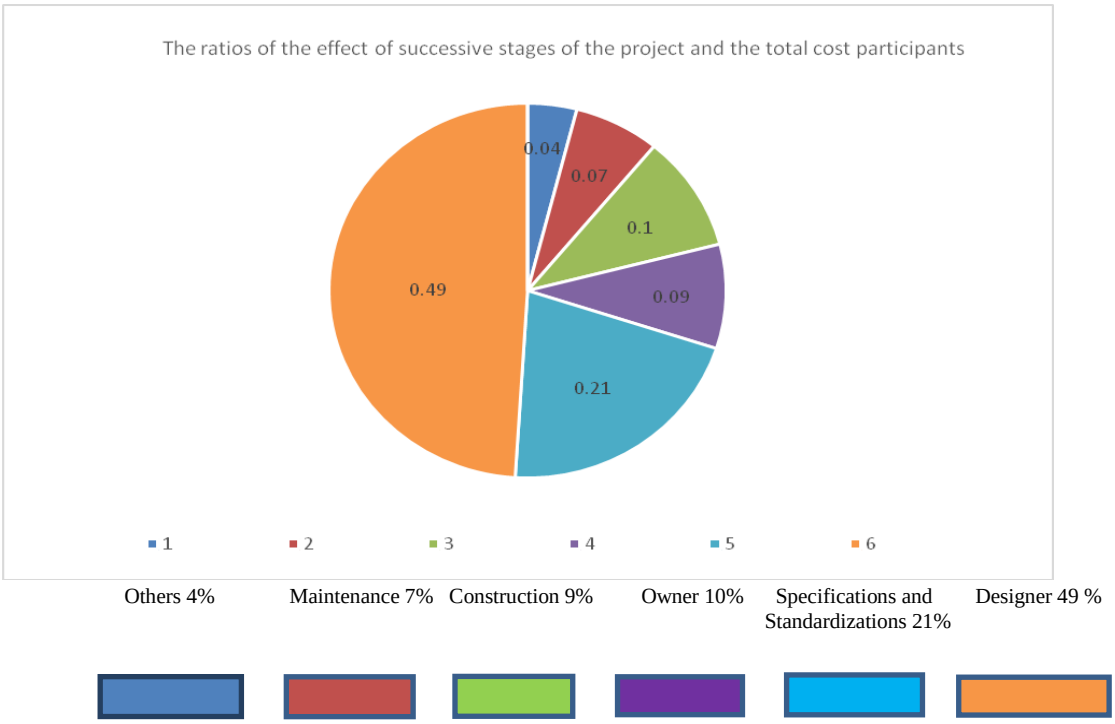

Figure (5) The ratios of the effect of successive stages of the project and the total cost participants, Daoud Abdel Razek, (2009)

4-7 Application areas of Value Engineering in architectural projects:

There are several application areas of *Value Engineering* in architectural projects, being an organized assessing process using different models. These models of cost made in a uniform cost system, by which cost estimated in all phases of the project, especially in the initial stages of design. The application of the design space models helps to clarify the proportion of spaces used to the total area, this will show the amount of waste in the spaces, and thus spaces used according to the functions after identified.

Applications include the procedure of analysis of functions for the construction elements to ensure their efficiency without wasting construction materials such as iron, cement and others. *Value Engineering* studies play a role in the exploitation of the site, and the choice of the best alternatives and systems. All architectural best alternatives and systems such as finishes, facades, water and heat insulation, and the other systems such as the structural systems and the use of various construction materials, as well as electrical and mechanical systems based on extensive study of performance, quality, ease of operation, maintenance and its impact on energy consumption, Daoud et al, (2009).

4-8 The means of activating the concept of value engineering in architectural projects:

The difference between the application of *Value Engineering* and activating its concept at the design process stages is the same as the difference between raising the efficiency of product and a high production efficiency, Fowler. T. et al, (1990). For activating the concept of *Value Engineering* in the architectural projects fields the following required;

1- Making sure that the foundations of private and public design are of achieved (Different codes- design and planning requirements- funded budget, etc.). As well as the design goals for those involved in the design, through activating the role of the work team in all design steps and

trying to get a collective agreement among themselves.
2- Controlling the design process through the action plan concept, this considered as a design strategy.
3 – The involvement of design product stakeholders (The owner, the user, the operator and the fundraiser, etc.) in the decision- making process at all design development stages.
4- Raising the value of the product either by raising the quality and operation efficiency or by the reduction of the cost of the level of project life cycle as the diversification of experiences of team members and the participation of relevant decision-makers is the secret of the power of the team.

5- Value engineering application steps in architectural projects:

5-1 Factors militating against the success of Value Engineering in architectur

Before embarking on the application of *Value Engineering* steps methods in architectural projects, knowledge of the factors that affect the accuracy and success of the method is required, Elikhuatir (no date). This becomes an objective in itself to achieving the concept and the method of *Value Engineering* in architectural projects successfully and accurately, such factors are;
1 - Knowing fully the requirements of all parties involved in the design.
2- The accuracy of the initial planning and design works.
3- To ensure that quantity surveyors get all the information needed to assess the actual cost accurately and clearly.
4- Cost items should not offered in totality, and work items detailed in order to get the actual cost, as well as getting the imbalance in where there are wastes as that should be avoided.
5- No reliance on previous projects data not updated.
6- Allocation of sufficient time for total cost estimation.
7- The completion of the design documents.
8- Taking into account the design of the geographical location, soil studies and other influences.
9- Taking into account accuracy in identifying non-traditional systems, especially in complex projects of special nature.

5-2 Steps of applying Value Engineering in architectural projects:

To implement steps of applying *Value Engineering* in architectural projects design stages, it is necessary to follow these steps, Stewart. R. (2005):
1- Careful study of the design of the project and its components aiming at improving performance through the achievement of efficiency savings that achieve the concept of value at the same time.
2- Identifying alternative solutions in the form of design modifications.
3- Identifying alternative methods of construction, and studying the right ones for the design that is already prepared.
4- Identify additional tasks to improve the results of the project.
5- Rationalizing the program of the project, with emphasis on functional performance efficiency and adjusting the cost of the projects.
6 - Maintaining the achievement of project objectives, quality and shelf life.
7- Presentation of ideas and execution alternatives and analyzing them in a s
8- Determining the ideal method of execution, operation and maintenance at the lowest possible cost.
9- Avoiding possible fragmentation of the project or the cancellation of some of its parts.
10- Ensuring the execution of the project in the specified execution time.

5-3 Experiences in the applications of Value Engineering in Architecture:

There are many experiences in the applications of *value engineering* at various level. At the top of these experiences and at the international level there are many in different sectors in the United States. As such methods began in *Value Engineering* in the year 1947 until now, they are many successful experiences that have acquired global interest after successful testing in projects, products and services such as GE, U.S. or General Electric Corporation, United State. It is in this Corporation that this method applied to many of the products of the company, and because of that, the company overtakes its competitors in the abundance of production and the proportion of

profits. Therefore, the application began to spread in companies and industrial enterprises in all branches of the U.S. Department of defense and the U.S. Navy and the U.S. Army Corps of Engineers, as well as in many other ministers.

As a result of the continues success the application moved in the year (1993) to the construction sector, which in turn interacts much with the applications of this method, and since then its employment began to spread in companies, institutions and private and public bodies within the United States of America. Thereafter began to spread in different countries to move to Japan, Europe, India and Australia, and as a natural result to these successful experiences and growing interest in this profession within the United States and abroad. The need arises for a professional organization concerned with the affairs of the profession, the organization, the development of the necessary laws to the exercise of the profession and the qualification to the profession. The organization was called (SAVE) or (*the American Society of Value engineers*), which later on becomes an international organization concerned with the affairs of the profession inside and outside the United State (International-SAVE), Greenfield, H (2004).

Because of all that, professional associations established in Japan, India and many other countries concerned with the application and qualification for the profession. More countries began some time ago to take advantage of the applications of *Value Engineering* after having experienced its successful experience. Because of all that these countries came out to set the necessary laws for applying it in projects to achieve the greatest economic return, the Kingdom of Saudi Arabia, Kuwait, the United Arab Emirates considered in the forefront of such countries.

5-4 The reasons behind the effectiveness of the application of Value Engineering on architectural projects:

The goal of *Value Engineering* is equal to that of the designer in providing design for the project to achieve the needs and requirements of the owner and the user, with a balance between performance and cost. With this in mind, it could be easy for the outstanding designer to be aware that the method of *Value Engineering* is complementary to the design process itself, Nabeeh, (2004). *Value Engineering* is a system helps to improve the changes that achieve the concept of *Value* in a certain project, which is difficult to conduct by many people. *Value Engineering* is working towards the development of changes, in the sense that it aims to create an atmosphere in which change could take place without losing faith in the project by any person. The reasons behind the effectiveness of the method of *Value Engineering* on architectural projects, Nabeeh (2004), as follows:

1- *Value Engineering* method characterized by an organized action plan similar to the process of architectural creativity and innovation.

2- Emphasizing the fact that all the architectural designs have unnecessary cost adjusted while maintaining its efficiency by following the *Value Engineering*.

3- The method of *Value Engineering* is the same as that of architectural goal in the need to develop the best possible design for the architectural project.

4- The configuration of qualified and distinguished team, which provides incentives for each of its members.

6- The findings and recommendations:

6-1 The results of the study:

6-1-1 the overall results of the study:

1- The importance of widening the application of the method of *Value Engineering*, due to its role in the thoughtful rationalization of expenditure.

2- The method of *Value Engineering* combines the preservation of efficient performance and product quality on the other hand, while reducing the overall cost in such a manner that does not affect it.

3- The method of *Value Engineering* is also concerned with the development of the quality of the

product, as that contributes greatly to reduce the total cost.
4- *Value Engineering* considered an important input in maintaining the various resources, as that reduces waste operations that result from following stereotypes form of production.
5- *Value Engineering* is impetus to the development of collective performance, and to the development of work teams.

6-1- 2 The results of the application of Value Engineering on architectural projects:
1- Improving the quality of architectural projects.
2- Raising the value of the functionality of the architectural projects.

3- Taking care of function with controlling cost.

4- Optimal use of resources.
5- Rationalizing future consumption expenditure of architectural projects in regards to operation and maintenance expenses and others expenses as well.
6- Stimulation of creativity and teamwork.

6-2 The recommendations of the study:
6-2-1 general recommendations of the study:
1- It is necessary to include *Value Engineering* in the methodological studies of architectural because of their role in increasing the architect's understanding and awareness.
2- The openness of architecture to other Engineering and non- engineering disciplines is necessary, as this openness of interest to architectural production.
3- It is necessary to seek a formal organization that ensures the right and correct application of the profession of *Value Engineering*.
4- Developing an administrative organization structure for the *Value Engineering* programs within the productive sectors, to take care of the task of conducting Value studies and to train on it.
5- Studying the enactment of legislation, which imposes the application of *Value Engineering* at a certain level of industries and projects of high costs.
6- Focus on the role of training in the field of *Value Engineering* applications and its importance in spreading awareness and understanding of the usefulness of that application.
7- The necessity of considering the practice of *Value Engineering* studies as consulting studies complementary to the process of engineering.

6-2-2 Special recommendations on the applied professional level in areas related to architectural projects:
1 The necessity to train designers to apply *Value Engineering* as a concept and a method in the design process.
2 - The necessity of activating the economic aspect as one of the main determinants in judging the design alternatives, especially in the early stages of the design process.

3 - Activating the role of the work team and team spirit by the participation of the parties concerned in decisions taking as the owner, the user, the operator and the financier, etc..

4- Being accurate in selecting the right team members to do handle the design process, and being careful in confirming their understanding to the techniques used in the design group sessions, in order to achieve the maximum benefit and the highest value of the design decisions based on these design meetings.
5 - Activating the concept of design strategy, as employed in the method of *Value Engineering*.

6-2-3 Special recommendations for the concerned with the design decisions:
The study recommends those who are involved in the design process and decisions (As the owner, the user, the operator, the financier, and the contractor etc.) as follows:

1- The awareness of the right *Value Engineering* concept and not considering it just as a method for costs reduction.
2- The awareness of the concept of project total cost and not limiting it to construction costs only.
3- The awareness of the economic concepts associated with the success or failure of projects, and giving sufficient time to conduct the necessary studies to ensure the feasibility of the design and construction.
4- The awareness of the notion of teamwork through the creative design sessions to increase the value of the design process, thus raising the efficiency of the building.

6-2-4 Special recommendations for governmental and executive bodies:

1- The employment of *Value Engineering* in government institutions that are based on the construction industry in order to develop the effectiveness and efficiency of their work.
2- Inserting and including the concept of *Value Engineering* in engineering contracts, especially in the field of housing to make this concept as one of the official procedures in government projects.
3- Including special conditions in government contracts so as to encourages contractors and execution companies in order to present economic ideas in the cost, with the support of the government as considered as the owner to speed up proposals submitted as a result of projects value studies.
4- Qualifying trained leaders in *Value Engineering* field with the aim of training specialists within government institutions to take care of the application study in its various projects.
5- The cooperation among regional systems such as the League of Arab States and the Gulf Cooperation Council (GCC), to exchange experiences, which began in some of these countries in the field of *Value Engineering*, and take advantage of the available expertise in this area.
6- Encouraging the development of training programs organized by the associations and students engineering unions in universities final years in order to prepare, and qualify students in advanced methods in the areas of design value administration.
7- To help in efficient work in the local labor market, as well as the competition in the global market if this new thought employed.

6-2-5 Special recommendations at the level of engineering consulting firms:

1- Studying the obligation of consulting engineering institutions to seek assistance from qualified specialists in the areas of *value* by subjecting all the projects under its departments to value study. This leads to ensure getting cost-appropriate projects, and the reduction of their cost, to attract customers and increase the movement of investment in the construction field.
2- Organizing advisory bodies for training courses for architects and engineers working on value management methods, in order to study its effectiveness during the design and execution phases of the projects.
3- The allocation of some such institutions in providing specialized value studies for projects, with the aim of reviewing building plans and making sure to achieve value through the designs that are already set.

7- Summary of the study:

The study Concludes that Value Studies are no longer technical luxury, it has become an urgent necessity, in order to rationalize spending thoughtfully away from the confusion and prejudice to come out with efficient functions and qualified projects. It as well aiming at achieving the best investment return for money spend, as the integration and inclusion of design, planning and execution in a single integrated action, including resources, materials, labor and design and execution work teams becomes the primary objective of management in the field of construction and building. *Value Engineering* gathers the goals of both the management and design process. In addition to achieving the previous goal, it develops the human factors related to creativity and innovative process to achieve the functions of the project, which are termed the *design process objectives*.

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