

# Value Engineering Methodology in the Management of Existing Projects – Case Study of “Mansoura University Hotel”

منهجية الهندسة القيمة فى إدارة المشروعات سابقة التنفيذ - فندق  
جامعة المنصورة كحالة دراسية

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## المخلص

يعتبر الهدف الرئيسى من هذه الدراسة هو الوصول إلى أفضل علاقة بين الأداء والتكلفة لأى مشروع. وتعتبر الهندسة القيمة ذات منهجية مميزة لدراسة وتحليل المشروعات وتقييمها ويهدف العمل بها إلى رفع قيمة المشروع من خلال صياغة منهج توافقى قيمى يعمل على قياس الاحتياجات الخاصة بمستخدمى المشروع وربطها بالتكلفة وذلك لحذف التكلفة غير الضرورية لتحقيق التوازن بين أداء المشروع وتكلفته ومن ثم زيادة جودته وقيمته. وتتلخص خطة عمل الهندسة القيمة فى جمع المعلومات عن المشروع من المصادر الموثقة ثم يتم تحليل وظائف المشروع وهنا يتم ربط الأداء بالتكلفة من خلال تصنيف تلك الوظائف، ثم ينتقل فريق العمل إلى مرحلة توليد أفكار ابتكارية ومقترحات وبدائل للمشروع تحقق نفس الأداء وبتكلفة أقل وحذف الوظائف غير الضرورية ثم يتم تقييم تلك البدائل واختيار أفضلها وحذف الأفكار غير المناسبة. وتعتبر دراسة متطلبات مستخدمى المشروع هى الخطوة الرئيسية لخلق الفراغ المتوافق مع احتياجات هؤلاء المستخدمين من خلال القيم الحاكمة للمجتمع. وتتحدد الكفاءة الوظيفية لتصميم ذلك المشروع القيمى من خلال تحقيق التكامل بين الوظائف الهيكلية والحضارية والطبيعية والتفاعلية، ومن هنا نجد أن ربط الدراسة المعمارية للمشروع ببيولوجية المستخدم لتصميم فراغات تتناسب انسانياً ووظيفياً من المستخدم حالياً ومستقبلاً.

## Abstract:

The main objective of this study is to reach a better relationship between the performance and the cost of any project. The Value Engineering characterized by a distinctive methodology for studying, analyzing and evaluating the projects; As work out with this study aims to raise the value of the project through the formulation of a valuable compromise curriculum works on measuring the special needs of users of the project and linked to cost in order to delete the unnecessary cost to achieve the balance between the performance of the project and its cost, thereby increasing its quality and value. The work plan of the Value Engineering is summarized, first, in gathering information about the project from documented sources, second, the functions of project are being analysed hence the performance is linked to the cost by classifying those functions, third, the team work moves to the phase of generating innovative ideas, proposals and alternatives of the project achieve the same performance and at a lower cost and delete the unnecessary functions, fourth, those alternatives will be evaluated, tested the best of them and delete the inappropriate ideas. The study of the requirements of users' project is the main step to create the vacuum compatible with the needs of these users through the ruling values of the society. Functionality is determined to design this valuable project through the integration of structural, cultural, natural and interactive functions. Finally it can be concluded that linking the architectural study of the project with the psychology of the user to design spaces is humanly and functionally fit with the current and the future user.

## Keywords:

Value engineering, Cost effectiveness, Users's needs, Project management

## 1. Introduction

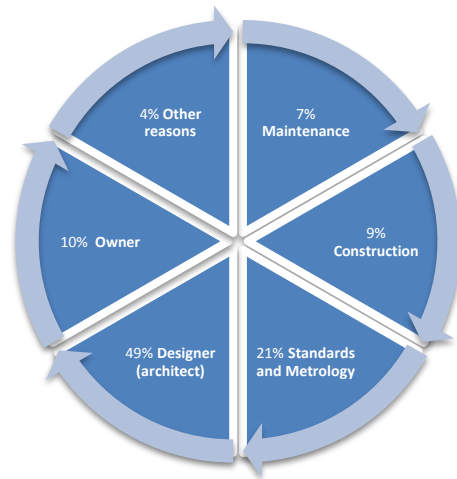
The primary objective of any project in any field is to reach the highest performance with the lowest possible cost; the economic factor is considered of the most important factors that determine the success or failure of the project, and the Value Engineering characterized by a distinctive style in the study, analysis and evaluate the projects then put proposals that are responsible for raising the performance and reduce the cost through the components' functional analysis of the project, after that the study team employ creativity and innovation to find alternatives that have the same functions and the same level of performance or better and at the lowest possible cost without affecting the quality or the beauty of the project or any prerequisites for its users.

## 2. Types of the project's cost

The cost of the projects is divided into:

- The necessary cost of the project: such as the cost of land - construction cost - the cost of rehabilitation of the project - the cost of taxes on the project.
- The unnecessary cost of the project: such as unnecessary cost of materials - unnecessary cost of elements - unnecessary cost as a result of the life cycle - unnecessary cost as a result of the weakness of use.

There are several factors that impact on costs, such as the designer, cost of construction, costs of maintenance and the cost of specifications and standards; as the impact ratios of those elements on the cost is different, as shown in Figure (1).



*Figure (1): the effect ratios of the common elements in the project cost*  
 Source: Value engineering in the construction industry P 27

## 3. Value Engineering Action Plan

It is the organization, sequential and logical steps that are implemented as the initial phase of the application of value engineering. There are a lot of entrances that adopt a specific sequence in dealing with the application of value engineering plan; however they are differ in the number of the total stages, they all agree that they are not depart from those basic stages.

### 3.1 Gathering information stage

Is the stage in which the documents and pamphlets of the project are collected and analyzed first; then studying the project financially and analyzed; after that setting the foundations for the design based on the result of meeting the owner and users of the project and understand their requirements through a questionnaire displays those requirements; followed by doing the initial analysis for the costs (1), and preparing space models, cost models, quality models and Energy models; finally calculated the total cost of the project life cycle models.

### 3.2 Functions analysis stage

It is the stage in which the performance is linked to the cost of the function performance through functional analysis of the components of the project and classified into basic functions (function of use - and aesthetic function) and secondary functions; then the cost of the function is calculate and thus the value coefficient is calculated from the following equation :

$$\text{Value coefficient} = \frac{\text{Actual cost (Cost)}}{\text{Cost owed (Worth)}}$$

This factor determines the strength or weakness of the value of the function; then the relationship between functions and test the accuracy of its classification and try to search for lost functions is clarified by the FAST chart to analyze the function of value engineering, (Figure 2).

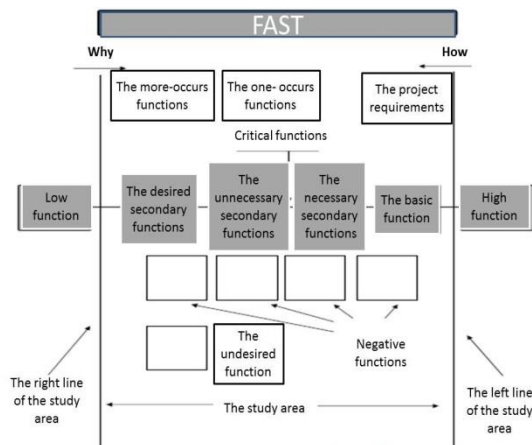


Figure (2) The (FAST) chart to analyze the function of Value Engineering

### 3.3 Creative and innovative thinking stage

The aim of this stage is to generate the innovative ideas which form the proposals and alternatives that lead us to maintain the functions of the component and the parts of the project at a lower cost and delete the unnecessary jobs.

### 3.4 Evaluation of alternatives stage

It is the stage of judging the ideas that have been generated in the previous stage and the best test of these ideas based on certain criteria such as (aesthetically - the expected return of the application of the idea - how easy the possibility of the application - the cost of developing the idea).

### 3.5 Development stage

At this stage, the ideas and alternatives that have been tested and transferred to the proposals are being studied, demonstrated and simplified through the graphics, then the total costs are estimated and a comparison between the current design and the proposed alternative is being done.

### 3.6 Display and application

This stage is the practical translation of the study from which the desired results can be achieved and that can only come when the owner is convinced to accept it; so the importance of this stage come in determining the character and nature of the decision-maker as by knowing this, the display will be formulated with what is commensurate with the character.

## 4. Analysis of value engineering projects requirements

### 4.1 Social requirements

The study of user requirements for the project and the try to achieve to reach the compatible approach that achieves a better relationship between cost and function of the most important priorities of the value engineering; and it is the main determinant of the form and nature of the design. These requirements are linked to several values that judging the vacuum compatible with the needs of the users of the project. These values are divided into social, cultural, religious and aesthetic and political values. (Fig. 3)

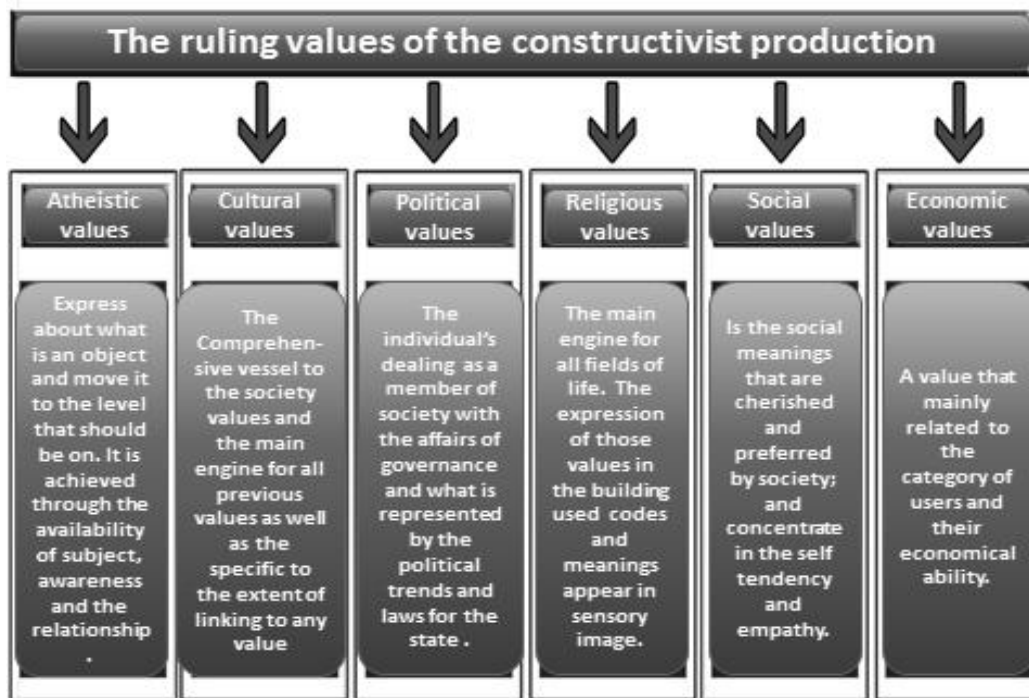
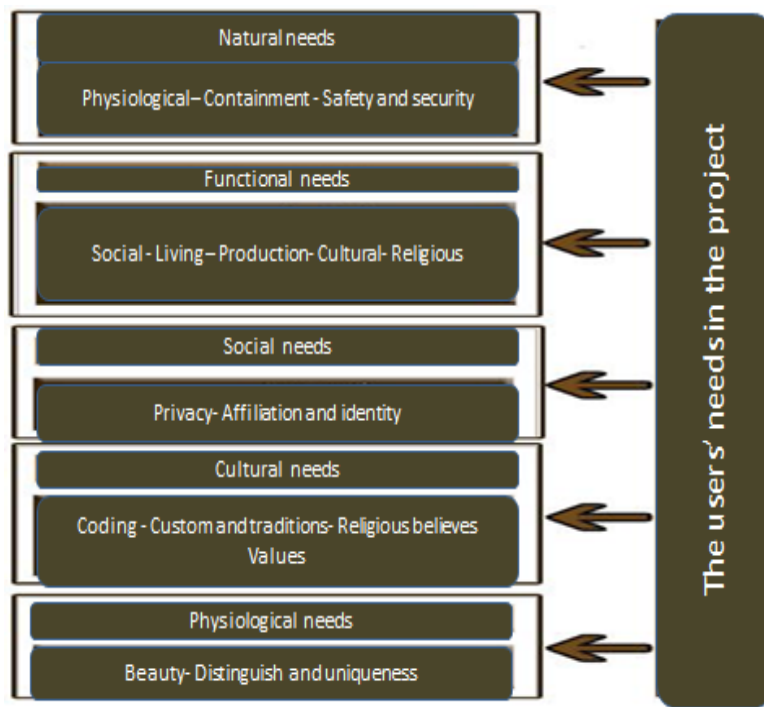


Figure (3): it shows an analysis of the ruling values of the constructivist production  
 Source: original sources with the researcher analysis

Non-conscious reading of those values leads to an imbalance in the provision of basic needs of the user. And thus it is a reason for failing the Housing to achieve what is required of it. It is required here the separation between the needs, which represent the necessary things for human life, and between the requirements. As it represents the complementary things for the continuity of human life and its unavailability does not cause a problem, where the needs of users can be divided into five levels as in the form (4).

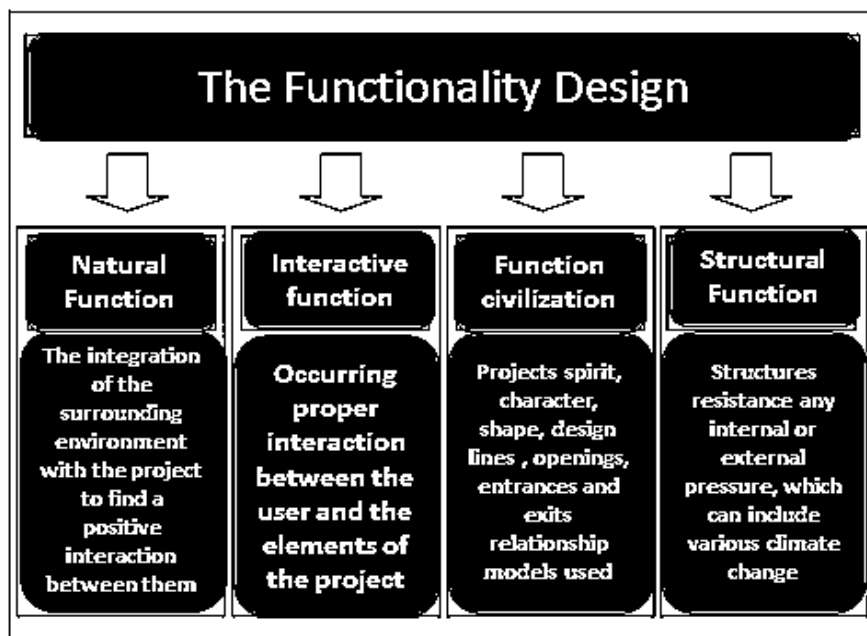
#### 4.2 Design requirements

The design requirements for the project is the factor that is competent to achieve the product that is compatible with all levels of humanitarian needs and requirements; and the functional efficiency of the design is achieved as a result of achieving parity between the structural function, the cultural function, the natural function and the interactive function of the project (Figure 5).



*Form (4): the users' needs in the housing*

*Source: Eng.RiemannRihan, follow-up and evaluation of the project low cost housing models, Master Thesis, 1999.*



*Figure (5): shows the functional efficiency of the design*

*Source: original sources with the researcher analysis*

## 5. The mechanism to apply the valuable methodology on the existing project (Mansoura University Hotel)

The Value Engineering approach has been applied in the functional analysis for the precedent implementation projects to determine the positions of the unnecessary cost and work to abolish it to access to a lower cost with the best performance of the project; then give a valuable alternative to the project with an application of the Value Engineering methodology. In order to that the existing project has been selected to be the study applied case of the thesis as it is “Mansoura University Hotel” where the project will be assessed and functionally analysed; and the results of this analysis of the database can be added in order to take advantage of it and can be applied to similar projects.

### 5.1 Steps of project evaluation

The following methodology steps are followed for evaluating the project:

First: the definition of the project, its importance, the general location, the destination of the design, the owner destination of the project, the area of the building and its components as well as the knowledge of the primary and the final cost of the project, the reasons for the increase of the final cost for the primary cost. The information about the project is collected through documents and drawings of the project from the Engineering Department at Mansoura University, in addition to a field study of the hotel, and making personal interviews with a number of hotel staff and users. Also a questionnaire is being done for the users of the hotel to check the availability of humanitarian and functional requirements at the hotel.

Second: Studying the project architecturally in terms of the horizontal projections of floors and knowing its components.

Third: Assessing the design elements of the hotel through designing the schedule that is specialized with the evaluation, as in which the owed grades of it are monitored in terms of the functionality and the economic performance, its planning elements, and the availability of users' needs, then set the final evaluation of the hotel.

Fourth: Counting the accuracy in calculating the project cost and the owed cost to it by calculating the value of the building in the event of primary cost by the equation: The value of the building in the event of primary

$$\text{cost} = \frac{\text{The schematic performance} + \text{human needs}}{\text{Primary cost}}$$

**Equation (1)**

Calculating the value of the building in the event of the final cost by the equation:

The value of the building in the event of final

$$\text{cost} = \frac{\text{The schematic performance} + \text{human needs}}{\text{final cost}}$$

**Equation (2)**

Calculating the economic performance coefficient of the hotel which determines the extent of its quality by the equation:

$$\text{Economic performance coefficient} = 1 - \left( \frac{\text{the final cost} - \text{the primary cost}}{\text{the primary cost}} \right)$$

**Equation (3)**

Fifth: Analyzing the shortcomings in the performance of the project and determining the positions of its unnecessary cost.

Sixth: Submitting the proposals to resolve the problems that led to deficiencies in the performance of the project and try to delete the positions of the unnecessary cost to reach the optimal performance of the hotel and at the lowest possible cost.

## 6. Results

By evaluating the design elements of the project, the hotel got the ratio (82.5%) this means that it is assessed by the grade (good), as shown in table (1)

*Table (1) the architectural evaluation of the University Hotel*

Serial	The Element	The great grade	The project's Degree	Notes
1	The Importance of the project	5	5	Residential – entertaining Project (wedding halls) – serve Mansoura University during the conferences rooms.
2	The planning elements	5	5	
2-1	Geographical location	3	3	Close to all the services needed by users and close to the internal and external transportation
2-2	Soil type	2	2	Mud and unfit for building
3-1	Distance or closeness for transport	5	5	close to all the transportation (internal and external)
3-2	The Earth surface	4	3	Earth's land surface is adequate but needs to parking places in addition to increasing green spaces
3-3	Directing the building	3	2	Not all spaces of the building oriented north
3-4	Site Coordination and it is divided as follows:	13	9	
3-4-1	Green spaces	2	1	It is not adequate and the existing untapped
3-4-2	Services	2	2	The building is closed to all services
3-4-3	Street width	1	1	The width of the street is good (main streets) and the movement of vehicles and pedestrians is facilitate
3-4-4	The pavement Finishes	1	1	Good finishes
3-4-5	External lighting elements	1	1	Good lightning
3-4-6	The external finishes	2	1	The finishes are medium quality where it needs to maintain each relatively short period without occurring that because of government routine
3-4-7	The number of the project's entrances	2	2	The entrances are sufficient for guests and visitors (main entrance) and workers and administrators (4 sub- entrances)
3-4-8	Parking lots	2	0	No parking
-	Total Performance	35	29	% 82.85
4	The user's comfort (the users' needs of the building)	35		

Continue: *Table (1) the architectural evaluation of the University Hotel*

Serial	The Element	The great grade	The project's Degree	Notes
4-1	Natural needs (physiological, containment, security and safety)	13	12	Available by a large ratio in the elements of the hotel
4-2	Functional needs (living and productivity)	7	5.5	* Available but the noise generated from the main electricity generator reduce the ratio of the productivity of users of the southern rooms. * Not to exploit some recreational elements in hotel
4-3	Social needs (Privacy)	6	4.5	Available but the terrace in the second floor sees most of North rooms which reduces the ratio of privacy in this floor.
4-4	Cultural needs (customs, traditions and religious beliefs).	5	4	Most of the cultural and religious needs are available for the users of the hotel.
4-5	Psychological needs (beauty)	4	3.5	The internally and externally shape and design helps sense of psychological comfort for users.
-	<b>Total Performance</b>	<b>35</b>	<b>29.5</b>	<b>% 84.28</b>
5	Unnecessary cost of the project	30		
5-1	Unnecessary costs resulting from rarity of the design (windows, finishes, flooring, furniture)	10	8	* Lack of single rooms. * The use of ores that need patrol maintenance each relatively short period.
5-2	The cost of unnecessary Specifications	10	8	Building 3 untapped hotel floors.
5-3	The unnecessary cost on the stages of the building age (maintenance cost)	10	7	Routine plays an important role in the lack of regular maintenance of the hotel.
-	<b>Total performance</b>	<b>30</b>	<b>23</b>	<b>% 76.59</b>
-	<b>The total of evaluation points</b>	<b>100</b>	<b>82.5</b>	
		<b>The final evaluation of the hotel</b>	<b>%82.5</b>	<b>It is a good building in its value (more than 75%)</b>



- In terms of calculating the accuracy in counting the project cost and the owed cost to it through calculating the value of the building in the event of the primary cost by using the equation (1). It was concluded that the lack of accuracy in costs calculation led to a decline in the value of the project by (20%). By calculating the economic performance coefficient of the hotel through the equation (2), the extent of the hotel's quality is determined by (0.77) this value is  $> 0.75$  that is means it is (good in its value).
- Deficiencies have been identified in the schematic performance of the Hotel by (17.15%) and deficiencies in the provision of the users' needs by (15.72%), as the positions of unnecessary cost are summarized as follows:
  - The lack of dedicated places of parking of the hotel.
  - Not to use the health club and the rest of recreational items existing in the basement floor despite the hotel guests' need for those elements.
  - Lack of attention to routine maintenance of the building because of the governing routine
  - The area of green spaces is not sufficient, and the available space is not used.
  - Constructing three residential floors contains 8 hotel suites and 48 hotel rooms, without the completion of its finishing and handed them over to the hotel despite the need to them.
  - Non-completion of finishing wedding halls at the last floor in the deadline.
  - The Air condition in the hotel is centrally and there are no separate units for each floor causing wastage of electricity

### 1. Conclusion:

- The value engineering methodology is applied in the buildings' evaluation in the post-occupancy by allocating 100 points to assess the project

divided into 35 points for the performance of the layout of the project and 35 points to the humanitarian needs of the users and 30 points for the non-essential cost of the project as the unnecessary costs counted.

*By counting the total grades of the project, it can be evaluated as follows:*

▪ 85% or more (very good).	▪ 75 to less than 85% (good)
▪ 50 to less than 75% (acceptable)	▪ Less than 50% is (unacceptable).

- The questionnaires to solicit the views of users of the building were done about the humanitarian and functional needs them in order to identify the key determinants of the shape and the requirements of the project.
- The position of the unnecessary cost to the project has been identified and it was working on deleting it to reach the highest performance of the project in order to reduce the total cost of the project with maintaining the highest functional performance to it.
- An only alternative was put forward for the project that is agreed upon by all parties (the team work of Value Engineering- the owner –the designer) as the value engineering methodology applied on it and the proposals were put forward to address the shortcomings of the project.
- The economic performance coefficient of the project which determines the quality of the project is calculated and it was (0.77). This means that project is (good in its value).

### Recommendations:

- Working on linking the architectural study of the project spaces by the user's psychology to design spaces humanly and functionally fit with the currently and the future user. Where neglecting this linkage is one of the

- main factors in increasing the unnecessary costs to be deleted to reach the best cost of the project.
- The use of modern materials in the construction that working on improving the environmental performance, the use of renewable energy resources and the study of the difference effect between it sexist or not in the project.
  - Working on the establishment of databases containing the prices of all raw materials used in the projects with the regular update of those prices to avoid the increase in the unnecessary cost of the project and in order to be applied to similar projects which saves time, effort and cost.
  - Working on providing a valued alternative or more of the project before the start of its implementation and choose the optimal alternative agreed upon by all parties of the project to reach the highest functional

performance of the project and at the lowest cost.

- Working on achieving the integration of the performance whether (economic - functional - Environmental - architect) for the project, as this integration works to achieve a balance between cost and quality.

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