

# Integration Value Engineering with Target Costs into the Design and Development Stage from the Product Lifecycle

## A case study of the Electronic Industries Company – Baghdad

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**ABSTRACT:** The integration of value engineering with target costs is one of the important tools for any economic unit that aspires to add value to itself by achieving a competitive advantage and satisfying its customers. During the analysis of the functions of the product with high costs in order to be able to reduce these costs while maintaining the quality of the job and the efficiency of product performance, and as a result of using the target costs in the analysis and extracting the value index for each component of the color TV (the research sample) produced by the Electronic Industries Company, it was found that three Components of color TV components with high costs of 50,000 dinars compared to imported color TV and these components are (screen, remote control, internal equipment) if their value index is more than one, which requires reducing their costs. Some components of color TV need to be re-designed using value engineering in order to bring their costs down to the cost of competitors.

**KEYWORDS:** Value Engineering, Target Cost, Product Lifecycle.

### INTRODUCTION

The contemporary business environment has imposed new challenges on the various economic units represented by intense competition between economic units at home at the same time from products imported from abroad, for this reason economic units try to use the characteristics resulting from the integration of value engineering technology and target costing technology with us for the purpose of adding value to them. The two technologies are integrated in an integrated manner, especially in the design and development stage of the product life cycle. Target costs determine the parts or components with high costs compared to the permissible costs. Then value engineering is followed by analyzing the functions of those high-cost components and trying to re-design them in order to preserve the basic functions of these components as well as their quality and performance. Time it trying to produce those parts within the limits of the target costs and thus the electronic industries company can compete with foreign products in costs and quality, and when the permissible costs cannot be reached, the appropriate alternative is to abandon the production of those products and switch to another alternative. The researcher has reached through his research The importance of target cost in improving the competitive position The Electronic Industries Company - Baghdad “published in Al-Taqni magazine No. 3 of 2010 that there are three parts of the color TV produced by the aforementioned company (screen, remote control, internal equipment) with high costs by (50,000) dinars compared to competitors, and in the research

Currently, the researcher complements the idea of his previous research with a research that deals with the high costs of those parts through the integration of value engineering with target costs in the design and development stage of the color TV production lifecycle for the purpose of production within the limits of target costs.

### RESEARCH PROBLEM

The Iraqi industry in general, and the electrical and electronic equipment industry in particular, suffers from severe competition from foreign products in several areas, including high manufacturing costs as well as other additional costs at the same time, low design quality and performance, so the electronics industry at the present time and even in the foreseeable future cannot compete The foreign product unless modern technologies are adopted in the field of cost reduction and product re-design in order to preserve the basic functions of these products.

### RESEARCH GOAL

The research aims to use the targeted cost and value engineering technique to add value to the economic unit. The first technique analyzes the functions of components with high costs, excludes unnecessary secondary functions, and re-designs those parts in a way that reduces their manufacturing costs and ensures the quality of their performance. The second technique identifies components whose costs are required to be reduced due to their high Compared to the allowable costs of producing those components.

## RESEARCH HYPOTHESIS

The use of the features of integration of value engineering technology with target costs in the design and development phase of the product life cycle will lead to reducing the costs of products or their components while maintaining their quality And the efficiency of its performance, which adds value to the economic unit and enhances its competitive position and market share.

Research importance

The research is determined by studying the problem of weak demand for the products of the Electronic Industries Company in Baghdad and the use of appropriate techniques that help the mentioned company in expanding its activity and presenting its products as a competitor to foreign products in the field of electronic industries.

## SEARCH METHOD

The functions of three components of a 42-node color plasma TV guitar model 4201 (monitor, remote control, and internal equipment) were analyzed, as these components have high costs compared to the target costs of these parts.

## CONCEPTUAL FRAMEWORK OF VALUE ENGINEERING TECHNOLOGY

### Value Engineering Concept

Value engineering is defined as (the organized method that aims to know the functional service provided by the product at the lowest possible cost). Or replacement by analyzing the functions of the facility and excluding or modifying costs that do not contribute to the functional performance of the economic unit (Matab : 2011 : 5( Value engineering is defined as the systematic process of reviewing and analyzing project functions, through the design and development phase of the product life cycle, by a multidisciplinary team outside the project in order to:

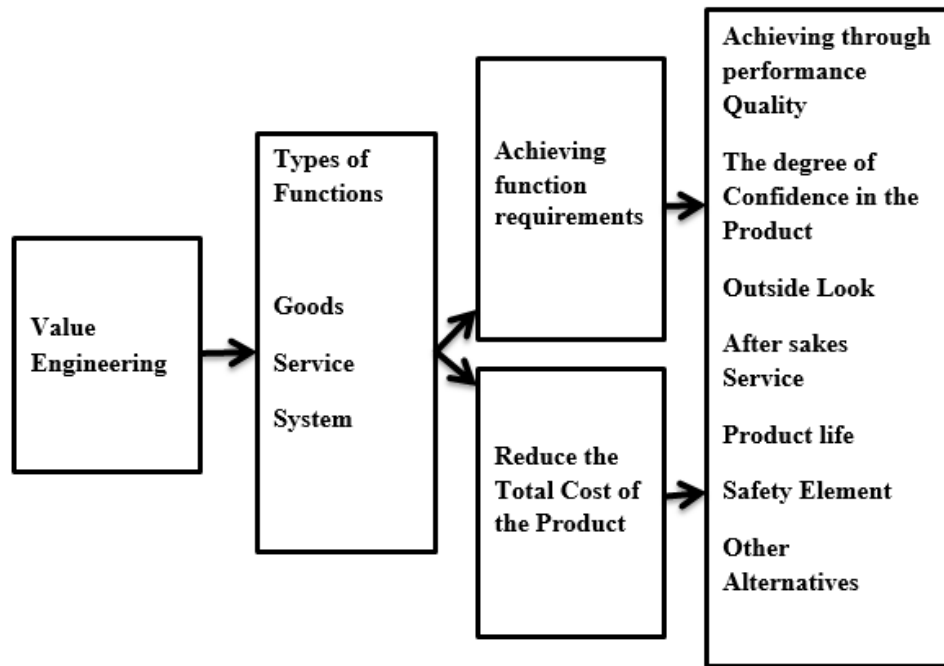
1. Provide safety for the required jobs, which are characterized by reliability and efficiency, and at the lowest total cost.
2. Improve the value and quality of the project.
3. Reducing project completion time. (Department of transportation, 2011:1 2)

Several concepts have similar meanings to some extent (value engineering, value methodology, value analysis, value management (to give a concept, a goal and a methodology to the value engineering ( Mutib, 2011: 5).

Value engineering is a powerful tool that can solve the problems of economic units by lowering the costs of the cost target while maintaining on improving the performance and quality requirements of products, value engineering focuses on analyzing the functions of components (projects devices, equipment, products, activities with the goals of raising the level of their value through an organized, creative, creative approach carried out by An integrated and specialized team, which helps economic units improve their competitive position : (Al-Tami, Shehab, 2010:10)

1. Reducing the costs of its various activities and then its products or services.
2. Increasing the profitability of the economic unit.
3. Improving the quality of its products.
4. Using the resources of the economic unit with high efficiency.
5. Solve the problems facing the activities of the economic unit.
6. Reducing the time of delivery of products to customers as well as the life cycle of the product.
7. Increasing the market share of the economic unit.
8. Developing the competitive position of the economic unit by providing the required products or services at the lowest possible cost Value engineering is a creative tool that analyzes and tracks the value of all components of activity dedicated to the production of a specific product, starting from The design stage until the final delivery stage to the customer, which leads to an increase in the value of the economic unit and Improves performance and reduces costs of its activities.

Value engineering is an effective technique that focuses on analyzing the functions of a project, whether this project is public or private engineering or management for the purpose of controlling the total cost and reducing unnecessary costs that do not add value Therefore, value engineering acquires great importance as it focuses on thinking: the project)( Abu Bakr, 2010:2) , Creativity and methodology does not mean replacing one element with another element or material for another, nor does it mean modification, Its use in all stages of the product life cycle, but the appropriate stage for its use is the stage of product design. Value engineering can also be viewed from the angle that value is a relationship and the ratio of job to cost, and therefore it can be increased value by improving functionality or reducing costs.



**Figure (1)** shows how value engineering works  
**Source:** (Transtutors, 2012:1)

Figure (1) shows that the value engineering work mechanism begins with collecting information related to design documents. Blueprints, specifications, approved standards in the field of costs, quality, bills of quantities and competing projects, Then by analyzing the functions of the product into a good, service, system, and then verifying the availability of job requirements and making sure of the Reducing costs throughout the product life cycle and characterizing this function with quality and efficiency of performance customer needs.

**Evolution of the concept of value engineering**

In 1940 Lawrence Miles and Harry Arger invented the concept of value analysis due to the shortage of skilled hands, Raw materials and spare parts during World War II while they were working for the American General Electric Company, Therefore, they searched for acceptable alternatives instead of scarce resources, and they found that these alternatives in most cases reduce cost, product quality improvement, or both, and this means adopting a new methodology at work it is called value analysis technique. (International Value Standard, 2007:7)

In 1954 the United States of America adopted the same method in dealing with the high costs to manufacture its warships in the design stage, as the costs were high, and this technology was called value engineering, which depends on creative thinking that focuses on analyzing the functions of the product. (Moon, 2005:3)

In the year1959, the American Society of Value Engineers was founded in Washington and began to use this technology

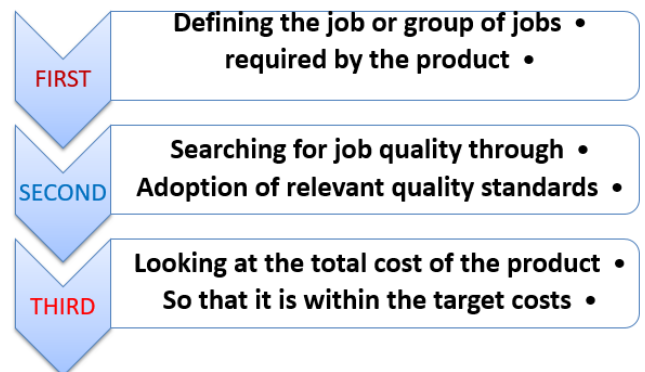
It is spread in various public and private sectors and in the construction industry and others.

In view of the proven success of value engineering in the countries of the world, the International Organization of Value Engineers was established

In the year 1959 and included in its membership the United States of America, Japan, Australia, India, and the Arab world Saudi Arabia and at the present time, many countries, such as Jordan, for example, have started to adopt this technology due to the many advantages that it provides enjoy it.

**The elements of value engineering**

Value engineering is an effective technique for solving engineering and management problems, as it is based on three components Basic starts with effectiveness by analyzing the job or required jobs based on the needs of customers and then the work In order to achieve efficiency by defining quality standards that are compatible with the product down to the total cost allowed.



**Figure (2)** shows the components of value engineering.

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Figure prepared by the researcher

**Methods of increasing the value of the product's function**

There are four ways to increase the value of a product's function as follows:

First: Reducing costs while ensuring the same level of performance.

Second: the costs are reduced, and the performance level increases.

Third: Increasing both costs and the level of performance, while ensuring that the level of performance increases more than the increase in costs.

Fourth: Enhancing performance while keeping costs at the same level.

**Value Engineering Technology Steps**

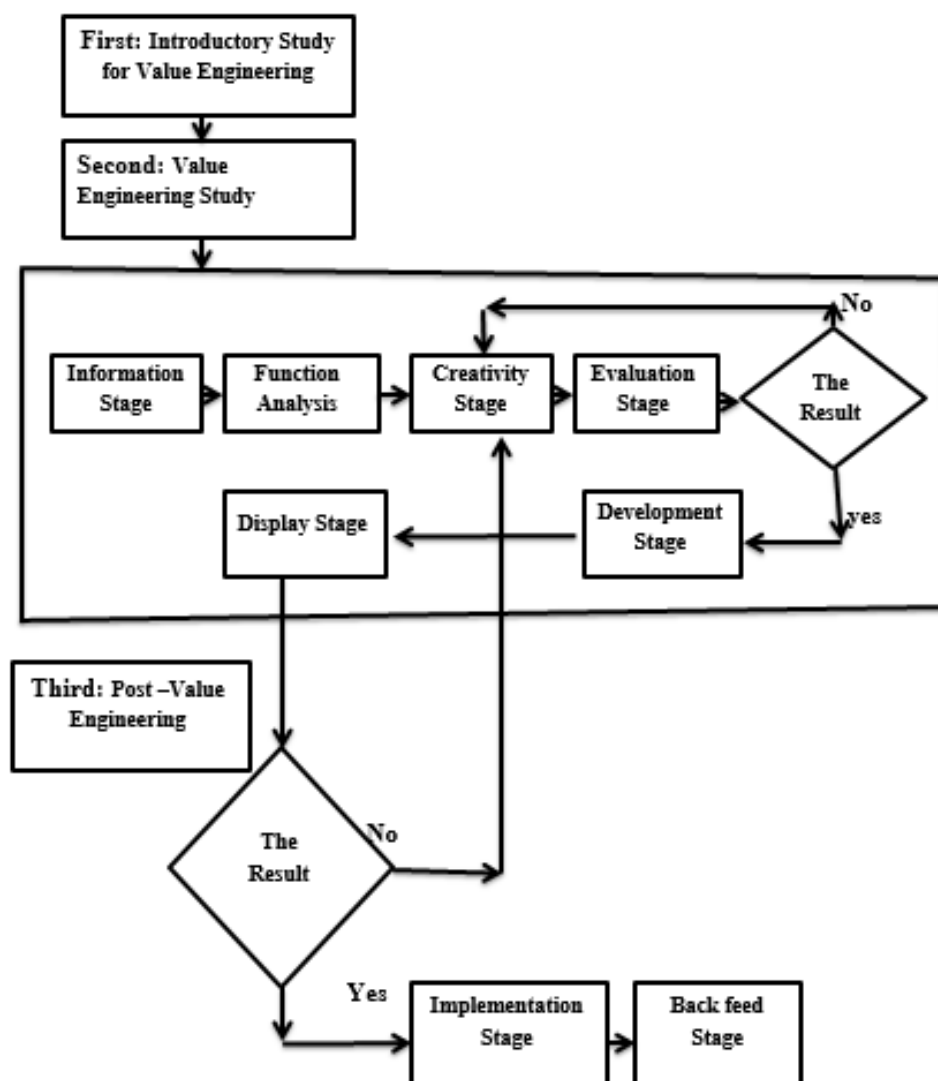
The International Organization of Value Engineers has developed a standard work plan for implementing the value approach when using Value or value analysis or value management and is suitable for various projects that want to use these techniques and consists of periods, which are as follows: (Al-Shaya , 2009:5).

First: The preliminary (preparatory) study for the value study.

Second: the study of value and it consists of:

1. The information stage
2. The job analysis stage
3. The creativity and innovation stage
4. Evaluation and selection stage
5. Research and development stage
6. Briefing stage and presenting recommendations.

Third: the subsequent study to study the value.



**Figure (3)** Explain how Value Engineering do

**Source:** (Save international Value Standard, 2007:12)

Here is a brief summary of the value engineering work steps (SAVE International Value Standard, 2007: 13-19).

**First: Preparatory study for value study**

The goal of this study is to plan and organize the study of value by answering the question of what should be To carry

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out the activities in this study, and the activities were determined by obtaining the approval of the senior management about the plan Work, determine project requirements, set a budget related to the completion period and project costs, as well as choose The work team and define the tasks of each of them and provide them with the information, documents, drawings and plans necessary for their success the project .

## **Second: the study of value.**

The critical stage in the study of value engineering is the focus on job analysis and redesign the product is in accordance with the target costs (allowed) and consists of several stages as follows:

### **1. Information stage**

At this stage, the data obtained during the preliminary study period are processed and in the light of it The work team determines the basic requirements and objectives of the project, and the information is classified into information related to The costs of the product and others related to product specifications and other information related to project budgets and achieved, in addition to information related to the study of the project, represented by the following: (Shiya, 2009: 28)

Examination of project documents, flowcharts and documentation..1

2. Determining a list of the information required to study the project.

Reaching an appropriate estimate of what the customer needs.3

4. Defining project goals and strategies

5. Preparing budgets of quantities and amounts for project requirements.

### **2. Stage job analysis.**

The business team analyzes the functions of a product, project, service, or activity to identify those that need to be addressed Improving, deleting or re-designing to meet the customer’s needs at the same time within the target cost range and with the achieves the project objectives.

### **3. The stage of creativity and innovation.**

At this stage, various non-traditional ideas that represent creativity and innovation for the work team are presented with the aim of Discover creative alternatives, options and possible ways.

### **. Evaluation and Selection Stage.4**

Ideas are limited to the creativity stage and each idea is evaluated based on criteria (newness of the idea, applicability The time it takes for the application, the expected financial return, the cost ) and an evaluation score is given for each idea and then it is done the comparison between t based on the degree of evaluation (Al-Salami,2006: 9)

### **5. Research and Development Stage.**

After choosing the alternatives from the ideas that got the highest rating in the previous stage, the follow-up is done

Working at this stage on the method of in-depth study of each alternative of ideas and comparing these alternatives among themselves on the basis of the expected initial cost savings as well as the product life cycle cost analysis.

6. Summarizing and presenting recommendations Stage.

The ideas are presented in their final form to the authorized parties to take the decision to adopt these ideas and finance their implementation the study of value in and of itself does not save costs or satisfy customers without turning into a practical reality.

### **Third: the subsequent study to study value engineering**

This stage is a summary of all previous efforts and activities, as the results of the value study are applied according to another Scientific developments that have been approved and approved by the relevant parties and consist of two activities applying the value study and following up on its implementation.

### **Integration of value engineering technology and target cost technology**

The core of value engineering focuses on how to obtain the best results at the lowest costs It can be used at any stage of the product life cycle, but it was found that its application is in the research stage And design comes with better results than if it was used in other stages of the product life cycle so in this The topic will apply value engineering to the product design stage as well as the target cost, as the two techniques They can work together at this point in the product life cycle so that the target cost determines the components that Its cost is high compared to competitors and it is accepted by customers and then value engineering comes to re-design these components High costs in order to reduce them while maintaining the same function in terms of quality and performance.

### **Target cost concept**

In modern production systems, such as the on-time production system, and before the actual production begins, the focus is on determining the target selling price by studying many factors, the most important of which are: (Al-Rakabi, 2010: 161)

-1The customer as his desires and needs and his ability to pay for the product (good or service).

-2 competitors

3-The strategy of the economic unit in producing products that meet the customer’s desire and guarantee them a market share with Competitors, as well as determining the target profit margin after taking into account the wishes of the investors and the management of the unit economic and related parties, and then the target or permissible cost is determined according to the formula the following:

Target cost = Target selling price – Target profit margin

Then the economic unit tries to produce at a cost that does not exceed the limits of the target cost shifting from the design

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and development stage to the actual production stage, and if you cannot for any reason, use Value engineering technique for the purpose of reducing costs, value engineering focuses on two main factors:

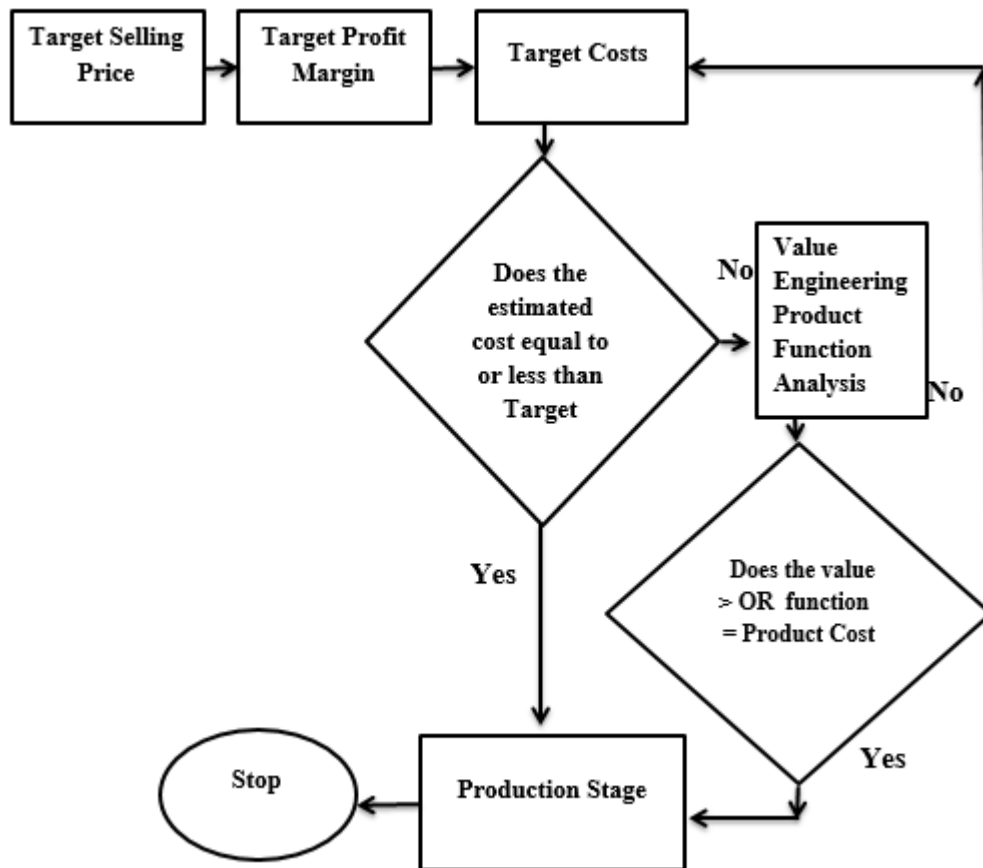
- 1 Function value.
- 2- Cost of the component that produces the function.

If the target cost is not reached, then the idea of production is canceled and the switch to other ideas This means that the target cost is a sensor or measure used by the economic unit for the purpose of reducing Uncertainty factor At the same time, it is also used to reduce the cost of the product before production begins in order to comply with closest competitors.

**Relationship of value engineering with target cost**

The main components of value engineering are the functional performance of the product or part of it and the quality of that performance the total cost of the job or the part that produces the job. As for the target cost, it is shared with engineering the value in the cost of the product or the cost of that part that produces the job in question. Thus, the researcher sees that there is a space directly shared between value engineering and target costs represented by product cost as well as availability Indirectly shared spaces between

them, the target costs are looking to reduce product costs in order to It matches the costs of the closest competitors, and this necessarily means focusing on customer needs and product preferences What he desires, and it requires a certain degree of quality and efficiency of performance, and this is what value engineering cares about Focuses on the quality of job performance, and as a result, both technologies can work in a complementary manner Especially in the stage of product design, and what this stage constitutes of great importance in the cost of the product, the percentage of The cost of the design and development phase is about (70 -90 % of the cost of the product in some economic units. (Tanaka, 2001:2) Some believe that there is a difference in the way both technologies work, as the target cost is reduced Costs by segmenting the cost objective (product) and eliminating some of its unnecessary parts while value engineering Based on the analysis of the functions of the cost objective (product) and the introduction of alternatives that perform the same function, but at a lower cost And higher quality. Thus, value engineering and target costing agree in the result and differ in style, and figure (4) explain this. (SWCC VE Program Guidelines, 2011:5)



**Figure (4)** Explain how value engineering and target costing agree in the result and differ in style  
Source: (Cokins, 2003:3)

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**COLOR TV FUNCTION ANALYSIS ACCORDING TO VALUE ENGINEERING TECHNIQUE AND COST TECHNIQUE**

**Targeted**

**Electronic Industries Company in Baghdad**

The Electronic Industries Company was established in 1973, and it is a mixed joint stock company with a capital of million dinars for the production of electronic devices such as television, radio and other devices, and then expanded its production during (30,000) the period of the eighties and nineties and the first years of the second millennium and its

capital became in the year 2004 billion Iraqi dinars. After the year 2003, the company faced many challenges, the most important of which was the competition of foreign industries and its low production. (Al-Rikabi, 2010:169)

Table (1) shows the extent of decline in the production of the Electronic Industries Company for its various products for the year 2007 due to several factors, the most important of which are the intensity of competition with foreign products and the high costs of products, color TV production decreased by 94%.

**Table (1).** It shows the significant decline in the company's production of various products

Product name	Production Plane 2007	Production Actual 2007	Execution Percentage	Production Actual 2006
Color TV	18000	1085	6%	4070
Total Radio	70000	25712	37%	28537
Total Phone	20000	611	3%	311
Computer	3000	1908	64%	917
Analog Pedals	10000	1328	13%	4744
Home Protection devices and reflectors	-----	5019	-----	4152
Digital Function	5000	1858	37%	448

**Source:** Information Report of the Board of Directors and the final statements and accounts of the Electronic Industries Company at 31/12/2007.

For the purpose of research and application of the value engineering technique, a color TV was chosen, a plasma type, a size of 24 knots, a guitar Model 2403 due to the decrease in

the volume of its production by 72% and its importance in the sequence of priorities of the producing company for it.

The following are the details of the company's production of color TVs and their selling prices:

Type Color TV	Size Color TV	Selling Price
Color TV	Size 22 model 2201	280000
Color TV	Size 26 model 2601	450000
Plasma Color TV	Size 42 model 4201	750000
Plasma Color TV	Size 50 model 5001	1500000
Plasma Color TV	Size 63 model 6301	3750000

Steps of applying value engineering and target costing to a plasma color TV size 42 model 4201:

1. Arranging the desires and needs of the customer and determining the relative importance of each part of the color TV.
2. Analyzing the gap between the estimated cost of television production and the allowable cost of its production for the life cycle of the product.
3. Analyzing the functions of the color TV set in light of the estimated cost of each one.
4. Measuring the degree of strength of the relationship between the desires and aspirations of the customer and the functions of the color television.
5. Measuring the contribution of the functions of the color TV to satisfying the customer's desires and needs.

6. Calculating the value index for each component of the color TV and then reducing costs estimated components whose index value is more than (1) to be equal to the permissible cost.

7. Re-design the components (parts) whose value index is more than (1) meaning that their value is less than their cost using value engineering technology while maintaining quality and performance.

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**Table (2).** Arranging the desires and needs of customers for the functions of plasma color TV size 42 model 4201

Customer wishes and needs Functions of color TV components	The relative weight of the significance of Customer's point of view					Percentage of relative importance
	1	2	3	4	5	
External appearance of color TV	4					20%
Screen Size	5					25%
Clarity in color and sound	5					25%
Color TV stand	2					10%
Remote control specifications	3					15%
Type, model and year of manufacture	1					5%
<b>Total</b>	<b>20</b>					<b>100%</b>

Table (2) shows the relative weight of the importance of the functions of the components of a plasma color TV size 42

from the point of view of the customer as well as the percentage of this importance.

**Table (3).** Analyzing plasma color TV size 42 model 4201 into its main components, the functions of these components and their estimated costs

















Basic components of a TV	Functions	Estimate costs	
		Cost	Percentage
Outer frame	Gives the shape and aesthetics of the device	123750	16.5%
Screen	To view various events	165000	22%
Headphone	To show the sound	105000	14%
Control board	To control the various activities of the device	75000	10%
Remote control	Turning on and off the device and meeting the customer's desire to Multiple options	105000	14%
Internal components	To meet the requirements of the operation of the device	176250	23.5%

**Source:** the information is a list of prices for plasma color TV size 42 issued by the Electronic Industries Company on 2009 / 12 /24.

Table (3) shows the estimated cost of each component (part) of the plasma color TV size 42, which is It will then be compared with the allowable costs of all components of the

TV set to be reduced by using Value engineering technique, considering the relative importance of each from the customer's point of view.

**Table (4).** The relationship of the functions of the components of the TV set to the wishes and requirements of the customer

Customer wishes and needs Functions of color TV components	Outer frame	Screen	Headphone	Control board	Remote control	Internal components
External appearance of color TV						
Screen Size						
Clarity in color and sound						
Color TV stand						
Remote control specifications						
Type, model and year of manufacture						



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△ : Strong relationship (0.5)

● : Weak relationship (0.2)

□ : Middle relationship (0.4)

**Table (5).** Calculation of value index for each component of plasma color TV size 42 model 4201

TV components colored	step (1) percentage the costs of each component to device TV Table (3)	Step (2) Importance Relativity for device components TV (2) *(4)Table	Step (3) Index value step (1/2)	Index value indication
Outer frame	16.5%	27.5%	0.6	No reduce
Screen	22%	13%	1.69	Reduce costs
Headphone	14%	20%	0.7	No reduce
Control board	10%	17%	0.59	No reduce
Remote control	14%	13%	1.076	Reduce costs
Internal components	23.5%	14%	1.68	Reduce costs

Source: (Crawford; 2007, 28)

Note: When the index value is equals (1) or more, this requires reducing the estimated costs of that part from the device to reach the target cost, using value engineering technology to redesign the product as etween.t able (5) shows

that the components of plasma color TV (Screen, remote control, internal components) need Redesigned to reduce costs.

**Table (6).** Analysis of the contribution of functions and components of plasma color TV 42

Functions components plasma color TV 42										
		Cost	Value	Gives the shape and aesthetics of the device	To view various events	To show the sound	To control the various activities of the device	Turning on and off the device	To meet the device requirements	Total Function Value
Components color TV 42				130000	125000	115000	90000	85000	170000	
Outer frame	123750			100000 100000	125000 130000				25000 23750	125000
Screen	165000			14000 20000					15000 15000	154000
Headphone	105000			16000 15000		80000 80000			12000 10000	108000
Control board	75000					8000 15000	74000 25000	50000 25000	13000 10000	145000
Remote control	105000					16000 10000	7000 80000	20000 10000	15000 5000	58000
Internal components	176250					11000 16250	9000 10000	15000 10000	90000 140000	125000
				135000	130000	121250	115000	45000	203750	
<b>Total Function Costs</b>										

Source: Minds.org (Creating, 2010:2)

When analyzing Table (6) according to the standard work plan for value engineering that was clarified on the pages the previous one reveals the following:

First: The main components of the TV set were identified by six components (the outer frame, the screen, speakers,

control panel, remote control, indoor equipment) and select corresponding functions It has six functions as well) gives the shape and aesthetics of the device, to display the various activities, to show the sound, to control the various activities, turn the device on and off, fulfill the device’s work requirements.

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Second: cells that contain two amounts, the higher amount represents the value of the function and the lower amount represents the cost of the component that performs the corresponding function.

Third: If the value of the function is higher than the cost of its component, then it does not need to be changed, as in the case of the framework external, as the value of the function as in the above table is (25000) dinars, while its cost is (23750) dinars, and this rule applies to the rest of the other five functions, but if the value of the function is high, as well the cost of the component is also high, then it requires improvements, as in the case of internal equipment, as it is valuable the function is (9000) dinars, while the cost of the component is (10000) dinars, but if the value of the function is low and the cost of the component is high, as in the case of the remote control device, as the value of the function reached (7000) dinars, while the cost of the component (80000) dinars, then it requires a re-design of that component to the cost of production becomes within the framework of the target cost, or the value of the function is higher than the cost of the component, Which uses value engineering technology?

Fourth: There are three components (the screen, the remote control, and the internal components) the cost of some of its functions higher than the cost of these components, which requires re-designing these components in order to reduce their costs.

Fifth: We note that the total cost of the screen component, the remote control, and the internal components is (165000, 105000, 176250) dinars, respectively, distributed over the functions of these components, while the total value of the functions for the same previous components is ( 154000, 58000, 125000 ) respectively, and they are distributed over the functions, and when we look at the total costs of the components, we find that they are high compared with the value of its functions and this requires re-design using the value engineering technology.

Sixth: The main objective of analyzing the functions of the components of the plasma color 42 is to increase the value of the functions or decrease component cost by understanding the functions and components that is the core of value engineering.

## CONCLUSIONS AND RECOMMENDATIONS

### The Conclusions

1. The competitive position of the Electronic Industries Company is weak because its production depends on the process of assembling components Color TV and not manufactured which weakens the company's ability to compete and limits its flexibility industrialization.

2. The value of the index value of the components (Screen, Remote Control Internal components) is more than (1) It

requires reducing its costs by (50000) dinars, at which point the company can compete with the foreign product.

3. There are many problems faces the company, some of which are related to the company's structure and the other to the legal aspects and financing, in addition to the lack of training and qualification of workers on modern methods of work and knowledge modern technologies to reduce costs.

### Recommendations

1. Adopting the manufacturing strategy instead of the currently in force assembly strategy, as it no longer fits the requirements of Industry in light of global competition, which provides the company with a competitive ability with foreign products and on the least in the cost of transporting products from the origin country to Iraq.

2. Increasing the value of the value index for some parts of plasma color TV requires analyzing the functions of these components and repeating them Re-designed in order to preserve its basic function and at the same time ensure the quality of its performance and all of this The procedures will not take place unless the appropriate manufacturing environment is available.

3. The company, as in other mixed sector companies, needs legislation and sources of funding in order to advance its activities rehabilitation of its functional and technical staff and raise their capabilities and skills in line with the modern technology that will It is used in the modern manufacturing environment.

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