

Integrating the attribute based costing (ABCII) and target costing (TC) techniques to enhance competitiveness: A case study of Al-Narges Company for production of pipe

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Abstract

In light of the conditions and changes that the Iraqi economic is currently experiencing, the products of the majority of the Iraqi economic units, including the companies witness downturn. This research aims at demonstrating the steps of integration between the attribute based costing (ABCII) and target costing (TC) technologies, and to demonstrate their practical impact on managing costs and supporting competitive advantages to enhance the competitiveness of Al-Narges company. Data were collected from 75 participants who use and deal with this product from customers, retailers and construction companies of Al-Narges Company for the production of plastic pipes, the UPVC pipe producer factory (25mm\ 1.5 mm\10 bar). Results indicated that the application of integration between the ABCII and TC technologies leads to reducing the cost of the UPVC pipe product (25 mm / 1.5 mm / 10 bar) by (234\$). Hence, the total cost of the product decreased to (1,764\$). It had costed according to the traditional system (1,998\$), i.e. a reduction rate of (11%), which is reflected in the decrease in the selling price of the product to become (2,182\$) instead of (2,398\$) Dollars, i.e. a reduction rate of (9%). This reduction gives greater flexibility in the product pricing process in light of the intense competition in the market. It is recommended that Al-Narges' company to adopt modern administrative and cost methods and techniques to achieving stability in the competitive and financial position of the company.

Keywords: Attribute based costing (ABCII), target costing (TC), enhance competitiveness.

Introduction

Due to the rapid changes in the modern business, the majority of economic units in general, and Iraqi industrial units in particular, face many challenges that threaten their competitive and financial future. Such threatens are resulted of the using traditional systems for cost and administrative accounting. Since, they have become unable to keep up with those changes, as a result of criticisms directed at them for their lack of managing accurate costs and support for competitive advantages, which causes weak competitiveness. Therefore, it becomes obligatory for the management of units that seek succeed and remain in the competition circle in light of the modern business development, to shift from practicing the traditional systems to

modern administrative and cost methods and techniques. Obtaining modern techniques lead to more accurate cost management and provide the necessary support for competitive advantages by contributing to the production and provision of products with specifications, advantages and competitive prices to meet the requirements and desires of customers and the competitive situation to enhance its competitiveness. Among these techniques are attribute based costing (ABCII) and target costing (TC).

Research methodology

Research problem

The research problem is centralized on what the economic units suffer from weaknesses in the sustainability and continuity of enhancing the competitiveness that affects their continuity in the circle of competition in the markets. Based on this, a survey and field visits were carried out by the researchers to the research sample to determine the problem that it suffers from in its inability to manage costs more accurately and provide the necessary support for the dimensions of competitive advantages and thus affect its competitiveness as a result of its adoption of traditional systems of cost and administrative accounting. In order to find solutions to this problem, it is possible to use some modern administrative and costing methods and techniques. Among these techniques are ABCII and TC. Therefore, the research problem can be formulated with the following questions:

- 1- Is it possible to integrate between ABCII and TC technologies?
- 2- What is the role of integration between ABCII and TC technologies in managing costs and supporting competitive advantages to enhance competitiveness?

Research importance

This research scientific importance is highlighted by its contribution to studying one of the most important contemporary issues in managing costs and supporting competitive advantages to ensure the continuity and sustainability of the competitiveness of the economic units. Furthermore, the practical importance of this study is highlighted in the possibility of applying the TC and ABCII techniques in practice and indicating the role of integration between them in managing costs and support competitive advantages in Al-Narges company for production of pipes to raise its competitiveness in the markets.

Research Objectives

The research aims to demonstrate the possibility of achieving integration between the ABCII and TC technologies in a way that helps provide appropriate and more accurate information to the management of the Al-Narges company for producing pipe, which helps it manage costs and supports competitive advantages to enhance its competitiveness.

Research hypothesis

This research is based on the following hypothesis: (the Integration between the ABCII and TC technologies contributes in addressing the deficiencies in traditional cost management systems, which leads to achieving the dimensions of competitive advantages to enhance the competitiveness of Al-Narges company).

Literature review

When reviewing the previous literature, the researchers did not find previous studies related to the role of integration between ABCII and TC technologies in directly enhancing competitiveness, but there are studies indirectly, including the following:

Quraishia and Ghabban (2020) found that companies are willingly to apply modern administrative and cost, including the ABCII method to achieve competitive advantages by meeting the requirements of customers in terms of quality, costs, prices and time. Kleib (2020) investigated the impact of applying the target costing method in achieving competitive advantage. This study concluded that the use of the TC method contributes to the success of competitive strategies by raising the level of quality and reducing costs for products in a way that ensures customer satisfaction and loyalty.

What distinguishes the current research from previous studies can be summarized as its focus on how to manage costs more accurately and support competitive advantages using ABCII and TC technologies through a complementary relationship between them to achieve the dimensions of competitive advantage in terms of (cost, quality, time, creativity and flexibility). This ensures the sustainability and continuity of the competitiveness of the economic unit and thus lead to the stability of the competitive and financial position of the economic unit.

Attribute based costing technology

As a result of the rapid transformations and changes in the economic and industrial environment, the search for systems, methods and technologies that are consistent and compatible with these variables has begun. Such studies ensure the achievement of the dimensions of competitiveness with a high degree of efficiency and effectiveness to achieve financial and competitive stability for economic units.

Therefore, many of these systems, methods and techniques emerged, including the ABCII technology. It is one of the modern management and costing techniques that relies on analyzing all cost aspects of activities and operations based on product specifications. They meet the increasing demand for information appropriate to the modern business environment instead of relying on traditional costing systems (TCS) that are unable to harmonize with changes in the modern business environment (Azeez et al., 2020,P.2).

Researchers identified many definitions of the ABCII technology. They were different in terms of concept, but similar in principle. (Sandborn, 2017,P.104) defined ABCII as an entry point for measuring the cost of the product by determining the basic specifications of the product and the cost drivers.

After that, the cost of each of the product attribute is determined, on the basis of which the product cost is calculated. ABCII is also defined by (Pirretti et al.2006,P.32) as the input that works to identify and allocate costs on the basis of activities and operations according to product attribute, with the aim of measuring and determining the cost of the product more accurately. The ABCII technology seeks to help economic units achieve according to (Alshami et al.2017,P.220) and (Nowlis and Simonon, 2018,P.154) the following goals:

1. Producing services or products with high specifications and quality at the lowest possible cost in order to strengthen the competitive position.
2. Creating an appropriate and accurate accounting information system, both costly and administrative, to assist the administration in making decisions.
3. Achieving and gaining the satisfaction and loyalty of customers through providing products characterized by having competitive advantages.
4. Measuring the cost of the product accurately through cost management on the basis of the specifications required by customers.

Target costing (TC) technique

Target costing (TC) technology is one of the modern technologies that is compatible and consistent with the interest in managing costs and achieving competitive advantages. TC is among the priorities of management that seeks to strategically manage costs and provide real support to achieve competitive advantages at the level of cost, quality, time, creativity and flexibility. TC also aims at achieving satisfaction customers in a way that ensures achieving the largest market share that leads to an increase in the profits of economic units (Alhurr & Ellessa, 2021,P.146).

Authors and researchers identified definitions and different points of view on the concept of TC technology. (Drury,2018,P.247) defined TC as a technology that focuses on managing costs during the product planning and design phase by determining the TC for the product resulting from the difference between determining the target selling price and the target profit margin.

(Chakraborty ,2019,P.66) viewed TC as a strategy that helps determine how much the product (service) should cost instead of current cost to highlight the culture of brilliance in the economic unit as a source of sustainable strategic advantage through cost management in terms of planning and cost reduction. TC technology seeks to achieve a set of goals, the most important according to (Celayir, 2020,P.1310)(Sevim, 2019,P.3) are the following:

- 1) Determining the selling prices and the profit margin that ensures that the economic units achieve the desired market share before launching the products in the market, to help them increase their current market share.
- 2) Achieving the strategic objectives of the senior management related to managing costs and profits and enhancing competitiveness.
- 3) Assisting economic units in building their strategies according to the requirements of the markets and their competitors.
- 4) The consistent and practical application of target cost management in the process of planning, design and product development.

Steps of integration between ABCII and TC

Bhimani and Bromwich focused on the ABCII and TC techniques. They pay attention to the external view of the economic unit, and they also showed the strength of the marketing management method (Roslender & Hart, 2010,P.18). In light of the fierce competition, the requirements and desires of customers and competing products became the main driver of the activities of the economic unit on the basis of which production and pricing decisions are taken. Consequently, the administration has no control over it except to manage costs with a level of efficiency and high effectiveness to support and enhance its competitive advantages.

On the basis of this, it is possible to determine the complementary relationship between the ABCII and TC technologies (Al-Rubaie & Saad, 2018,P.706)(Jasim, 2015,P.69), in terms of participating in orientation towards customers and the market, making a successful pricing decision that is consistent with market conditions and customers. It can be also determined by providing appropriate descriptive and quantitative data, managing costs strategically, reconciling cost, benefit and return, and supporting competitive advantages by adopting multiple strategies simultaneously.

According to recent accounting literature, we see several motives for the integration between cost-effective and modern administrative techniques, including the integration between the ABCII and TC techniques used in several accounting and administrative fields.

The most prominent of these motives is the inadequacy of TCS in managing costs and supporting the competitive advantages of the economic unit according to a strategic vision, to orient the market and increased focus on customers, the changing of the modern business environment and the need for technology to analyze specifications, and the intensity of competition in the modern business environment (Kazem, 2019,P.124). We can summarize the steps of integration between the two technologies of (ABCII and TC) according to (Al-Rubaie, 2015,P.55) and (Al-Daffi, 2019,P.76) as follows:

The first step

Determining the current cost for each attribute by studying the market reality, identifying the needs and desires of customers, defining a set of basic attributes and characteristics of the product, determining the relative importance and levels of achievement of each specification, and determining the activities and their costs to achieve each of the product attributes.

The second step

Determining the target cost of the product by identifying the target selling price of the product, determining the target profit margin. Then the target profit margin is subtracted from the target selling price of the product.

The third step

Determining the target cost for each product attribute by adopting the exact cost basis that shows the complementary relationship between the ABCII and TC technologies according to the ratio of the cost of each product specification to the current cost of the product multiplied by the target cost of the product (Datar & Rajan, 2018,P.429).

The fourth step

Determining the cost gap (target reduction level) by comparing between the first step (the current cost of the attribute) and the third step (the target cost of the attribute).

The fifth step

Achieving the target cost through the use of some tools and alternatives for the purpose of achieving the target cost of the attribute for the purpose of producing a product within the specific specifications based on the needs and desires of customers, the target selling price and the target cost in order to achieve customer satisfaction in terms of attributes, quality and prices.

The role of integration between ABCII and TC in enhancing competitiveness

Integration between these two technologies facilitates the cost management process for the economic unit in a more efficient and effective manner. A manner that guarantees support and enhancement of its competitive advantages. The most important advantages of this integration can be summarized according to (Al-Rubaie, 2015,P.60) and (Jasim ,2015,P.473) as follows:

- 1) Managing the cost effectively and efficiently through cost planning, accurate identification and allocation of costs, cost reduction, providing appropriate cost information to improve decision-making, and improving cost control.
- 2) Working on the optimal utilization of the economic unit resources through cost analysis and identification of utilized energy sources.
- 3) Seeking to support and enhance the dimensions of competitive advantage in order to achieve customer satisfaction and win their loyalty.

- 4) Contributing to enhancing competitiveness in a way that secures the stability of the competitive and financial position of the economic unit.

Practical application

Methods

The steps and advantages of this integration will be clarified in the results of this research by applying it in a practical way in Al-Narges Pipe Production Company on the UPVC pipe product (25 mm \ 1.5 mm \ 10 bar) to find solutions to the problems that the company suffers from not managing costs and supporting competitive advantages. This product is more accurate, which causes weak competitiveness.

Sample

Al-Narges Company for Pipe Production Limited Liability is one of the subsidiaries of Al-Narges Contracting, General Trade, Design and Project Management Company (the parent company) for the manufacture of various plastic pipes, including pipes for power lines. Al-Narges Pipe Production Co., Ltd. has obtained many certificates of quality and business development according to international organization for standards including ISO 9001, 2015 and ISO 21138-1, 2020.

Applying the integration steps between ABCII and TC

The first step

Determining the current cost of each specification by applying the ABCII technique represented in the following points:

- 1) Determining the needs and desires of customers by studying the reality of the market and determining the needs and desires of customers, in terms of basic specifications, quality, selling price, and time.
- 2) Determining a set of basic product attributes using several methods, including joint analysis and self-interpretation, and the method of value engineering, which clearly shows that the product contains four basic specifications, three of which are technical specifications and a service one, namely size, durability, design, safety and reliability.
- 3) Determining the relative importance of each specification of the UPVC pipe product (25 mm\1.5 mm\10 bar). To do this, the researchers designed a questionnaire distributed to 80 participants of the target party who use and deal with this product from customers, retailers and construction companies. The researchers received back 75 correct responses. The questionnaire aimed at exploring the participants' opinions about the relative importance of each product specification to benefit from it in giving the company importance commensurate with the importance of customers to those specifications when manufacturing the product and knowing the share of each specification in the costs, especially the costs related to decision and energy.

It is possible to clarify and analyze the results of the compilation from the questionnaire forms to determine the total weighted and the relative importance of each of the product specifications in the Table 1:

Table 1: *The total weighted and the relative importance of each specification of the UPVC pipe product*

Attribute	1	2	3	4	5	6	Relative importance of specifications
	Very important 5	important 4	Important to some extent 3	Not important 2	Not very important 1	total Weight	
Size (diameter, weight)	73	2				373	0.29
Durability (thickness)	45	20	10			335	0.26
Design	15	20	30	10		265	0.21
Safety (reliability)	30	27	18			312	0.24
Total						1285	100%

Determining the activities and their costs to achieve each of the product specifications. This step is practically applied by performing the following procedures:

Determining the materials and production stages associated with each specification.

With the help of the experience of the engineering staff within the company, the researchers made interviews with them and with the director of the production and planning department. The materials and production stages associated with each specification of the UPVC pipe product (25mm \ 1.5 mm \ 10 bar) were determined, as shown in Table 2.

Table 2: *Materials and production stages associated with each specification of the UPVC pipe product*

No	Substances	Attributes			
		Size (diameter, weight)	Durability (thickness)	Design	Safety (reliability)
1-	Ghadeer Resin (pvc)	70%	30%		
2-	Calcium carbonate	30%	40%	30%	
3-	Thermal stabilizer	20%		30%	50%
4-	Titanium	15%	65%	20%	
5-	Stearic acid	10%	10%	60%	20%
6-	CPEIM888	5%	75%	20%	
7-	Processsync		50%		50%
8-	Wax			50%	50%
9-	White dye (flowered)	5%		95%	
10-	Sticky tape				100%
11-	Packaging materials (nylon bag)	20%			80%
Activities and production stages					
1-	Manual mixing stage	100%			
2-	Breaker stage	80%	20%		
3-	Heating (oven) stage	50%	50%		
4-	Template stage	30%	30%	40%	

5-	Cooling stage		50%	50%	
6-	Printing stage			100%	
7-	Withdrawal stage		20%	80%	
8-	Shredding stage	20%		80%	
9-	Formation stage			100%	
10-	Quality checks		20%	20%	60%
11-	Packaging	5%			95%
12-	Full production warehouse			50%	50%
13-	Preparing for customers				100%

Second: *Determining the total cost of each of the specifications by calculating its share of the costs associated with production volume, activity, energy, and decision.*

Determining the costs associated with the production volume for each attribute

The costs associated with the production volume include all the costs of raw materials spent to produce one ton of UPVC pipe product (25 mm \ 1.5 mm \ 10 bar) and according to the ratios shown in Table 2 for those materials. Each of the product specifications represented in size (diameter, weight), durability (thickness), design, safety and reliability, as shown in Table 3:

Table 3: *Costs associated with the production volume for the production of one ton of UPVC pipe*

	1	2	3	4	5	6
Raw materials	Measurement	Quantity	The percentage of material for each attribute	The quantity associated with the attribute (2 * 3)	Weighted price	Amount in dollars (4 * 5)
Ghadeer Resin (pvc)	Kg	680	70%	476	2.00 \$	952.00 \$
Calcium carbonate	Kg	180	30%	54	0.16 \$	8.64 \$
Thermal stabilizer	Kg	25	20%	5	2.000 \$	10.00 \$
Titanium	Kg	10	15%	1.5	3.850 \$	5.78 \$
Stearic acid	Kg	2	10%	0.2	4.000 \$	0.80 \$
CPEIM888	Kg	1	5%	0.05	2.540 \$	0.13 \$
White dye (flowered)	Kg	1	5%	0.05	32 \$	1.60 \$
Packaging materials (nylon bag)	Kg	25	20%	5	1.50 \$	7.50 \$
Total						986 \$

The costs associated with the production volume for the remaining attributes are found in the same way as for the size of attribute. Table 4 summarizes the costs associated with the production volume for each attribute as follows:

Table 4: Summary of costs associated with production volume for each attribute for producing one ton of UPVC pipe

No	Attribute	Costs associated with production volume	
		for each attribute	amounts in dollar(
1.	Size (diameter, weight(	986 \$	
2.	Durability (thickness)	449 \$	
3.	Design	68 \$	
4.	Safety (reliability)	75 \$	
	Total	1,578 \$	

Determining the costs associated with the activity for each attribute

Activity-related costs include labor costs and indirect industrial costs (except obsolescence). Using the ABCII technique, the researchers identified several steps to accurately calculate the activity-related costs for each specification by determining the labor costs for each attribute, and determining the indirect industrial costs for each attribute.

Determining labor costs per attribute

Work costs are determined for each attribute by determining the time of the activities and production stages necessary to accomplish each attribute. Then the work cost is determined for each attribute according to that time, and this is shown in Table 5.

Table 5: The time required for activities and production stages to achieve the size specification

Activities and production stages	Responsible section	Time required for each production stage (in minutes(	time ratio for each specification	Number of employees	Total time / in minutes (2 * 3 * 4)
Manual mixing stage	Production	17	100%	1	17.0
Breaker stage	Production	20	80%	1	16.0
Heating (oven) stage	Production	25	50%	1	12.5
Template stage	Production	123	30%	1	36.9
Shredding stage	Production	20	20%	1	4.0
Packaging	Production	28	5%	1	1.4
		Total			87.8

The time required for activities and production stages to complete the remaining attributes is determined in the same way as for the size attribute. The times required to complete each specification of the UPVC pipe product (25mm/1.5 mm/ 10 bar) can be summarized in Table 6.

Table 6: Summary of the total time required to complete each attribute of the UPVC pipe product

No	Attribute	Total time per minute	Percentage time per Attribute
1	Size (diameter, weight)	87.8	24%
2	Durability (thickness)	72.7	20%
3	Design	148.9	41%
4	Safety (reliability)	56.6	15%
	Total	366	100%

According to Table 6, labor costs can be calculated for each attribute, which represents one of the costs associated with the activity, on the basis of the time required for each attribute and the rate of wages per minute, as shown in the following Table 7.

Table 7: Labor costs required to fulfill each attribute of the UPVC pipe product

No	Attribute	Average wage per minute (\$/minute)	Total time per minute	Labor costs per attribute (in dollars(2*3))
1	Size (diameter, weight)	0.56 \$	87.8	49.2 \$
2	Durability (thickness)	0.56 \$	72.7	40.7 \$
3	Design	0.56 \$	148.9	83.4 \$
4	Safety (reliability)	0.56 \$	56.6	31.7 \$
	Total		366	205 \$

Determining the indirect industrial costs for each attribute (except for depreciation).

Indirect industrial costs, including depreciation, represent 40% of labor costs, which is 82 dollars. The depreciation costs, which are estimated at 33 dollars, must be excluded from the indirect industrial costs per ton of UPVC pipe product (25 mm /1.5 mm/10 bar) as associated energy costs, so that the remaining indirect industrial costs are charged for each specification on the basis of relative importance. Table 8 shows a summary of the total costs associated with the activity for each attribute as follows:

Table 8: Summary of the total costs associated with the activity for each attribute of the UPVC pipe product

No	Attribute	Labor costs per attribute	indirect industrial costs for each attribute (except for depreciation)	Activity-related costs for each attribute (2+3)
1	Size (diameter, weight)	49.2\$	14.2 \$	63.4 \$
2	Durability (thickness)	40.7 \$	12.8 \$	53.5 \$
3	Design	83.4 \$	10.1 \$	93.5 \$
4	Safety (reliability)	31.7 \$	11.9 \$	43.6 \$
	Total	205\$	49 \$	254 \$

Determining the costs associated with energy for each attribute

The energy-related costs represented by the depreciation costs amounted \$33 for each attribute are determined on the basis of the percentage of time required to complete each product attribute, because time is the main driver of these costs.

Determining the costs associated with the decision for each attribute

The costs associated with the decision include the administrative and marketing costs incurred by the company at 6% of the total industrial costs per ton of UPVC pipe product (25 mm \ 1.5 mm \ 10 bar) amounting to \$112. These costs are charged to each of the product attribute on the basis of the relative importance of each attribute.

5) Determining the cost of the product by collecting the total cost for each of the product attributes. It represents the current cost of producing one ton of UPVC pipe product (25 mm \ 1.5 mm \ 10 bar) that the company determines according to the requirements and desires of customers, and this is what the Table 9 shows.

Table 9: The current cost based on the attribute of the UPVC pipe product

	1	2	3	4	5	6
No	Attribute	Production volume costs per attribute	Activity-related costs per attribute	Energy related costs per attribute	Costs associated with the decision per attribute	The total cost per attribute (2+3+4+5)
1	Size (diameter, weight)	986 \$	63.4 \$	8 \$	33 \$	1,090 \$
2	Durability (thickness)	449 \$	53.5 \$	7 \$	29 \$	538 \$
3	Design	68 \$	93.5 \$	13 \$	23 \$	198 \$
4	Safety (reliability)	75 \$	43.6 \$	5 \$	27 \$	151 \$
	The total cost of a tube product UPVC(25 mm \ 1.5 mm \ 10 bar)	1,578 \$	254 \$	33\$	112 \$	1,977 \$

The second step: Determining the product target cost

It is determined by the target selling price of the product through a prospective study of the competing products offered in the market by finding the average selling prices for those products. This represents the target selling price of Al-Narges Company for the production of UPVC pipes (25 mm / 1.5 mm / 10 bar) is (2,200 \$). This helps Al-Narges company to compete with similar products in the market in terms of selling prices. Then the target profit margin that Al-Narges company seeks to produce pipes is determined by 20% of the target selling price per ton of UPVC pipe product (25 mm \ 1.5 mm \ 10 bar). Next, it is time to determine the target cost of the product through the following equation:

$$\text{Target cost} = \text{target selling price} - \text{target profit margin}$$

$$2,200 - 440 = \$1,760 \text{ per ton}$$

The third step: Determining the target cost for each attribute

Table 10: Target cost for each UPVC pipe product attribute

No	Attribute	1	2	3	4	5
		Current cost per attribute	Current cost for the product	The target cost for the product		The target cost per attribute (2/3)* ⁴
1	Size (diameter, weight)	1,090 \$	1,977\$	1,760 \$		970 \$
2	Durability (thickness)	538\$	1,977\$	1,760\$		479 \$
3	Design	198\$	1,977 \$	1,760 \$		176 \$
4	Safety (reliability)	151\$	1,977\$	1,760 \$		135 \$
	The total cost of a product attribute	1,977 \$	—	—		1,760 \$

Step Four: Determining the cost gap (target reduction level)

A comparison is made between what was determined in the first step (the current cost of the attribute) and the third step (the target cost of the attribute) of the integration steps to determine the level of the target reduction in the current cost of the attribute in order to reach the target cost of the attribute. This gives the product acceptability competitively, and this is shown in Table 11.

Table 11: Determining the cost gap (target reduction level) for each product attribute

No	Attribute	1	2	3	4	5
		The target cost per attribute	Current cost for the attribute	The difference (gap) in costs (2-3)		The percentage of each attribute of the (gap) in costs
1	Size (diameter, weight)	970 \$	1,090 \$	-120 \$		55%
2	Durability (thickness)	479 \$	538 \$	-59 \$		27%
3	Design	176 \$	198 \$	-22 \$		10%
4	Safety (reliability)	135 \$	151 \$	-16 \$		8%
	Total cost gap (target reduction level)	1,760 \$	1,977 \$	-217 \$		100%

Table 11 clearly shows the amount of the cost gap (negative gap) between the current cost and the target cost of the product which is (217 dollars). Therefore, this gap represents the level of the target reduction in the current cost on the basis of product attributes to reach the target cost on the basis of product attributes which amounted (1,760 dollars). This enables the pricing of the product in accordance with the competitive prices of competing and similar products to ensure that the company enhances its competitiveness.

Step Five: Achieving the target cost

This is the last step of integration between the ABCII and TC technologies, in which the researchers seek, in coordination with the engineering staff of the research sample company, to achieve the target cost. They use a set of tools on which the TC technology relies

to achieve the target reduction in the current product cost to reach the allowable cost by applying both value engineering (VE) and reverse engineering (RE).

Therefore, the researchers will use these two tools to help the integration between the ABCII and TC technologies to achieve the research goals in managing costs and supporting competitive advantages to enhance the competitiveness of the research sample company. This can be achieved by producing a product within the specified target cost limits on the basis of the market. The reverse engineering is used first to study and analyze the raw materials for each attribute of the UPVC pipe product attribute (25 mm\ 1.5 mm \10 bar) to identify the opportunities for managing costs and supporting competitive advantages when compared with the most prominent competing products represented by the product of the Pamuk Company.

Secondly, VE is used to study and analyze the functionality and design of each product attribute in order to reduce waste and loss of resources and to know the extent of the feasibility of implementing the available opportunities resulting from the use of RE without affecting other aspects of the product to achieve the dimensions of competitive advantage (cost, quality, time, creativity and flexibility) in a more efficient and effective manner. Table 12 shows the results of the differences when applying the tools of reverse engineering and value engineering in terms of materials and time.

Table 12: Comparing the differences between the company's competing product when applying RE

Attribute	Raw materials	Measurement	Al Narges company product			Competitor's Producer (Pamuk)			The amount of reduction or increase in quantity
			1 Quantity	2 The percentage of material for each attribute	3 The quantity associated with the attribute (2 * 3)	4 quantity	5 The percentage of material for each attribute	6 The quantity associated with the attribute (4*5)	
Size (diameter, weight)	Ghadeer Resin (pvc)	Kg	680	70%	476	590	70%	413	-63
	Calcium carbonate	Kg	180	30%	54	275	30%	82.5	28.5
	Thermal stabilizer	Kg	25	20%	5	20	20%	4	-1
Durability (thickness)	Ghadeer Resin (pvc)	Kg	10	30%	204	590	30%	177	-27
	Calcium carbonate	Kg	2	40%	72	275	40%	110	38
Design	Calcium carbonate	Kg	1	30%	54	275	30%	82.5	28.5
	Thermal stabilizer	Kg	1	30%	7.5	20	30%	6	-1.5
Safety (reliability)	Thermal stabilizer	Kg	25	50%	12.5	20	50%	10	-2.5

Table 13: Reducing the completion time for some product attributes by using VE

	1	2	3	4	5	6	7	8	9	10
Attribute	Activities and production stages	Time required for each activity and production stage)in minutes(	Time ratio for each attribute	Time before using VE for each attribute (2*3)	Time after using VE in minutes	Time ratio for each attribute	Time after VE use per attribute 5*6)(	Reduction amount per)7-4 (minutes	The total time for each attribute before reduction in minutes	The total time for each specification after reduction is (8-9) in minutes
Size (diameter, weight(	manual mixing stage	17	100%	17	12	100%	12	5	87.8	82.7
Design	Packaging complete production warehouse	28	5%	1.4	25	5%	1.25	0.15	148.9	147.9
		18	50%	9	16	50%	8	1		
Safety (reliability)		28	95%	26.6	25	95%	23.75	2.85	56.6	52.8
				9	16	50%	8	1		
Total reduction time				63			53	10		
	The total time required to complete all product attribute before reduction								366	
	The total time required to complete all product attribute after reduction								366	

Table 14: *The amount of waste in materials for some product attribute using VE*

Attribute	1	2	3	4	5	6	7	8	9
	Raw materials	measurement	Quantity before using VE	Quantity ratio for each attribute	Quantity before using VE per attribute (3*4)	Quantity after using VE	Quantity ratio for each attribute	Quantity after using VE per attribute (6*7)	Reduction amount)7-4()Kg(
Size (diameter, weight)	Packaging materials (nylon bag)	Kg	25	20%	5	17	20%	3.4	1.6
	Sticky tape	roll	20	100%	20	10	100%	10	10
Safety (reliability)	Packaging materials (nylon bag)	Kg	25	80%	20	17	80%	13.6	6.4
Total amount reduction					45			27	18

Therefore, the researchers suggest, in coordination with the engineering staff, based on the most important differences that were identified by using the RE as shown in Table 12, as well as what resulted from the use of VE as shown in Tables 14 & 13 to achieve the objectives of integration between ABCII and TC technologies to manage costs more efficiently and effectively and support the competitive advantages of Al-Narges company's product of UPVC pipe (25 mm \ 1.5 mm \ 10 bar).

This contributes to enhancing the competitiveness of Al-Narges company, ensuring its stability in the competitive and financial position. The three proposed steps are applied first, by changing the amounts of raw materials through the using RE, secondly, determining the amounts of waste in raw and supplementary materials to be excluded using VE.

Thirdly, by reducing the completion time for some product attributes using VE, in the same way as applying the steps of integration, but on the basis of the proposed steps that will change some items when determining the cost of the product. According to the results from the proposed steps that the researchers identified and have been applied can be summarized in Table 15 as follows:

Table 15: *The current cost of producing one ton of UPVC pipe implementing the proposals*

No	Attribute	1	2	3	4	5	6
		Production volume costs per attribute	Activity-related costs per attribute	Energy related costs per attribute	Costs associated with the decision per attribute	The total cost per attribute)2+ 3+ 4+ 5(
1	Size (diameter, weight)	861\$	59.8 \$	8 \$	29 \$	958 \$	
2	Durability (thickness)	401 \$	52.8 \$	7 \$	26 \$	486 \$	
3	Design	70\$	92.6 \$	13\$	21 \$	197 \$	
4	Safety (reliability)	53 \$	40.7 \$	5 \$	24 \$	123 \$	
	The total cost of a product attribute	1,385\$	246 \$	33 \$	100 \$	1,764 \$	

It is clear from Tables 15 that the current cost of producing one ton of UPVC pipe (25 mm \ 1.5 mm \ 10 bar) amounted to (1,764 \$) after implementing the proposal specified by the researchers through the use of RE, VE tools based on the implementation of only three proposed steps, while the target cost of the product was (1,760 \$). Therefore there is a difference between the current cost of the product after implementing three steps of the proposal. The target cost of the product is estimated at (4 \$). This means that achieving and reaching the amount of the target reduction for all product attributes as shown in Table 13 amounted to (213\$), i.e. (98%) of the total amount of the targeted reduction.

Therefore, there is a need to implement a fourth step added to the three steps proposal to reach the target cost to bridge the remaining cost gap and give greater flexibility in the process of controlling the cost and pricing of the product. This can be achieved by adopting the management's decision to reduce the percentage of the target profit margin to (19%) instead of (20%) commensurate with the competitive situation and increasing the acceptability and satisfaction of customers with the selling price of Al-Narges company's product.

According to the results of Table 15, the application of integration between the ABCII and TC techniques gives the management of Al-Narges company the flexibility and accuracy in managing the costs of the product with the required efficiency and effectiveness in line with the competitive situation.

Furthermore, applying the integration between ABCII and TC techniques supports and enhances the competitive advantages by producing the product with high attributes based on the requirements and desires of customers at the lowest cost, high quality, faster time in producing and delivering the product to customers. It also assures the flexibility in the product pricing process to be in line with the purchasing power of customers and in line with customer satisfaction and gaining their loyalty. Thus, it enhances the competitiveness of the product that secures the stability of the company competitive and financial position.

Conclusions and recommendations

The researchers conclude that the integration between ABCII and TC technologies helps in identifying the proposed alternatives while maintaining the level of quality to achieve the target cost for each attribute of the UPVC pipe product (25 mm / 1.5 mm / 10 bar). The researchers used the TC technology tools, including RE and VE by defining proposals that lead to achieving the targeted reduction for each attribute. Likewise, it becomes clear after implementing the proposals through the use of TC technical tools that the amount of the achieved reduction reached (213 \$), i.e. (98%) of the total amount of the targeted reduction. Hence, the reduction amount proposal of the target profit margin was implemented commensurate with the competitive situation to achieve the target reduction by (100%).

Thus, the application of integration between the ABCII and TC technologies led to cost management in a more efficient, effective and accurate way. It contributed to supporting and enhancing the dimensions of competitive advantages (cost, quality, time, creativity and flexibility), by reducing the production and delivery time of the product to customers by (84) minutes compared to the standard time of the product. Therefore the time after the reduction became (356) minutes instead of (440) minutes, i.e. a reduction rate scored (19%).

Furthermore, applying the integration between ABCII and TC technologies resulted in reducing the cost of the UPVC pipe product (25 mm / 1.5 mm / 10 bar) by (234\$). Hence, the total cost of the product decreased to (1,764\$). It had costed according to the traditional system (1,998\$), i.e. a reduction rate of (11%), which is reflected in the decrease in the selling price of the product to become (2,182\$) instead of (2,398\$) Dollars, i.e. a reduction rate of (9%). This reduction gives greater flexibility in the product pricing process in light of the intense competition in the market.

Finally, after the questions of the research problem have been answered by clarifying the possibility of applying integration between the ABCII and TC technologies to manage costs and support competitive advantages in Al-Narges' company and explain its role in managing costs and supporting competitive advantages to enhance competitiveness. Yet, the research hypothesis has been proven, as it can be said that integration between the two techniques of TC and ABCII contributes in addressing the deficiencies in the traditional systems of cost management. This leads to achieving the dimensions of competitive advantages to enhance the competitiveness of Al- Nerges' company.

The researchers recommend Al-Narges' company to adopt modern administrative and cost methods and techniques, including the ABCII and TC technologies, because of their great impact in managing costs more accurately and supporting competitive advantages in a way that helps to enhance competitiveness and thus leads to achieving stability in the competitive and financial position of the company.

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