The Impact of Integration Between Target Costing (TC) and Value Engineering (VE) Methods on Reducing Manufacturing Costs
(Field Study on Sudanese Food Industry)

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المستخلص :

تناولت الدراسـة أثر التكامـل بين اسلوبي التكلفة المستهدفة وهندسـة القيمـة في تخفيض التكاليف الصناعية، في الصناعات الغذائية السودانية ، حيث تمثلت مشكلة الدراسة في أن هناك العديد من أوجه القصور في تطبيق الاساليب التقليدية لمحاسبة التكاليف مما أثر على تحديد وقياس التكاليف الصناعية، وذلك بسبب أن طريقة التسعير في هذه الاساليب تعتمد على إضافة هامش ربح لتكلفة الإنتاج، وبالاعتماد على ذلك قد تتأثر القدرة التنافسية لتلك المنشآت، علاوة على أنها لا تمكن من تخفيض التكاليف الصناعية في مراحل التصميم الأولية للمنتج. اتبعت الدراسة المنهج التاريخي للوقوف على الادبيات والدراسات السابقة التي تناولت موضوع الدراسة بالإضافة الى المنهج الوصفي التحليلي، وتم اعداد استبانة وتوزيعها على عينة الدراسة، وخضعت البيانات بعد جمعها وتصنيفها الى التحليل الاحصائي عن طريق برنامج الحزم الإحصائية للعلوم الاجتماعية(SPSS). خلصت الدراسـة الـى مجموعـة من النتائج منها: تكامل التكلفة المستهدفة وهندسـة القيمـة ساهم في تخفيض التكاليف الصناعية الكليـة لمنشآت الصناعات الغذائية السودانية. في ضوء النتائج التي تم التوصل إليها، توصي الدراسة بتطبيق الاساليب الحديثة في تحديد وقياس التكلفة والمتمثلة في اسلوب التكلفة المستهدفة وهندسة القيمة بصورة علمية وتدريب محاسبي التكاليف عليها.

ABSTRACT:

The study examined the impact of integration between target costing and value engineering on reducing manufacturing costs in Sudanese food industry. The study problem stemmed from the existence of many deficiencies in applying traditional costing techniques, which affect the determination and measurement of manufacturing costs, because pricing method in traditional costing system depends on adding a profit margin to manufacturing costs, and relying on this method may affect the competitiveness capabilities of these companies. Moreover, this method may not succeed in reducing manufacturing costs in the early design stages of a product. The study followed the historical method to review literature and the previous studies, which deal with the topic of the study, besides the descriptive and analytical method. A questionnaire was designed and distributed to the study sample, and the data were subjected after its collection to a statistical analysis through using the Statistical Package for Social Sciences Program (SPSS). The study concluded with a number of findings including the integration of target costing and value engineering contributed in reducing total manufacturing costs for Sudanese food industry. The study recommended applying the recent costing methods in the determination and measurement of costing such as target costing method and value engineering in a scientific manner, and training cost accountants on these methods.

Keywords: Target costing, Value engineering, manufacturing Costs, Sudanese Food Industry.

Introduction:

There is a greater awareness on the part of the manufacturers about the need to improve quality of product, service and reduce cost, not only to maintain market share but also to improve it. To meet the customer expectations of quality and value for money, the premier tool that can be used is "value engineering"; value engineering is recognized as an effective technique for reducing costs, increasing productivity, and improving quality-related features such as durability, reliability, and maintainability. On the other hand, target costing is an approach to determine a product's life-cycle cost, which should be sufficient to develop specified functionality and quality, while ensuring its desired profit. It involves setting a target cost by subtracting a desired profit margin from a competitive market price. The critical reason underlies for chosen this topic is the high prices of Sudanese food products. As the researcher specializes in cost accounting sought to identify the original roots of this problem and found that the reason for the high prices of these products commodities is due to the increase in its manufacturing costs, Therefore, the researcher sought to find a relationship between target costing and value engineering in an attempt to contribute to the reducing of manufacturing costs by collecting the necessary data and analyzing it to confirm the validity of the hypotheses by taking a field study on a randomly selected sample of the study population, it representative on a group of industrial companies working in Khartoum North.

The Problem of study:

The increasing in manufacturing costs which it suffers of all sectors and its impact on industrial sector is higher because of the scarcity of raw materials and increase its prices, in addition to the increase in labor costs and overhead costs. The problem of this study can show that there are many insufficiencies in applying traditional costing techniques, that have an effect on determination and measurement manufacturing costs in Sudanese food industry companies working in Khartoum North, because pricing in a traditional costing system depends on adding a profit margin to manufacturing costs, relying on this has a significant effect competitiveness of company that adopting the traditional costing system. Moreover, they don't help reduce manufacturing costs in the design stages of a product. That's cause for arising contemporary costing system and techniques to help to cure this insufficiency, including target costing and value engineering. The problem of this study can be formulated in the following three questions:

Q1. To what extent the target costing help reduce overhead costs?

Q2. To what extent value engineering help to reduce manufacturing costs in the design stage?

Q3. To what extent the integration between target costing and value engineering help reduce total manufacturing costs?

The objectives of study:

Through this study the researcher seeks to achieve the following objectives:

- To identify how the target costing help, reduce overhead costs.

- To identify how value engineering help to reduce manufacturing costs in the design stage.

- To study the effect of integration between target costing and value engineering in reducing total manufacturing costs in Sudanese food industry companies that working in Khartoum North.

The importance of study:

The theoretical significance: This study draws its importance by contributing to the strengthening of the efforts of scientific research in the field of accountancy. By noting the previous studies related to the study theme, the researcher noted the lack of studies on the use of contemporary techniques in cost accounting, which preceded the failure of traditional approaches in this field to achieve the company goals, so this study comes to fill the knowledge gap in this area.

The practical significance: The main importance of this study is to provide for managers of Sudanese food industrial companies some contemporary techniques in cost accounting, which contribute to the practical application of cost management, by proposing target costing and value engineering to reducing manufacturing costs.

The methodology of study:

For the purpose of this study and to achieve its objectives it adopted the following methods: the historical approach in order to review and analyze the previous studies, the deductive method to determine the nature of the study problem and formulate hypotheses, the inductive in the purpose of inducting all the scientific literature related to the research topic, and the analytical descriptive method to identify the extent of the possibility of the integration between target costing and value engineering.

The hypotheses of study:

The study seeks to test the following hypotheses:

H1: There is statically significant relationship between target costing and reducing overhead costs in Sudanese food industry.

H2: There is statically significant relationship between value engineering and reducing manufacturing costs in the design stage in Sudanese food industry.

H3: There is statically significant relationship between integration between target costing and value engineering and reducing total manufacturing costs in Sudanese food industry.

Review of the previous studies:

Study of Alkababji, (2014) :

The study aimed to identify the availability of the ingredients of implementing target costing entrance in Palestinian shareholding industrial companies, and the extent of awareness of the concepts, principles and the importance of using the target costing in the management costs for the products of the lower cost and with the same quality and to improve profitability. It aims at clarifying the effect of using of value engineering entrance on reducing the cost of products, thus access to the target costing. The study found that the most important difficulty was the high financial costs than returns the application of the entrance to the target costing and value engineering.

Study of Abed, (2015) :

The study aimed mainly to measure the impact of the implementing target cost and value engineering techniques in enhancing the competitive advantage upon the Palestinian listed corporations, and take advantage of the complementary relationship between the two techniques in enhancing the competitive capability advantage of each corporation though representative sample of the study. The study found no statistically significant differences among respondents towards the consequences of effective complementary between target costing and value engineering in enhancing the competitive advantage.

Study of Talebnia, G., Baghiyan, et at, (2017):

The study tested the linkages between target costing and value engineering and expected profit and kaizen. The study developed five hypotheses such as; Target costing has a direct relationship with the customer, Kaizen costing, value engineering and achievable goal is directly related. The study found that the target costing is a pricing method used by firm; it is defined as a cost management tool for reducing the overall cost of a product over its entire life-cycle with the help of production, engineering, research and design. A target cost is the maximum amount of cost that can be incurred on a product and with it the firm can still earn the required profit margin from that product at a particular selling price.

Study of Elamir, (2017) :

The study aimed to examine the effect of integration between the target costing and value engineering techniques and the role of competitive strategy, to enhance performance of Sudanese manufacturing firms. The results of the study indicated that integration of target costing and value engineering is found to be significant in relation to operational performance. However, Sudanese manufacturing firms cannot achieve financial performance from such integration and the positive role of applying value engineering to the operational performance of manufacturing firm has been revealed through the moderating role of the comparative strategy.

Study of Hamid , (2018) :

The study examined the role of target cost and value engineering in cost reduction to support competitive advantage in industrial companies, the problem of the study represented that the most of Sudanese industrial companies cannot achieve a balance between what customers want and reduce the cost to arrive to the lowest possible price for the product. The study found that the target cost dealt with coordination and organization of all stages and sections of the project from planning, designing, producing and controlling. Value engineering also dealt with identifying the project's functions and determining the importance of those jobs, and identifying the different ways to perform these basic functions in order to improve the project's value.

Study of Srour M. & Abdul- Ridha, (2018) :

The study aimed to examine the relationship between green target cost and cost reduction to achieve competitive advantage through integration with other technologies. The problem of study includes finding how to produce environmentally friendly products that support the competitive position of the economic units and help them increase their market share by providing environmentally friendly products of high quality. The main aim of the project is to find appropriate solutions to the problems experienced by the economic units through the use of modern technologies that are sensitive to environment.

Comment: The previous studies focused on identifying the importance of using the target costing and value engineering methods, identify the factors that influence the determination of the it, and the level of success of the application in the conditions of intense competition in the modern economy and the speed of technological development. Also, examining differences between companies applying the target costing and value engineering methods and that do not apply it. The current study added to the benefit of previous studies, it defines to the Sudanese food industrial companies the importance of the target cost and value engineering by highlighting their respective dimensions and reflecting the impact of integration between it on reducing the manufacturing costs.

Section two: Theoretical framework:

Firstly: Target costing (TC) :

Target costing is a technique which developed in the early 1970s in Japan's manufacturing industry as consumer demand for more diversified products and shorter product life cycles made the development and planning stages of new products more important. (Hamid, et at. 2016)

Target costing is a systematic approach for the desired product quality and the ability to function, what price should be produced with profit expected to be attended by sales forecasts. (B. Shahrabi & S. Ashouri, 2011).

According to Ibusuki & Kaminski (2007), Target costing method has two objectives:

- Reduce the cost of new products so, that the level of required profit could be guaranteed, satisfying the levels of quality, development time and price demanded by the market.
- Motivate all the employees to achieve the target profit during the new product development, turning target-costing into an activity of profit administration for the whole company, using the

creativity of employees from several departments to draw up alternative plans that allow higher cost reductions.

Researcher's opinion, Target costing is a tool of reducing the overall cost of a product over its product life cycle; management utilizes this pricing method to meet both the demands of its customers as well as company target profit.

Secondly: Value engineering (VE) :

VE evolved in the 1940s when the transition was made from the search for an alternative to the search for means of fulfilling the functions of an alternative. Shortly afterwards it was observed that function-oriented alterations in working methods often result in improving quality along with eliminating unnecessary cost. (Naderpajouh & Afshar, 2008)

Value engineering is an organized effort to analyze the functions of goods and services so a firm can find ways to achieve those necessary functions and essential characteristics while meeting its target costs. (Wouters, M., et at, 2005)

Value engineering, steps of application: (MOHAMED, K. & MOHAMED, A., 2018)

- The first step (a preliminary): is the preparation and planning of the scope.
- The second step: describes the information acquisition.
- The third step: features a functional analysis of the product based on essential information (e.g. drawings, costs, quantities).
- The fourth step: focuses on the generation of ideas for the accomplishment of functions by different alternative courses of action.
- The fifth step: focuses on the discussion and assessment of the ideas or even alternatives with a suitable evaluation technique (e.g. score evaluation).
- The sixth step: focuses on the development of ideas.
- The seventh step: deals with the presentation and implementation.

Researcher's opinion, value engineering is a technique that helps to reduce costs in initial step of product lifecycle, it can play a critical role in the cost management of future products.

Thirdly: Manufacturing Costs:

Manufacturing cost is the sum of costs of all resources consumed in the process of making a product. The manufacturing cost is classified into three categories: direct materials cost, direct labor cost and manufacturing overhead. (Ostwald, 2003)

Product manufacturing costs can be categorized as fixed or variable. Those that are insensitive to the volume of product made are considered to be fixed. Labor, although not completely fixed, is somewhat independent of product volume, since the number of people operating a plant and their salaries are not easily adjusted as demand fluctuates. Raw material costs are variable if more product is to be made, more raw material is required. (Anderson, J., 2009)

How to reduce the manufacturing costs?

To reduce the manufacturing costs, it is necessary to reduce a labor requested, by implementing extensive automatization of as many of the operations taking place in the plant as possible. A reduction of the cost of the major equipment must also be performed, by a simplification of design based in the extensive knowledge accumulated. The equipment cost can also be reduced when the size of the equipment, and hence the production capacity, is increased. (HASSAN & MOHAMED, 2018) .

On the other hand, the role of target costing is basically a cost management tool or for reducing the overall cost of a product over its entire production life-cycle with the help of other personnel in production, engineering, research and design. A target cost is the maximum amount of cost that can be incurred on a product of which the firm can still earn the required profit margin from

that product at a particular selling price. To achieve this, value engineering employs a systematic means or application of recognized technique to identify the factor affecting the cost of a product or services in order to devise means of achieving the specified purpose at the required standard of quality and reliability of the target cost. The aim of value engineering is to achieve the assigned target cost by providing the most acceptable design standard for the product that would meet the customers perceive value of the product based on functions or requirements in the market, identifying improved product designs that reduce the product cost without sacrificing functionality and eliminating unnecessary functions that may increase the products cost and for which customers may not prepared to pay extra. Value engineering works closely with design engineer to identify new designs that will accomplish all these. (Anayo, E. C., et at, 2019)

Researcher's opinion, target costing and value engineering will be most beneficial if the firm is large compared to its suppliers and can dictate selling prices to them. Consequently, a firm that is growing faster than its suppliers or is selecting smaller suppliers from which to source its components will get increasing benefits from adopting target costing, value engineering.

Section three: The empirical study:

Procedures of the empirical study include the following:

Data collection procedures:

Primary data was collected using questionnaire; it was initially written in English language and then translated to Arabic language. Next step it was reviewed by arbitrators to ensure that content and translation was appropriate for the study purpose. Based on the received comments, it was revised as needed. After that it was distributed to the study sample.

Data analysis technique:

The data collected was coded, and analyzed through SPSS-23. Descriptive statistics such as percentages, mean, standard deviation, Chi-Square, degree of freedom, and value of probability were used to test the hypotheses of study.

Population and Sample Selection:

The original population consists of all employees of the food industrial companies working in Khartoum North, which involve; managers, financial managers, production managers, heads of departments, internal auditors, financial accountants, cost accountants.

Sample size:

The study sample was randomly selected from the population, the researcher distributed (250) questionnaires to the sample, and the number of non-recovered was (30) questionnaires, while the number of recovered (220) questionnaires in percentage (88%) of the total number. This sample is relatively large in statistical requirements, which leads to the acceptance of the results of this study and its dissemination to the study population.

Reliability and validity of the study:

The researcher has made the following statistical analysis to verify the validity and reliability of the questionnaire.

1. Age:

Table (1): The distribution of frequency and percentage of the age groups of study sample

Rang of age	Frequency	Percent
30 years and less	43	19.5%

(31 to 35) years	62	28.2%
(36 to 40) years	54	24.5%
41 years and more	61	27.8%
Total	220	100%

Source: prepared by the researcher from the questionnaires, 2020.

The results presented by table (1) illustrate the age of the study sample indicated that 19.5% less than 30 year, 52.7% range between (31-40 years), and finally 27.8% age is 41 years and more. Consequently, this result indicated that the age of the majority of the sample range between (31-40 years) indicating the maturity of the study sample and hence increasing the reliability of the study.

2. Education:

Table (2): The distribution of frequency and percentage of the education of study sample

Level of Education	Frequency	Percentage (%)
Diploma	12	5.5%
Bachelor	105	47.7%
Postgraduate diploma	21	9.5%
Master degree	63	28.6%
PhD	19	8.6%
Total	220	100%

Source: prepared by the researcher from the questionnaires, 2020.

The results showed by table (2) illustrate the level of education of the study sample pointing that 5.5% have got diploma, while 47.7% have got a bachelor degree, 9.5% have got a postgraduate diploma, 28.6% hold a master degree, and 8.6% hold PhD. Accordingly, to this analysis that more than 94.5% are holding a bachelor or postgraduate certificates, therefore it increases the reliability of this study.

3. Qualification:

Table (3): The distribution of frequency and percentage of the qualification of study sample

Certificates	Frequency	Percent
Sudanese fellowship	33	15%
Arabian fellowship	11	5%
British fellowship	9	4.1%
American fellowship	8	3.6%
others fellowship	62	28.2%
I haven't fellowship	97	44.1%
Total	220	100%

Source: prepared by the researcher from the questionnaires, 2020.

The results showed by table (3) illustrate the qualification of the study sample pointing that 15% have got Sudanese fellowship, while 5% have got Arabian fellowship, 4.1% have got British fellowship, 3.6% hold American fellowship, 28.2% hold others fellowship, while 44.1% haven't hold any qualification certificates. Accordingly, to this analysis that 55.9% are holding qualification certificates, therefore it increases the reliability of this study.

4. Specialization:

Table (4): The distribution of frequency and percentage of the specialization of study

Field of study	Frequency	Percent
Accounting	82	37.3%
Cost accounting	41	18.6%
Business administration	38	17.3%

Mechanical engineering	40	18.2%
Marketing	14	6.4%
Another fields	5	2.3%
Total	220	100%

Source: prepared by the researcher from the questionnaires, 2020.

The results showed by table (4) illustrated the specialization of study sample, which showed that 37.3% specialized in accounting, while 18.6% specialized in cost accounting, 17.3% specialized in business administration, 18.2% specialized in mechanical engineering, 6.4% specialized in marketing and finally 2.3% others specialization. Accordingly, to this analysis that more than 97.7% are accounting, cost accounting, business administration, marketing, and mechanical engineering, therefore it increases the reliability of this study.

5. Posts occupied:

Table (5): The distribution of frequency and the percentage of the posts occupied by study sample

Jobs	Frequency	Percent
Financial manager	20	9.1%
Financial accountant	66	30%
Cost accountant	29	13.2%
Internal auditor	19	8.6%
Production manager	12	5.5%
Manager	38	17.3%
Head of department	36	16.4%
Total	220	100%

Source: prepared by the researcher from the questionnaires, 2020.

Table (5) showed that 9.1% of study sample are financial managers, 30% are financial accountants, 13.2% are cost accountants, 8.6% are internal auditors, 5.5% are production managers, 17.3% are managers, and finally 16.4% are heads of departments. Accordingly, to this analysis that more than 75.1% are (financial manager, financial accountant, cost accountant, mechanical engineer and manager); therefore it increases the reliability of study.

6. Experience:

Table (6): The distribution of frequency and percentage of the years of experience of study

Years of experience	Frequency	Percent
5 years and less	70	31.8%
6 to 10 years	60	27.3%
11 to 15 years	50	22.7%
16 years and more	40	18.2%
Total	220	100%

Source: prepared by the researcher from the questionnaire's data 2020.

The results showed by table (6) illustrate the distribution of frequency and percentage of the years of experience of study sample, and showed that 31.8% from study sample have got five or less years of experience, 27.3% have got (6-10) years of experience, 22.7% have got (11-15) years of experience, 18.2% have got more than 16 years of experience. Consequently, indicating that the majority of the study sample years of experience ranged between (6 - More than 16 years), this means that about 72.7% of the sample has got more than five years of experience, indicating that their knowledge about the work nature is so high, and then their opinion about the statements is considerable. Also, this supports the reliability of this study.

Data analysis and hypotheses and testing:

This part discusses the data analysis and hypotheses testing as follows:

1. The data analysis and testing of first hypothesis:

"H1: There is statically significant relationship between target costing and the reducing overhead costs in Sudanese food industry.

For substantiation of the first hypothesis, the analysis of respondents' answers for all statements of this hypothesis, by using percentage frequency, descriptive statistics and Chi-Square can be shown by the following tables (7) and (8):

Table (7) :The percentage of the answers of study sample about first hypothesis

N	Statement		Agree	Strongly agree	Neutral	Disagree	Strongly disagree
1	Pricing process under target costing technique helps to achieve fair price.	Frequency	86	114	11	7	2
		Percent	39.1%	51.8%	5%	3.2%	0.9%
2	Determine target price requires reducing indirect materials costs.	Frequency	101	78	22	15	4
		Percent	45.9%	35.5%	10%	6.8%	1.8%
3	Achieving target price require reducing indirect labor costs.	Frequency	133	64	12	6	5
		Percent	60.4%	29.1%	5.5%	2.7%	2.3%
4	Achieving target price require reducing overall overheads costs.	Frequency	128	74	9	7	2
		Percent	58.2%	33.6%	4.1%	3.2%	0.9%
5	Achieving target profit requires reducing indirect materials costs.	Frequency	107	101	2	5	5
		Percent	48.6%	45.9%	0.9%	2.3%	2.3%
6	Achieving target profit requires reducing indirect labor costs.	Frequency	134	73	1	9	3
		Percent	60.9%	33.2%	0.4%	4.1%	1.4%
7	Achieving target profit requires reducing overall overheads costs.	Frequency	115	72	18	12	3
		Percent	52.3%	32.7%	8.1%	5.5%	1.4%
8	Allowable cost can be achieved by reducing indirect materials costs.	Frequency	100	90	16	9	5
		Percent	45.5%	40.9%	7.2%	4.1%	2.3%
9	Allowable cost can be achieved by reducing indirect labor costs.	Frequency	128	69	10	10	3
		Percent	58.2%	31.4%	4.5%	4.5%	1.4%
10	Allowable cost can be achieved by reducing overall overheads costs.	Frequency	111	74	20	12	3
		Percent	50.5%	33.5%	9.1%	5.5%	1.4%

Source: prepared by the researcher from the questionnaire's data 2020

Comments on the results of table (7): It showed that most of the responders are either agreed or strongly agree, this support the hypothesis one.

Table (8) shows the descriptive statistics and Chi-Square for hypothesis one as follows:

Table (8) :Descriptive Statistics and Chi-Square for hypothesis one

N	Statement	Mean	SD	Chi-Square	DF	P. value
1	Pricing process under target costing technique helps to achieve fair price.	4.38	0.799	247.409	4	0.000
2	Determine target price requires reducing indirect materials costs.	4.06	0.944	166.591	4	0.000
3	Achieving target price require reducing indirect labor costs.	4.11	0.806	279.773	4	0.000
4	Achieving target price require reducing overall overheads costs.	4.20	0.740	279.864	4	0.000
5	Achieving target profit requires reducing indirect materials costs.	4.34	0.808	273.273	4	0.000
6	Achieving target profit requires reducing indirect labor costs.	4.20	0.764	311.273	4	0.000
7	Achieving target profit requires reducing overall overheads costs.	4.10	0.863	209.227	4	0.000
8	Allowable cost can be achieved by reducing indirect materials costs.	4.19	0.905	199.591	4	0.000
9	Allowable cost can be achieved by reducing indirect labor costs.	4.14	0.805	265.318	4	0.000
10	Allowable cost can be achieved by reducing overall overheads costs.	4.10	0.873	197.045	4	0.000
	Total average of hypothesis one	4.18	0.831	242.936	4	0.000

Source: prepared by the researcher from the questionnaire's data 2020

Comments on the results of table (8):

The analysis showed in table (8) showed that the Chi-Square values of the first hypothesis statements between (166.591 – 311.273) with P. values < 0.05 for all statements, this indicated there is statistically significant differences in responders' answers about the hypothesis phrases. And total average mean was (4.18) when total average standard deviation (0.831) this corresponds to

acceptance of hypothesis one: "There is statically significant relationship between target costing and reducing overhead costs in Sudanese food industry".

2. The second hypothesis data analysis and testing:

"H2: There is statically significant relationship between value engineering and reducing manufacturing costs in the design stage in Sudanese food industry".

For substantiation of hypothesis two, the analysis of respondents' answers for all statements of this hypothesis, by using percentage frequency, descriptive statistics and Chi-Square can be shown the following tables (9) and (10):

Table (9):The percentage of the answers of study sample about hypothesis two

N	Statement		Agree	Strongly agree	Neutral	Disagree	Strongly disagree
1	Research and Development (R&D) help to reduce costs of materials.	Frequency	59	144	9	6	2
		Percent	26.8%	65.5%	4.1%	2.7%	0.9%
2	An innovation a new way for production helps to reduce labor costs.	Frequency	89	109	11	8	3
		Percent	40.5%	49.5%	5%	3.6%	1.4%
3	Developing the production process helps to reduce the overhead costs.	Frequency	112	86	16	4	2
		Percent	50.9%	39.1%	7.3%	1.8%	0.9%
4	VE helps to abolish elements and activities that don't add value.	Frequency	83	113	17	6	1
		Percent	37.7%	51.4%	7.7%	2.7%	0.5%
5	VE helps to design products according to the study of customers' needs and desires.	Frequency	88	110	16	4	2
		Percent	40%	50%	7.3%	1.8%	0.9%
6	Labor costs can be reduced by redesign production process.	Frequency	114	69	26	8	3
		Percent	51.8%	31.4%	11.8%	3.6%	1.4%
7	Overhead costs can a reduce in the design stage.	Frequency	110	64	32	11	3
		Percent	50%	29.1%	14.5%	5%	1.4%
8	VE focuses on reducing costs at different stages of production.	Frequency	94	97	16	9	4
		Percent	42.7%	44.1%	7.3%	4.1%	1.8%
9	The team of VE produces new ideas to design the production process.	Frequency	101	87	22	8	2
		Percent	45.9%	39.6%	10%	3.6%	0.9%
10	VE help to reduce waste of materials and time.	Frequency	86	112	13	6	3
		Percent	39.1%	50.9%	5.9%	2.7%	1.4%

Source: prepared by the researcher from the questionnaire's data, 2020

Comments on the results of table (9): It showed that most of the responders are either agreed or strongly agree, this support the hypothesis two.

Table (10) show descriptive statistics and Chi-Square for hypothesis two as follows:

Table (10):Descriptive Statistics and Chi-Square for hypothesis two

N	Statement	Mean	SD	Chi-Square	DF	P. value
1	Research and Development (R&D) help to reduce costs of materials.	4.53	0.779	333.136	4	0.000
2	An innovation a new way for production helps to reduce labor costs.	4.33	0.841	234.455	4	0.000
3	Developing the production process helps to reduce the overhead costs.	4.25	0.746	239.455	4	0.000
4	VE helps to abolish elements and activities that don't add value.	4.37	0.780	234.182	4	0.000
5	VE helps to design products according to the study of customers' needs and desires.	4.36	0.773	237.273	4	0.000
6	Labor costs can be reduced by redesign production process.	4.08	0.835	200.591	4	0.000
7	Overhead costs can a reduce in the design stage.	4.00	0.873	174.318	4	0.000
8	VE focuses on reducing costs at different stages of production.	4.23	0.889	202.682	4	0.000
9	The team of VE produces new ideas to design the production process.	4.20	0.829	196.409	4	0.000
10	VE help to reduce waste of materials and time.	4.35	0.823	238.045	4	0.000
	Total average of hypothesis two	4.27	0.817	229.055	4	0.000

Source: prepared by the researcher from the questionnaire's data ,2020

Comments on the results of table (10):

The analysis showed in table (10) represented that the Chi-Square values of the second hypothesis statements between (174.318 – 333.136) with P. values < 0.05 for all phrases, this

indicated there is statistically significant differences in responders' answers about the hypothesis phrases. And total average mean was (4.27) when total average standard deviation (0.817) this corresponds to acceptance of hypothesis two**: "There is statically significant relationship** between value engineering and reducing manufacturing costs in the design stage in Sudanese food industry".

3. The third hypothesis data analysis and testing:

"H3: There is statically significant relationship between integration between target costing and value engineering and reducing total manufacturing costs in Sudanese food industry**".**

For substantiation of hypothesis three, analysis of respondents' answers for all statements of this hypothesis, by using percentage frequency, descriptive statistics and Chi-Square can be shown by the following tables (11) and (12):

Table (11) :The percentage of the answers of study sample hypothesis three

N	Statement		Agree	Strongly agree	Neutral	Disagree	Strongly disagree
1	Determine allowable costs and redesigning the time of production process help to reduce materials costs.	Frequency Percent	95 43.2%	104 47.3%	14 6.3%	5 2.3%	2 0.9%
2	Determine allowable costs and redesigning the time of production process help to reduce labor costs.	Frequency Percent	115 52.3%	73 33.2%	19 8.6%	10 4.5%	3 1.4%
3	Determine allowable costs and redesigning the time of production process help to reduce overhead costs.	Frequency Percent	107 48.6%	83 37.7%	27 12.3%	3 1.4%	0 0%
4	Achieving target profit requires reducing cost of materials and losses.	Frequency Percent	91 41.3%	105 47.7%	16 7.3%	7 3.2%	1 0.5%
5	Achieving target profit requires reducing costs of labor and wasted time.	Frequency Percent	102 46.4%	82 37.3%	21 9.5%	13 5.9%	2 0.9%
6	Achieving target profit requires reducing costs of overhead and losses.	Frequency Percent	111 50.4%	80 36.4%	22 10%	5 2.3%	2 0.9%
7	Achieving target selling price require reducing costs of materials and losses.	Frequency Percent	98 44.5%	93 42.3%	20 9.1%	9 4.1%	0 0%
8	Achieving target selling price require reducing costs of labor and wasted time.	Frequency Percent	117 53.2%	73 33.2%	15 6.8%	11 5%	4 1.8
9	Achieving target selling price require reducing costs of overhead and losses.	Frequency Percent	105 47.7%	76 34.5%	25 11.4%	12 5.5%	2 0.9%
10	Planning and reducing production costs requires analyzing and determining allowable costs.	Frequency Percent	102 46.4%	96 43.6%	18 8.2%	0 0%	4 1.8

Source: prepared by the researcher from the questionnaire's data 2020

Comments on the results of table (10): It showed that most of the responders are either agreed or strongly agree, this support the hypothesis three.

Table (12) shows descriptive statistics and Chi-Square for hypothesis three as follows:

Table (12):Descriptive Statistics and Chi-Square for hypothesis three

N	Statement	Mean	SD	Chi-Square	DF	P. value
1	Determine allowable costs and redesigning the time of production process help to reduce materials costs.	4.34	0.774	236.045	4	0.000
2	Determine allowable costs and redesigning the time of production process help to reduce labor costs.	4.11	0.844	212.364	4	0.000
3	Determine allowable costs and redesigning the time of production process help to reduce overhead costs.	4.23	0.711	126.836	3	0.000
4	Achieving target profit requires reducing cost of materials and losses.	4.33	0.783	225.727	4	0.000
5	Achieving target profit requires reducing costs of labor and wasted time.	4.13	0.879	183.227	4	0.000
6	Achieving target profit requires reducing costs of overhead and losses.	4.19	0.776	217.136	4	0.000
7	Achieving target selling price require reducing costs of materials and losses.	4.25	0.786	120.618	3	0.000
8	Achieving target selling price require reducing costs of labor and wasted time.	4.11	0.869	220.455	4	0.000
9	Achieving target selling price require reducing costs of overhead and losses.	4.10	0.868	179.409	4	0.000
10	Planning and reducing production costs requires analyzing and determining allowable costs.	4.30	0.771	142.909	3	0.000
	Total average of hypothesis three	4.21	0.806	186.473	3.7	0.000

Source: prepared by the researcher from the questionnaire's data, 2020

The Comments on the results of table (12):

The analysis showed in table (12) represented that the Chi-Square values of the third hypothesis statements between (120.618 – 236.045) with P. values < 0.05 for all phrases, this indicated there is statistically significant differences in responders' answers about the hypothesis phrases. And total average mean was (4.21) when total average standard deviation (0.806) this corresponds to acceptable of hypothesis three: "There is statically significant relationship between integration between target costing and value engineering and reducing total manufacturing costs in Sudanese food industry."

Section four: Findings and recommendations:

Findings:

The study reached to the following findings:

(1)Target costing technique helped to reduce manufacturing overhead by using functional cost analysis.

(2)Value engineering technique contributed to reduce manufacturing costs in the design stage to completion stage.

(3)Value engineering is a powerful methodology for reducing costs while improving performance and quality requirement.

(4)Integrate target costing with value engineering contributed to reduce total manufacturing costs by analyzing it.

(5)Value engineering and target costing are complementary processes, because one of them allows the identification of where cost reduction could be achieved, while the other shows the target to be achieved to guarantee the profitability plan of a company.

Recommendations:

According to the above findings, the following are recommendations:

(1)Cost management must start at the earliest stages of a product's life because the ability to change the product significantly increases the degree to which costs can be reduced.

(2)Should pay more attention to target costing technique in the pricing process to achieve fair selling price.

(3)To achieve target price, companies should reduce overall costs.

(4)Should using Research and Development (R&D) to reduce materials costs.

(5)Target costing and value engineering provide considerable payoffs to early adopters. By applying them the company can rapidly reduce costs of new products without having to compromise on quality and functionality, and will gain market share and experience economic success.

Recommendations for further studies:

(1)The implementation of integrating target costing with value engineering and its impact on reducing costs

(2)The integration between quality function deployment, target costing and value engineering and its impact on product design and development.

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