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Application of Product Life Cycle Technology to Reduce Cement Production Costs (Kufa Cement Factory)

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Abstract : The current study aims to clarify the cognitive foundations related to the product life cycle costing technology to reduce costs and increase quality, as the current product was designed according to customer requirements. This is done by drawing a clear picture of the product characteristics in the early stages of its design, which contributes to improving the product's value and reducing its cost, increasing its quality, and thus enhancing customer satisfaction. This approach contributes to achieving a competitive advantage by measuring the cost of the product at each stage of its life cycle. This technology will be applied in the Kufa Cement Factory, with the aim of implementing one of the modern strategies represented by the product life cycle, which helps reduce production costs, as some costs are reduced in the planning and design stage, while others are reduced during the production stage, and the application of the product life cycle costing technology works to reduce total costs starting from the planning and design stage until the final product .

The research concluded that the product life cycle costing technology reduces costs in the entire production process. The laboratory (the research sample, Kufa Cement Factory) recommends applying this technology to invest in tracking and allocating costs in a sound manner, which leads to achieving profits and then achieving a competitive advantage.

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Keywords: Product life cycle costing technique, Cost reduction, Cement Industry .

Introduction:

The current business environment is characterized by a number of developments and changes. The most prominent of these are strong competition and short product life cycles as a result of the continuous change in customer tastes and their need for high-quality products at reasonable prices and in less time. This situation has prompted economic units to re-evaluate traditional accounting systems and the methods used due to increasing criticism indicating their inability to provide the necessary information that reflects changes in the business environment, as these systems focus mainly on the internal environment of the units and the search for technologies. In contrast, the modern strategy in the field of cost accounting and management is to provide appropriate information in which product life cycle technology plays a vital role, which helps units achieve a competitive advantage in reducing costs. This role can be enhanced by employing product life cycle costs (PLCC).

Our economic units face major challenges due to their reliance on traditional approaches in cost systems and their failure to adopt modern strategic methods in management accounting and costs. This has led to increased product costs, and these units have become unable to calculate the costs associated with these products efficiently and effectively. Therefore, it has become necessary to use new methods to measure costs. This has necessitated the search for modern techniques that contribute to calculating, planning, reducing and controlling costs within an organized framework that covers all stages of the product life cycle. The importance of this research is highlighted in addressing all stages of the product life cycle, starting from the production stage to after-sales services. In this context, economic units must study and understand the product life cycle to help them determine the best way to introduce the product to the markets or withdraw it from them, based on the competitive position of similar products and the extent of the product's success or failure. Applying product life cycle costs provides an opportunity to understand the factors that contribute to achieving profit, which helps in taking appropriate measures during the early stages of the product life cycle by increasing revenues and reducing costs. You see that: Applying product life cycle costs will provide the

opportunity to know. Factors that lead to achieving profit for the union of appropriate procedures in the early stages of the product life cycle by increasing revenues and reducing product costs.

First: Research Methodology

1: Research Problem

The research problem is represented by raising the following questions:

1. Can the product life cycle costing technique be applied and its role in reducing production costs and achieving competitive advantage be explained
2. ؟How can the product life cycle costing technique be used to reduce costs and achieve competitive advantage?

2: Importance of the Research

The study derives its significance from the importance of making use of the product existence level costing technique and its application in economic units in the desire of the research sample to reduce its costs to the lowest possible level while maintaining good product quality and high efficiency and quality in the sector of cost accounting, which caused its quest to discover suitable management to manipulate and reduce prices in the mild of severe competition. . This helps increase profits and move towards customer requirements by reducing costs .

3:Research Objectives

1. Study of a sample of tools to demonstrate the cognitive foundations of product life cycle costing technology and its role in reducing costs.
2. Study and analysis of the possibility of applying this technology in Iraqi industrial companies to meet customer requirements and reduce costs in the laboratory research sample.

4: Research speculation

The research is based on the following hypothesis:

1. There is a possibility of applying the product life cycle costing technique in light of reducing costs and enhancing competitive advantage.

5: Research limits

The spatial and temporal boundaries of the research can be determined as follows:

1. Spatial boundaries of the research: Research sample: Kufa Cement Factory was selected.
2. Temporal boundaries of the research: The financial and non-financial data of the research sample (Kufa Cement Factory) for the year (2022) were relied upon for the purpose of fulfilling the applied aspect of the research, and the sample was chosen for the year (2022) for the following reasons:

1. The delays and stoppages that occurred for the rest of the year.
2. Continuing full production for this year.
3. Weak competitiveness of the factory's products.

6: Research Plan

The research was divided into several axes. The first axis dealt with the research methodology. The second axis included the costs of the shadow cycle of cost reduction. The third axis was devoted to the practical aspect of the research. The product life was concluded in the fourth axis with conclusions and recommendations.

Second: The cognitive foundations of the product life cycle costing technique

1.A The concept of the product life cycle (PLC)

The product life cycle deals with estimating the costs associated with the entire life cycle of the product, starting with the research, development and design phase, through production, marketing and distribution, and ending with providing after-sales services to the customer. This mechanism is considered an effective means of assessing the costs that the economic unit will bear during a specific period of time, in addition to taking into account all economic factors related to the future costs of the products and services of the economic unit. The importance of this technology comes from the following: (Alnawaiseh, 2012:34):

1. Determine and control the cost of the product throughout its life cycle.
2. Reduce unjustified costs associated with activities or elements that do not add value at each stage of the product life cycle.
3. Help determine the profitability of the product by providing important information.

(Al-Muhta ,2020 :41)) indicates that in light of the changes that have occurred in the business environment and the use of modern manufacturing systems and the accompanying clear change in production techniques and the increase in industrial automation, this has naturally resulted in a clear change in the cost structure (especially indirect industrial costs that have increased more than other costs as a result of the entry of prices), and the trend towards meeting customer needs and providing new products at competitive prices while ensuring high quality, in addition to preserving traditional markets and entering modern markets. Where it is necessary to search for innovative technologies that contribute to the process of calculating, planning, reducing and controlling costs according to an organized context that includes all stages of the product life cycle, and perhaps the most prominent of these

technologies that specialize in this field is the cost of the product life cycle, which highlights its importance in addressing everyone. The stages of the product life cycle, starting with the pre-production stage and reaching the post-production stage, are represented by the stage of services and after-sales (Khader, 2013: 185)

2: product life cycle Stages

Many studies, research and literature related to the product life cycle indicate that the product goes through several stages that together form its life cycle. These stages differ based on points of view, whether related to the market, production, or the customer. From the customer's perspective, it can be said that the product goes through the following stages:

(Hansen ,et.al,2009 : 389) ; (Blocher ,et.al,2010:566)

A.Stages of the product life cycle in terms of production :

The product life cycle stages from a production perspective include several steps, namely the research and development stage, the design, engineering and manufacturing stage, the marketing and distribution stage, and finally, the after-sales customer service stage:

(Datar&Rajan,2010:546) ; (Blocher,et.al.2010:566)

1. Costs of studies and development or product design segment:

This stage consists of three sub-stages as follows : (Atkinson,et.al,2012:303)

1. Market research: At this stage, the increasing needs of customers are analyzed and new ideas for developed products are presented...
2. Product design: At this stage, the technical specifications necessary for products that meet customer needs are determined.
3. Product development: At this stage, the company works to determine the basic characteristics that contribute to achieving customer satisfaction, and it also designs the prototype of the product, and determines the necessary production processes, in addition to determining the necessary tools needed for these processes.

2. Production stage :

After the completion of the research and development phase of the economic unit, the manufacturing phase begins, where funds are invested in purchasing raw materials, hiring workers, and covering indirect manufacturing costs in order to produce and distribute products. At this stage, the opportunities for making engineering decisions are limited to reducing production costs through redesign decisions because most of the costs have been determined in advance in the development phase. (Atkinson et al, 2012: 303)

3. Marketing and Distribution Stage :

This stage begins after the end of the manufacturing stage, where the product is marketed and distributed in the market, and includes marketing costs. At this stage, the company bears the costs of customer service and product disposal. Although these costs are determined in the research, development and design stage, the actual service stage begins once the product is delivered to the customer. This stage overlaps to some extent with the production stage, as this stage consists of three sub-steps, which are as follows:

1. Rapid growth in costs from the first time a product is shipped and continues as sales increase.
2. Moving from peak sales to peak after-sales service.
3. Maturity of peak after-sales service at some point. Sales to final maintenance are provided to the customer and then disposed of at the end of the product's life.

4. After-sales service stage :

At this stage, the economic units bear the costs of providing after-sales services, as these costs are determined in advance during the research and development stage. This stage actually begins when the first unit of the product is delivered to the customer. (Atkinson.et tal, 2012:303) .

B. Product life cycle stages from a marketing perspective:

The stages that a product goes through from a marketing perspective consist of a series of steps that reflect the product's life in the market. These stages begin with the introduction of the product, followed by the growth stage, then the sales stage. Then maturity, and finally the decline and dissolution stage. Thus, the product life cycle can be divided into four main stages, as follows: (Gigan,2021:6) (Hansen,et.al,2009:389) (Blocher, et.al, 2009:39)

1.Product introduction stage :

At this stage, sales start in small quantities. Profits may remain negative or move from negative to positive, but they are small. Although the unit profit margin may be very large, customers are willing to pay a higher price to obtain the new product. Costs are high in the research and development stage, and the price is high due to the distinctiveness of the product and the high costs at this stage. The diversity of the product at this stage is limited. At this stage, management focuses on design, distinctiveness, and marketing. Marketing a new product is often in low demand, but some customers get to know it and the extent to which it meets customers' desires. At this stage, sales start in small quantities, and profits may remain negative or move from negative to positive, but they are small, although the unit

profit margin may be very large due to customers' willingness to pay a higher price to obtain the new product, and costs are high due to research and development costs. This stage is characterized by the following features:

1. Making the necessary changes and modifications to the product design.
2. High flexibility in making changes and modifications and conducting experiments to show the product at the required level and shape.
3. Small production quantity, short duration and high cost per unit produced.
4. Full commitment to achieving quality.

2. Growth stage :

This period is considered a stage in which market penetration accelerates significantly. If the new product is successful in meeting customer needs, the growth rate and sales increase significantly. When user (customer) demands increase as a result of increased awareness and acceptance resulting from advertising campaigns, sales promotions and field sales efforts, this growth in terms of customer awareness and satisfaction is invested in an advanced manner during this stage through segmentation, differentiation and expansion in new markets, so profits increase during this period. If the new product is successful and meets customer desires, then the sales growth rate: significantly increases. User (customer) demands expand following increased knowledge and acceptance of the product due to advertising, sales promotions and field sales efforts. Therefore, this stage is characterized by the following characteristics: (Al-Akeely ,2014: 14)

1. Increase sales volume.
2. Increase production volume with increased energy utilization rates and lower unit cost

3. Maturity level:

At this stage, the aggressive landscape is decided and the product can also have a set proportion at the same time as the Income of the pesticide maintains to growth, but at lower fees. And the reliance on price and excellent in Competition . This stage is characterized by the following Characteristics : (krajewski & Ritzman, 2010:44)

1. Making the necessary changes and modifications to the product design.
2. High flexibility in making changes and modifications and conducting experiments to show the product at the required level and shape.
3. Small production quantity, short duration and high cost per unit produced.
4. Full commitment to achieving quality.

4. Decline and Decline Stage:

This stage indicates the beginning of a decline in the product's market share due to changing consumer tastes and strong competition. New products may emerge to replace the current product, leading to a decline in sales that may reach zero or stabilize at their lowest levels, with a gradual decrease in the number of customers if there is nothing to attract them to the product. This stage is characterized by the following characteristics:: (The high ,2000:129)

1. Ages level of demand for the product.
2. Requires control of costs and quality of the product..
3. Decrease and decline in the volume of production and thus decrease in energy utilization.

3. Product Life Cycle Costing Concept

Researchers have presented many concepts for product life cycle costing technology, some of which can be accomplished through the following table:

Table (1)
Product life cycle costing concepts

No	Source	Concepts
1	(Al-Amiri and Al-Rikabi, 2013 :93)	It is about all the sacrifices associated with products whether they are goods or services from the emergence of the idea to the provision of after-sales services. This includes all the costs incurred from the beginning stage to the end.
2	(Kadarova & Kobulnicky& Teplicka, 2015:548)	It is all the money spent by the economic unit to support the product from the moment it is designed and manufactured until the moment it is disposed of at the end of its productive life.
3	(Datar&Rajan,2018:560)	Product life cycle costing is the process of tracking and collecting costs associated with each product along the value chain, from the initial research and development stage to the end of after-sales services provided to customers.
4	(Shallah ,2020: 54)	This technology is an effective means of managing costs and aims to reduce them without affecting the quality of the product at all stages of its life cycle, starting from the pre-production stage until the disposal stage at the end of its productive life.
5	(Hansen,et.al.2020:739)	Product life cycle costing is the process of tracking and collecting the costs associated with each product along the value chain, from the initial product research and development stage to the end of the sale of services to customers.
6	(Horngren,et.al,2021:546)	The process of tracking and collecting the costs associated with each product includes analyzing the value chain starting from the initial research and development stage to the after-sales services provided to customers.
7	(Waldemar, 2021:3)	It is a method for calculating the estimated life cycle costs of a product as the sum of purchase costs, ownership costs, and operating costs according to the following equation:

Source: Prepared by the researcher based on the mentioned sources, opinions of each .

It is clear from the previous concepts that the product life cycle cost represents a method 1 approach to calculating all costs by allocating expenses across all stages of the product's life, starting from its entry into the market until its end of existence, during a period of time that may differ from one product to another. These costs are combined to form the total cost of the product.

4: Product Life Cycle Costing Technology Objectives

There are many objectives for applying product life cycle costing technology, the most important of which are the following: (Al-Anani ,2015:494) (Al-Jadri, 2022:72)

1. . Determine the costs of each stage during the product life cycle, whether before manufacturing, manufacturing or after manufacturing, to achieve comprehensive cost measurement for the product.
2. Clarify the reciprocal relationships between cost elements at each stage and study their impact on other stages and make appropriate decisions that lead to reducing costs.
3. Clarify the importance of the research and development stage and the extent to which other stages and how to reduce costs in most of the expected costs. Decisions are made during the research and development stage. The stages that follow it. T and development and the extent of their impact on
4. The product life cycle costing technique aims to assess whether the profit resulting from a specific product covers the costs of research and development or the costs of abandoning it during the production period or normal production.

5: The importance of product life cycle costs

Product life cycle cost analysis is beneficial to many parties, and manufacturers traditionally care about manufacturing costs from the beginning of production until the product is delivered to the customer. There are many benefits to product life cycle costs, and the most important of them can be discussed as follows:

1. Product life cycle cost analysis is considered a tool to evaluate the effectiveness of the planning function by comparing the actual costs of the product during its life cycle with the estimated costs in the budget during its life cycle. (Dunk , 2004: 401)
2. Product life cycle cost analysis provides valuable information to managers, enabling them to manage costs more efficiently. This analysis focuses on the behavior of costs at each stage of the product life cycle, requiring managers to understand and recognize this behavior throughout those stages. (El.Kelety, 2006: 437)
3. Product life cycle cost analysis is used to provide a better picture of the profitability of products in the long term. Product life cycle cost analysis also provides information about product prices, as some products have a long life and these products will bear a lot of costs before the manufacturing period begins. In order to be comfortable, economic units must achieve sufficient profits to cover the costs of the product during its life cycle. (Maher, 2008:42)

6: Reasons for adopting the product life cycle costing technique :

There are a number of reasons that require the economic unit to apply the product life cycle costing technique, including the following : (Meaning 28:2019)

1. The intensity of competition between projects and the desire to obtain the largest share in the sale of their products.
2. Increased production costs for products that have modern technological features.
3. Short product life cycle for some modern products, which requires the application of product life cycle costing technology.
4. As a result of continuous development, most economic units seek to increase the added value of the product, and this requires reducing the cost of the product during its life cycle, in addition to trying to discover defects at the earliest possible stage.

7: Product life cycle costing technical requirements

There are several aspects that an economic unit should consider when applying the product life cycle costing technique :(Fermawi ,2011: 256)

1. The existence of a good costing system helps in measuring and controlling costs during the different stages of the product life cycle and provides management with the necessary data and information to develop policies and make appropriate decisions.
2. It is necessary for senior management in the economic unit to be convinced of the objectives and advantages of applying this technology in order to achieve integration between the various departments within the economic unit as well as to provide communication channels that help in the flow of information.
3. The effective application of the product life cycle costing method requires developing a realistic plan for using the product, because estimating the costs of the product throughout its life cycle is not accurate. There is also a lack of a detailed description of the activities carried out during this cycle and future uses of the product.
4. The product life cycle costing technique is associated with a certain degree of predicting the future, so the uncertainty element should be taken into account when applying the product life cycle costing technique, and efforts

should be made to reduce the uncertainty associated with prediction based on correct and realistic historical data, as well as using statistical methods, in addition to using the probability approach.

8: The difference between product life cycle costing technology and traditional costing systems :

Product life cycle costing technology is distinguished from traditional cost accounting systems in several aspects. Officials in the organizational structures of economic institutions pay great attention to manufacturing costs, ignoring other cost items related to the product life cycle. As a result, these costs are not included in the total product costs despite their importance. Table (2) shows some points of difference between product life cycle costing technology and traditional costing systems.

Table (2)

The difference between product life cycle costing technology and traditional costing systems

Product life cycle costs	Traditional costs
Bearing the costs of development and logistics support	**Development and logistics costs are period costs.**
Takes into account all costs including period costs	**Only considers costs related to the product.**
It is concerned with controlling costs at all stages	**It is concerned with controlling costs in the production stage.**
Based on product life cycle reports	**Based on periodic reports**

Source: Surur manal Jabbar 2021: 360 Strategic Cost Management Al Jazeera Printing and Publishing, Third Edition/ Baghdad Al-Waziriyah .

9 : Technical Assumptions of Product Life Cycle Costs

The concept of the product life cycle is based on a set of assumptions, according to the researcher, which are as follows: (Atwa ,2020 :65)

1. At each stage of the product life cycle, sales and profits are different as a result of the different stages. Thus, it can be said that the more competition in the markets, the shorter the life of the product.
2. Applying any marketing strategy at one stage may not be possible in the next stage of the product life cycle.
3. Each product has a specific life cycle similar to a human life that may be long or short, starting from the moment of birth until death.
4. It is not necessary for the product to go through all stages of its life cycle, as it may end up at any of these stages

Third: Applying product life cycle technology to reduce cement production costs

The aim of applying the product life cycle costing technique in the Kufa Cement Plant for the year (2022) is by focusing on the stages of the product life cycle, which can be explained as follows:

1-Research and Development Stage

This is the first stage of the product life cycle, where ideas related to production and testing are presented. This stage begins with a market study to determine customer needs and the quantities that the laboratory can produce. It also includes a study of the available capabilities of welding materials and laboratory supplies, in addition to analyzing the market need for laboratory products for a certain period. After that, a detailed plan is developed for the product expected to satisfy customers. This stage represents an activity that is becoming increasingly important in the laboratory, especially in light of competition and the need to continue in the market. The need to reduce external competition enhances the importance of obtaining accurate accounting information to support this stage. The following table shows the costs of the research and development stage.

Table (3)

Cost table for the research, development and design phase in Kufa Cement Plant in 2022

No.	Account name	2022	Basis of calculation	Percentage of total cost
1	Salaries and wages	**491,734,412**	Payrolls	81.3
2	Miscellaneous	**2,456,447**	Disbursement Document	0.4
3	Transportation, delegation and communications	**70,257,113**	Number of Employees and Mobile Cards Disbursement	11.6
4	Energy	**40,546,640**	Lists Area	6.7
	Total	**604,994,612**		100%

Source: Prepared by the researcher and based on laboratory records .

It is noted from the above table that the total costs of research and development amounted to (604,994,612) dinars. The salaries and wages of employees were determined based on the payrolls, the cost of stationery was determined through the laboratory disbursement documents, energy was determined based on the area, and employee transportation was determined based on the number of employees in the research and development department. The

costs of travel, lighting and training were determined by examining the disbursement documents. Communications were calculated based on the mobile card disbursement lists. As for the percentage of each of salaries, wages, miscellaneous, energy, transportation, secondment and communications, they were (0.81) (0.004) (0.11) (0.06) respectively.

2. Production stage :

Production represents the stage in which raw materials are converted into a finished product by subjecting it to a set of procedures for the purpose of providing a product with the characteristics that were previously determined in the planning and design stage. Within this stage, the cost of each of the raw materials, indirect industrial costs, materials used in production, and the number of workers required to produce one ton are determined. This stage includes obtaining the main materials for production until the final product is reached. Operations

The production departments divided according to the following cost centers can be explained:

1. Material Crushing /Quarrying Section :

It is the first production section where the stone is crushed and converted into small sizes. The table below shows the costs of this section :

Table (4)

Cost table for the crushing stage of materials / quarry section in Kufa Cement Plant in the year 2022

No.	Account name	2022	Basis of calculation	Percentage of total cost
1	Salaries and wages	**2,217,671**	Payrolls	39.2
2	Raw materials	**2,223,716**	warehouse output documents	39.27
3	Miscellaneous	**27,471**	Disbursement Document	0.49
4	Transportation, delegation and communications	**313,017**	Number of Employees and Mobile Cards Disbursement	5.5
5	Depreciation of machinery and equipment	**364,549**	Productive age	6.44
6	Energy	**514,970**	Lists Area	9.1
	Total	**5,661,394**		100%

Source: Prepared by the researcher and based on laboratory records .

It is noted from the table above that the total costs of the quarry crushing department amounted to (5,661,394,000) dinars. The salaries and wages of workers were determined according to the payrolls, and the costs of raw materials and materials used in the manufacture of the cement product were matched with the warehouse output document, which accounted for the highest costs. This indicates the large use of raw materials and thus increased production. The costs of miscellaneous stationery, supplies and equipment were determined according to the energy disbursement bonds. They were determined on the basis of area and amounted to. Depreciation was calculated on the basis of productive life and its costs amounted to. As for the percentage of each of salaries, wages, raw materials, miscellaneous, energy, transportation, delegation, communications and depreciation, they were (0.39) (0.39) (0.004) (0.055). 0.064), (0.09) respectively.

2. Conveyor Section

It is the second section of the production stage, in which the crushed stone is transferred to the stone warehouse inside the factory. The table below shows the costs of this section.

Table (5)

Cost table for the crushing stage of materials / conveyor section in Kufa Cement Plant in the year 2022

No.	Account name	2022	Basis of calculation	Percentage of total cost
1	Salaries and wages	**1,589,845**	Payrolls	71.8
2	Miscellaneous	**11,412**	Disbursement Document	0.51
3	Transportation, delegation and communications	**45,653**	Number of Employees and Mobile Cards Disbursement	9.34
4	Depreciation of machinery and equipment	**206,832**	Productive age	2.06
5	Energy	**360,788**	Lists Area	16.29
	Total	**2,214,530**		100%

Source: Prepared by the researcher based on laboratory records.

It is noted from the table above that the total costs of the carrier section amounted to (2,214,530,000) dinars at the factory level according to the cost distribution bases shown opposite each paragraph of the stage. The salaries and

wages that were determined based on the payrolls amounted to. It is noted that there is a decrease in wages as a result of the decrease in the use of labor and its replacement by machines to complete the work. This explains the increase in the depreciation of this equipment, which is calculated according to the productive life and amounted to. The miscellaneous paragraph was determined by reviewing the disbursement documents. As for energy, fuel and oils, water and electricity (they were determined on the basis of area. As for the percentage of each of salaries, wages, miscellaneous, energy, transportation, delegation, communications and depreciation, they were (0.72) (0.005) (0.021) (0.093) (0.16) respectively.

3. Raw Material Mills Section :

It is the third section of the production stage, in which limestone and other materials are ground in preparation for transferring them to the kilns. The table below shows the costs of this section.:

Table (6)

Cost table of the raw material mills section in Kufa Cement Factory in 2022

No.	Account name	2022	Basis of calculation	Percentage of total cost
1	Salaries and wages	**1,795,547**	Payrolls	19.66
2	Raw materials	**4,535,466**	warehouse output documents	49.66
3	Miscellaneous	**105,386**	Disbursement Document	1.15
4	Transportation, delegation and communications	**47,023**	Number of Employees and Mobile Cards Disbursement	0.51
5	Depreciation of machinery and equipment	**1,006,567**	Productive age	11.02
6	Energy	**1,642,038**	Lists Area	18
	Total	**9,132,027**		100%

Source: Prepared by the researcher based on laboratory records .

It is noted from the table above that the total costs of the Material Mills Department amounted to (9,132,027,000) dinars. Salaries and wages were determined on the basis of payrolls. The cost of raw materials and primary materials used in the cement industry according to the warehouse output documents, whether these materials were imported from abroad or locally. The miscellaneous paragraph was determined by reviewing the disbursement documents. As for energy, fuel, oils, water and electricity, they were determined on the basis of area. The depreciation of machinery and equipment was determined on the basis of productive life. As for the percentage of each of salaries, wages, raw materials, miscellaneous, energy, transportation, communications and depreciation, they were (0.20) (0.50), (0.011), (0.11), (0.005), (0.18) respectively.

4. Raw Materials Burning Section (furnaces):

After the fourth section of the production stage, in this section, burning is done in stages, including the drying stage, the crystallization water loss stage, and then the calcination stage. The table below includes the costs of this section:

Table (7)

Cost table for the Raw Materials Burning Section (Ovens) in the Kufa Cement Factory in 2022

No.	Account name	2022	Basis of calculation	Percentage of total cost
1	Salaries and wages	**2,584,865**	Payrolls	21.7
2	Raw materials	**30**	warehouse output documents	0.0003
3	Miscellaneous	**18,435**	Disbursement Document	0.16
4	Transportation, delegation and communications	**15,820**	Number of Employees and Mobile Cards Disbursement	0.13
5	Depreciation of machinery and equipment	**7,316,981**	Productive age	61.6
6	Energy	**1,951,424**	Lists Area	16.4
	Total	**11,887,555**		100%

Source: Prepared by the researcher based on laboratory records .

Observed from the table above that the total costs of the ovens department amounted to (11,887,555) dinars. Salaries and wages that were determined on the basis of payrolls amounted to the cost of raw materials and primary materials. The cost of raw materials decreased because the materials were already used in cement production at an earlier stage. The miscellaneous paragraph was determined by reviewing the disbursement documents. As for energy, it was determined on the basis of area. As for the rest of the paragraphs of the department's costs, they were calculated according to the appropriate basis. As for the percentage of each of salaries, wages, raw materials, primary materials,

miscellaneous, energy, transportation, delegation, communications, and depreciation, they were (21.7), (0.003), (0.16) , (0.13), (61.6) , (16.4) respectively

5. Cement Mills Department :

It represents the fifth stage of production, in which the cement material is ground and ready for marketing and transferred to the packaging department. The table below includes the costs of this department::

Table (8)

Cost table of the cement mills department in Kufa Cement Factory in 2022

No.	Account name	2022	Basis of calculation	Percentage of total cost
1	Salaries and wages	**2,089,907**	Payrolls	18.8
2	Raw materials	**5,730,850**	warehouse output documents	51.6
3	Miscellaneous	**51,710**	Disbursement Document	0.47
4	Transportation, delegation and communications	**12,914**	Number of Employees and Mobile Cards Disbursement	0.13
5	Depreciation of machinery and equipment	**1,537,078**	Productive age	13.9
6	Energy	**1,675,216**	Lists Area	15.1
	Total	**11,097,675**		100%

Source: Prepared by the researcher based on laboratory records .

It is noted from the table above that the total costs of the cement mills department amounted to (11,097,675,000) dinars, salaries and wages that were determined on the basis of payrolls. The cost of raw materials and primary materials according to the warehouse release documents amounted to the fact that the raw materials were used in previous stages of production, and the work of this stage is limited to completing work on these materials to obtain the final product (cement) and market it as soon as possible without delay. This is consistent with the project resource planning system in its quest to complete work as quickly as possible and with the highest quality. The depreciation of machinery and equipment was determined on the basis of productive life. As for the percentage of each of salaries, wages, raw materials, miscellaneous, energy, transportation, delegation, communications, and depreciation, they were (0.19) (0.52), (0.005) . . 0.14), (0.001), (0.15) respectively..

6. Packaging Department :

It is the last stage of production in which the ready-made cement is packed in preparation for transferring it to the marketing department. The table below includes the costs of this department:

Table (9)

Table of costs of the packing department in the Kufa Cement Factory in 2022

No.	Account name	2022	Basis of calculation	Percentage of total cost
1	Salaries and wages	**1,815,987**	Payrolls	65.03
2	Miscellaneous	**28,984**	Disbursement Document	1.04
3	Depreciation of machinery and equipment	**203,907**	Productive age	7.3
4	Energy	**743,731**	Lists Area	26.63
	Total	**2,792,609**		100%

Source: Prepared by the researcher based on laboratory records .

It is noted from the table above that the total costs of the packaging department amounted to (2,792,609,000) salaries and wages were determined based on payrolls and the depreciation of machinery and equipment was determined based on the productive life, while the rest of the paragraphs were calculated each according to the appropriate basis for each paragraph, as the costs vary from increase or decrease according to the nature of the work in the cost complex. As for the percentage of each of the salaries, wages, miscellaneous, energy and depreciation, they were (0.7), (0.01) (0.07), (0.3) respectively.

We note from the previous tables that PLCC aims to reduce production costs starting from raw materials and ending with the final product with the required specifications that were determined in the research and development stage, and that this is what the system seeks to achieve by providing accurate and comprehensive performance indicators and raising the level of interaction and communication between departments. Providing information about energy, maintenance, machinery, equipment, materials and devices needed for production. This leads to operational efficiency and better information about production. It also seeks to push the factory to a higher level. This leads to a higher level of productivity, which in turn leads to more profits. The following table shows a summary of the costs of the production stage.

Table (10)
Summary table of the costs of the production level in the Kufa Cement Factory during the year 2022

Section	Accumulated
Quarry section	5,661,394,000
Carrier section	2,214,530,000
Material Mills Department	9,132,027,000
Ovens section	11,887,555,000
Cement Mills Department	11,097,675,000
Packing department	2,792,609,000
Total	42,785,790,000

Source: Prepared by the researcher based on laboratory records .

The table above shows the costs of each section of the production stage. It was noted that the largest part of the costs of this stage is concentrated in the material mills section and the cement mills section because they bear the largest part of the work in the production stage. The rest of the costs are distributed among the other cost pools, each according to the work it accomplishes.

3- Marketing and product presentation stage :

This stage involves defining the characteristics of the product to customers and determining the mechanism through which the product is delivered through different channels. The factory works to raise the customers' conviction in the cement product it offers, thus bearing costs that require appropriate scientific approaches to manage, as the factory markets its products through its headquarters in the factory as well as agents .

As for distribution, it is delivering the cement product to customers. Distribution in the cement factory includes delivering cement to contracting companies and government sectors that use the product, agents, and individuals. Distribution activities play an important role in marketing and selling the product. It is also a suitable field for increasing factory sales and acquiring the time element for the stock of ready production.

Table (11)
Marketing stage cost schedule in Kufa Cement Factory / 2022

No.	Account name	2022	Basis of calculation	Percentage of total cost
1	Salaries and wages	**1,661,302,200**	Payrolls	97.5
2	Miscellaneous	**11,288,350**	Disbursement Document	0.7
3		**4,097,581**		0.24
4	Transportation, delegation and communications	**12,850,000**	Number of Employees and Mobile Cards Disbursement	0.75
5	Depreciation of machinery and equipment	**2,960,000**	Productive age	0.17
6	Energy	**10,930,500**	Lists Area	0.64
	Total	**1,703,428,631**		100%

Source: Prepared by the researcher based on laboratory records .

It is noted from the above table that the total costs of the marketing and product presentation stage amounted to (1,703,428,631) dinars. Salaries and wages were determined based on payroll lists, packaging costs were determined according to warehouse output documents, and advertising, printing and hospitality were determined according to disbursement documents. The rest of the costs were distributed according to the basis specified for them. As for the percentage of salaries, wages, miscellaneous materials, packaging, advertising, printing, hospitality and energy, they were (0.006) respectively.

4. After-sales services

In this type of industry, there are no after-sales services, as if the product is damaged, it is not returned to the factory because the cost of returning it, including transportation fees and returning it to the factory, is greater than the benefit achieved from it based on the principle of cost and benefit..

5. Administrative costs

The laboratory has sufficient human cadres to perform its work and implement its various activities, as there are (175) employees in the laboratory who work in an administrative capacity on the permanent staff and with different titles

distributed across the departments and various work sites. The following is a table of administrative costs for the year (2022)

Table (12)
Administrative costs of the Kufa Cement Factory for the year (2022)

No.	Account name	2022	Basis of calculation
1	Salaries and wages	**6,490,923,000**	Payrolls
2	Miscellaneous	**159,752,000**	Disbursement Document
3	Transportation, delegation and communications	**53,556,000**	Number of Employees and Mobile Cards Disbursement
4	Energy	**418,978,000**	Lists Area
	Total	**7,123,209,000**	

Source: Prepared by the researcher based on laboratory records.

It is noted from the table above that the total administrative costs amounted to (7,123,209) dinars, and salaries and wages were determined according to the salary lists, while the rest of the paragraphs were distributed according to the cost guide that suits their distribution in a way that achieves fairness and realism for all departments and activities of the laboratory, and some paragraphs were determined by examining documents and knowing the activity and department to which the amount was disbursed directly.

Through the results reached by the researcher, the research hypothesis was proven, which indicates the possibility of applying the product life cycle costing technique and its role in reducing costs. This was done by measuring the cost of each stage of the product life cycle and increasing profits by reducing costs. Applying the steps of the product life cycle costing technique has effectively contributed to significantly reducing the cost of the cement product. In addition, following the sequence of steps related to the product life cycle costing technique has greatly contributed to achieving the smoothness of the results of this research.

Fourth: Conclusions and recommendations

Conclusions :

First: Conclusions of the theoretical aspect:

1. PLCC aims to Reduce costs and Reduce cost management and control. Stages of the entire production process while maintaining product quality across stages.
2. The use of product life cycle costs (PLCC) is a modern method, especially in various sectors. This method provides accurate data and clear figures on the main and subsidiary activities, which helps the economic unit avoid causes of waste and losses during the various stages of the product's life.
3. The product life cycle costing technique tracks the costs associated with the product from the planning and design stage, through the production, marketing and distribution processes, to the stage of product disposal.
4. The cement plant, the research sample, has a weak cost accounting system in terms of staff and application, due to its reliance on the traditional system for calculating costs.

Second: Conclusions of the applied aspect:

1-The cement product in the studied factory needs to reduce its high costs, especially indirect costs, and improve the quality of the product. This is intended to help management achieve a competitive price that meets customer needs better than competitors. This goal can be reached by applying the product life cycle costing technique>

2-Adopting the economic unit of modern costing techniques, such as product life cycle costs. This system suffers from a lack of ability to identify, measure and classify costs, in addition to providing information related to them.

3-The Kufa Cement Factory witnessed a decline in production in terms of design capacity and available capacity, as a result of the decrease in demand for the factory's products compared to competing products.

Recommendations :

1. The necessity of adopting and applying the product life cycle costing technology to achieve the set goals that the project aims to achieve in order to raise the performance of employees at all administrative levels.
2. Focus on adopting modern technologies and methods to reduce costs in line with the characteristics of the contemporary environment and in line with the nature of the factory and its cost structure, in addition to choosing the best and most optimal technologies that contribute to achieving its goals.
3. The research sample laboratory should apply this technology to invest it in maintaining product quality by tracking and allocating costs properly.
4. The Kufa Cement Factory adopts product life cycle costs as a research tool for the purposes of product pricing and cost management. This technology provides valuable information that contributes to improving pricing strategies and cost management throughout the product life cycle. This indicates the necessity that: Product life cycle costs be less than the total costs of the product.

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