Measuring the Costs of Value Stream by using the Supply Chain Management and its Role in Cost Management

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***Abstract*— The present research aims at studying the knowledge bases of value stream costs, Lean Accounting and supply chain management. Proper supply chain performance plays a crucial role in the success of organizations. Therefore, it is essential to use an appropriate supply chain performance assessment system to continuously improve it. The purpose of this research is to analyze supply chain performance according to the operational reference model of supply chain. In addition to using the tools of Lean Accounting in measuring the costs of value stream so that helps economic units in managing and reducing costs consistent with the requirements of the modern manufacturing environment. The measurement of value steam costs helps to provide appropriate information that can serve the management of the economic unit in decision making process in such a way as to help control all elements of the value steam costs effectively and efficiently. As well as improving and developing value stream reports as a result of the easy understanding of the stream of information and the stream of materials, assets and procedures in a streamlined. The current research has been applied in Al-Zawraa General Company/Power Structured Factory for financial year ended 2017. The research also presented a set of recommendations that emphasize the importance of using Lean Accounting tools in measuring costs of value stream in the manner that is reflected in cost management effectively and efficiently.**

***Keywords*—** *Costs of value stream, tools of Lean Accounting, Supply chain management, cost management*

1. Introduction

Costs of value stream are the costs allocated to the required activities that add value to both the economic unit and the client in order to determine the cost of the product from the beginning of the R&D stage and the design stage until it is delivered to the client (Rother & Shook, 1999: 9). Costs of value stream is considered one of the basic principles upon which the lean thinking concept is based, as the economic unit applied for this concept determines the value streams in the manner that helps it to manage its activities in order to enhance the value of each of the economic unit and the client, and the importance of the costs of value streams comes from the importance of appropriate information that serves the management in the decision-making process in the manner that helps in imposing an effective and efficient control on all elements of the costs (Guan, et.al., 2009: 409), as well as improving and developing value stream reports for easy understanding of financial and non-financial information on value streams in the economic unit. Herein, the role of Lean Accounting tools came to measure the costs of value stream effectively and efficiently in addition to reducing costs and improving the quality of both processes and products. A supply chain is a network of facilities that generates raw materials, transforms them into primary goods and then final products, and delivers products through the distribution system to customers. To achieve integrated management of supply chain management, a number of researchers and interns have devoted their efforts to developing models for the expression of elements and chain activities. The supply chain set up by more than 650 member organizations (both academia and industry) around the world has expanded the SCOR model of supply chain operations. The SCOR model is the reference model process that intends to have industry standards capable of managing future supply chain management.

This model includes the standard description of management processes or the framework of relationships between standard processes, standard metrics for measuring process execution, management tasks that produce the best performance and setting of software features and functionality.

2. First Section: Methodology of Research and Literature Review

2.1. Research Methodology

2.1.1. Research problem

Costs of value stream are related to value adding activities or resources for each of the economic unit and the client starting from the R&D stage till serving the clients, and to calculate these costs, it is necessary to divide the economic unit into group of value streams addressed to achieve a specific objective, and the costs of value stream include a group of elements and they are the costs of each of materials, wages, foreign operations, facilities, support and monuments. As a result of the importance of the costs of value stream and their relationship with the lean practices, it is necessary to measure them accurately by relying on Lean Accounting tools in the manner that commensurate with the information needed by the economic unit management for good decision-making, accordingly, the research problem can be expressed through the following intellectual questions:-

i. What is the meaning of costs of value stream? and what are the appropriate ways to measure them in line with the nature of the economic units and the requirements of modern manufacturing environment and the accompanying developments?
ii. Can Lean Accounting tools be used to measure the costs of value stream in a way that helps economic units provide the information needed to manage cost effectively and efficiently?

2.1.2. Research Objectives

The research aims at addressing the knowledge bases of the costs of value stream in terms of their concept, importance and appropriate methods of measuring them, in addition to addressing the knowledge bases of Lean Accounting and the use of their tools in measuring the costs of value stream in a way that helps economic units to manage costs as well as reducing unnecessary and unjustified costs in accordance with the requirements of the modern manufacturing environment and the accompanying changes and developments.

2.1.3. Research Importance

The importance of the research is to recognize and measure the cost of value stream by using Lean Accounting tools and their role in providing appropriate information that serves management in the decision-making process in order to effectively and efficiently control all elements of cost of value stream, in addition to enhancing and developing cash stream reports to facilitate the understanding of financial and non-financial information on value streams in the economic unit.

2.1.4. Research Hypothesis

The research is based on the fundamental hypothesis and it shows that (there is a possibility to measure the costs of value stream by using accounting tools as Lean Accounting tools in the manner than helps the economic units in cost management).

2.1.5. Research Approach

The current research is based on two scientific approaches: the descriptive approach and the analytical approach. The descriptive approach is used in the theoretical aspect of research by presenting and discussing the contributions of researchers in this field by reading books, researches, periodical and university theses and dissertations. Data collected from the research sample were studied and analyzed.

2.1.6. Research Sample

Al-Zawraa General Company/Al-Zawraa Power structured factory was chosen as one of the formations of the Iraqi Ministry of Industry and Minerals because of its reliance on traditional methods of accounting which are no longer suitable for the requirements of the modern manufacturing environment. The current research was applied for the financial year ended 2017.

2.2. Previous studies and the current research contribution

2.2.1. Previous studies

i. Study of (Mashall, 2004) Refers to Importance of Lean Accounting in Manufacturing Firms. The purpose of the study is to demonstrate the importance of applying Lean Accounting in industrial companies and the role it plays in improving the overall performance of these companies. The study draw many conclusions, the most important one is that the application of Lean Accounting in manufacturing companies can help to make significant improvements to the performance of these

companies, whether operational or strategic performance, as a result of continuous performance improvement in accordance with the practices and methods of accounting lean. (Mishra & Pradhan 2009) Refers to Lean Accounting: Recent Developments in Management Science: The study aims at reviewing traditional accounting systems and replacing them with modern systems that are consistent with the developments accompanying the modern business environment. The study indicates that Lean Accounting helps management to make the best management decisions, reduce process and product costs, improve quality and reduce lost time, as well as better financial performance of the economic unit than in traditional accounting. (Gardon, 2010) Refers to Value Stream Costing: The study aims to identify the appropriate methods for measuring the cost of the value stream in accordance with the nature of the work of the economic units. The study draws a number of conclusions. The most important ones are two ways to measure the cost of value stream and they are the method of cost rate, characteristics and advantages. The cost rate method is appropriate for economic units where production is standard and the units have the same cost, whereas the method of characteristics and advantages is appropriate for economic units where production is non-standard and based on clients' requests.

2.2.2. Contribution of Current Research and the Extent of its Difference from Previous Studies

ii. The current research examined the measurement of costs of value-stream using Lean Accounting tools and the role it plays in managing and reducing unnecessary costs as well as improving the quality of processes and products through continuous improvement processes, unless they are found in previous studies.
iii. A rational basis has been developed for the application of Lean Accounting tools and their use in measuring the cost of value streams in Iraqi economic units in a way that is commensurate with the requirements of the environment in which these units exist and this helps to manage and reduce costs as well as improving the quality of operations and products.
iv. The current research examined the measurement of costs of value-stream using Lean Accounting tools and the role it plays in managing and reducing unnecessary costs as well as improving the quality of processes and products through continuous improvement processes, unless they are found in previous studies.
v. A rational basis has been developed for the application of Lean Accounting tools and their use in measuring the cost of value streams in Iraqi economic units in a way that is commensurate with the requirements of the environment in which these units exist and this helps to manage and reduce costs as well as improving the quality of operations and products.

3. Second Section: The theoretical framework Research

3.1. Concept and Importance of Costs of Value Stream

Costs of value stream are seen as the costs allocated to the required activities that add value to both the economic unit and the client in order to determine the cost of the product from the beginning of the R & D stage and the design phase till the stage of its delivery to the client (Rother & Shook, 1999: 9). Costs of value stream relate to the allocation of the actual costs of an economic unit over value streams instead of directly allocating these costs to cost units (Winberg, 2010: 15). Value streams are fundamental principles underlying the concept of lean thinking, as the economic unit applying this concept is working on determining the value streams in the manner that helps it to manage its works in order to enhance the value of the economic unit and the client (Guan, et.al., 2009: 409). The costs of value stream include a set of elements. These elements can be explained as follows:

Costs of Value Stream Materials: They are calculated on the basis of the items actually used in the value stream and represents the cost of the purchased raw materials (purchase price and purchase expenses) required to complete the production processes (Bahadir, 2011: 33).

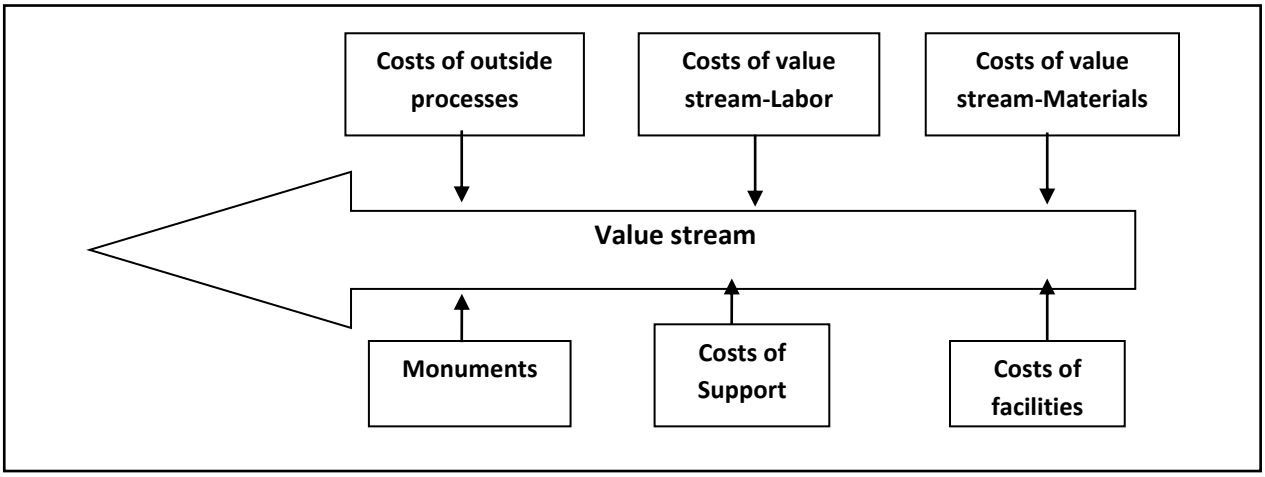
Costs of Value Stream Labor: The wages paid to labor in the main activities of value streams, either paid to employees outside the value stream, are indirect wages treated as Period Costs Transaction, Hansen & Mowen (2007: 726).

Costs of Outside Processes: Some costs are associated with individuals outside the value stream, but they utilization from their services at a certain rate, such as marketing and administrative costs, which must be charged to the value stream according to the percentage of utilization (Gordon, 2010: 12).

Cost of Facilities: These costs consist of rents, rentals, maintenance, security and protection services. These costs are allocated to the value stream according to the percentage of utilization (Fullerton, et.al. 2010: 11).

Cost of Support: These costs are represented in the fittings of the economic unit, spare parts; office equipment and miscellaneous costs incurred during the period, and these costs are allocated to the value stream according to the percentage of utilization (Maskell, et.al. 2007: 178).

Monuments: The large machines used in the economic unit that are used for more than one value stream in this unit. The share of the value stream of these costs is determined on the basis of a percentage according to the percentage of utilization (Stenzel & Senge, 2007: 159).



Source: (Mashell, 2004:3) and (Huntzinger, 2007:254), prepared by the researcher.

Figure 1. Costs of Value Stream

As for the importance of costs of value-stream, they can be illustrated by a set of points:
To help reduce all unnecessary and unjustified costs associated with activities, resources, components or functions that do not add value to both the economic unit and the client.

To provide appropriate information that can serve the management of economic unit in the decision-making process in such a way as to help control all elements of the cost of value stream effectively and efficiently.

To help focus attention on the cost problems associated with the stream of value, as well as providing appropriate views, solutions and proposals that will improve value streams.

The possibility of improving and developing reports of value stream due to the easy understanding of financial information as well as this information shall be real and does not contain any difficult and complex methods or techniques..

3.2. Relevant Methods for Measuring the Costs of Value Stream

Several researchers have identified two ways to measure the cost of the value stream: the average cost per unit method and the characteristics and features method. These two methods can be illustrated by the following:

First: Average Cost Per Unit Method

This is the case for economic units where the production of the value stream is relatively similar products or this stream consumes the same or the product mix is relatively constant, In the light of this method, there is no need to know the cost of the products individually. Rather, the focus is on the average cost of the unit produced over a given period of time, so this method is suitable for the value stream that produces similar products or these products are different but their production mix is relatively constant, this method can be used as an important tool to measure the economic efficiency of the product (Hansen & Mowen, 2009: 735).

Second: Characteristics and Features Method

This is appropriate for the economic units in which the production of the value stream is in the form of different products with different forms. The production is going through different and various stages for each product. Therefore, the cost of the products must be calculated on the basis of the characteristics and features rather than the average cost per unit. The cost of products streaming through different production stages depends on the speed of production rather than on the speed of

resource use (Maskell, et.al., 2012: 209). Thus, the method depends on the characteristics and features of the product when calculating its cost (Guan et al., 2009: 420).

3.3. Concept and Importance of Lean Accounting

The concept of Lean Accounting is one of the modern concepts in accounting, and refers to the measurement, control and administrative methods that resulted from the economic unit's adoption of the lean thinking and practices, and through Lean Accounting we can achieve the best administrative decisions through which to manage costs effectively and efficiently (Mishra & Pradhan 2009: 37). Based on the above, it can be said that the importance of Lean Accounting stands out as an important tool to help achieve a range of utilizations for economic unity, which can be clarified through the following points:

Improve production processes in line with the concept of lean thinking and the application of lean practices.

Encourage managers and employees to learn and teach graceful methods and gain scientific and practical experience.

Eliminate cost and time losses as well as improving process quality.

Ii-iv Principles, Tools and Applications of Lean Accounting:

These principles, tools and practices can be clarified through the following:

First: Basic Lean Accounting Business:

There is a series of Lean Accounting work that aims to reduce cost and time losses while improving the quality. These works are related to improvements that must be made early in order to shift from traditional to lean business through simplification and simplification of production processes. There are three tools that are consistent with this principle as follows: (Maskell & Baggaley, 2006: 37)

Value Stream Maps.

Lean Continuous Improvement.

Schema of Linking Performance Measurements.

Second: Supporting Lean Accounting Business:

This principle relates to the management control of operations in order to manage and reduce costs, as well as continuous improvement processes, and the lean methods and accounting reports associated with them can help in the transition to agility in the performance of various processes, as these methods are directed towards continuous improvement, There are three tools that are consistent with this principle: Mishra & Pradhan (2009: 38)

Performance Measurement Scheme.

Value Stream Panels.

Points Box.

Third: Preparation of financial and non-financial information in a timely manner (Preparing Financial and Non-financial Information timely):

Accounting reports that include financial and non-financial information can help to clarify the overall value of the economic unit's value stream. Thus, Lean Accounting focuses on measuring and improving the value of clients through timely and appropriate information on design, pricing and product improvement. Three tools are consistent with this principle as follows: (Joe, 2007: 315)

i. Value Stream Costs.
ii. Value Stream Income Statement.
iii. Target Cost.

Fourth: Planning Processes According to the concept of lean manufacturing and lean practices:

According to this principle, planning and preparation of operational and capital budgets are carried out in line with prudent accounting practices. Three tools are in line with this principle as follows: (Spithoven 2001: 731)

i. Optical Performance Boards.
ii. Performance Box.
iii. Strategic and Operational Planning.

Fifth: Strengthening internal controls in the economic unit:

The operations of the economic unit, as well as stock assessment and risk management, are carried out. Three tools are in line with this principle: Guan et al., 2009: 410.

i. Losses Determination Matrix.
ii. Control Panels on Stock.
iii. Risk Assessment Models.

The Lean Accounting principles, tools and practices can be clarified through the following table:

Table 1. Lean Accounting principles, tools and practices

S	Principles	Tools	Practices
i	Basic Lean Accounting works	Value Stream Maps. Lean Continuous Improvement. Schema of Linking Performance Measurements.	Eliminate losses in both costs and time continuously, in addition to streamlining and simplifying processes and transactions
ii	Lean Accounting works	Performance Measurement Scheme. Value Stream Panels. Points Box.	Administrative control of operations for management and cost reduction, as well as continuous improvement processes.
iii	Preparation of financial and non-financial information timely	Value Stream Costs. Value Stream Income Statement. Target Cost.	Prepare cost reports, financial and non-financial reports and deliver them to the decision makers in the economic unit in a timely manner.
iv	Planning of processes according to the concept of lean manufacturing and lean practices	Optical Performance Boards. Performance Box. Strategic and Operational Planning.	To carry out planning and budgeting processes, whether operational or capital, in line with Lean Accounting practices.
v	Enhancement of internal control processes in the economic unit	Losses Determination Matrix. Control Panels on Stock. Risk Assessment Models.	Conduct controls on the lean operations of the economic unit, in addition to stock assessment and risk management

Source: (Maskell & Baggaley, 2004:37)

Thus, the principles of Lean Accounting are only a set of basic principles that must be taken into account when applying Lean Accounting on the ground, which is based on a set of tools that represent methods aimed at activating the concepts of lean thinking and efficient practices that will be applied in the economic unit.

3.4. Using the tools of Lean Accounting in Measurement and Management of the Costs of Value Stream

Tools of Lean Accounting seek to achieve a set of objectives, the most important of which are cost measurement and management. This paragraph will explain how these tools can help to measure the costs of value stream and among the tools that achieve this are Value Stream Maps, it can assist management in tracking streams of materials, information, procedures, assets, etc. through value stream (Yamberd, et.al., 2017: 526). The researcher suggests a set of steps to measure and manage the cost of value streams using Lean Accounting tools. These steps can be illustrated as follows:

i. Division of the economic unit into a set of value streams, each one is related to the production of a specific product.

Division of the value stream into work cells (production cells) after determining the value stream manager, assistant manager and secretarial, as well as the most important units and sections related to the value stream.

Calculation of the cost of the value stream for each of the paragraphs referred to in the previous point in relation to the cost of materials, wages, external operations, facilities, support and monuments.

Preparation of the income statement for the value stream under the application of Lean Accounting tools.

4. Third topic: Applied aspect of the research

4.1. An overview of Al-Zawraa General Company

Al-Zawraa General Company is one of the industrial companies affiliated to the Iraqi Ministry of Industry and Minerals. The company was established in 1988. It is specialized in the production of electric distribution control panels for low pressure and high pressure in addition to manufacturing industrial battery trucks, manufacturing printed circuit boards,

manufacturing of mosaics systems as well as manufacturing control panels for programmed machines. The company is located in Baghdad in the industrial zone/Zafaraniyah on an area of 60,000 square meters and currently has more than 1,000 employees, and the company seeks, since its establishment, to expand its activity and development to include multiple products in order to meet the needs of the client with the specifications which they need. The Company consists of six main Factories: medium voltage Factory, low voltage Factory, Power structured factories, electronic unit production Factory, self control Factory and metal fabrication Factory. The products of the companies are non-metallic products produced in accordance with the IEC Global Specifications.

4.2. Measuring the Costs of Value Stream in Al-Zawraa General Company by Using the Tools of Lean Accounting

The current research will be carried out at one of the factories of Al-Zawraa General Company which is the specialized power structured factory in the power supply industry which is used in electrical stations for smelting, coating and other purposes. The actual cost of the Factory products can be explained by the following table:

Table 2. Actual cost for the products of power structured factory during 2017

S	Cost elements	Details	Amount in dinar (Partial)	Amount in dinar (Total)	Percentage to total cost
i	Direct materials	Product structure	48,338,000		3.97%
		Magnetic circuit	72,126,000		5.92%
		Coils	36,062,000		2.96%
		Cables boxes	84,114,000		6.90%
		Push toggles	32,446,000		2.66%
		Spiral pulleys	38,769,000		3.18%
		Heat measurement for the converter	90,715,000		7.45%
		Oil pan	80,412,000		6.60%
		Oil level indicator	56,987,000		4.68%
		Pressure measurement valves	61,035,000		5.01%
		Total		601,004,000	49.33%
ii	Direct wages	Production labor wages		502,622,000	41.25%
iii	Indirect expenses	Indirect industrial expenses	57,373,000		4.71%
		Indirect marketing expenses	34,421,000		2.83%
		Indirect administrative expenses	22,955,000		1.88%
		Total		114,749,000	9.42%
		Total actual cost for the products		1,218,372,000	100%

Source: Preparation of the researcher based on data available in the Cost Division for 2017.

Table 2 shows that the actual cost of Power structured factory products during the year was 1,218,372,000 dinar. The cost of direct materials, direct wages and indirect expenses amounted to 601,004,000, 502,622,000 and 114,749,000 dinar, respectively, which accounted for 49.33%, 41.25%, 9.42% respectively of the actual total cost of the products, noting that the number of units produced

during the year was 68 units, so the actual cost per unit is 17,917,235 dinar, and the price of sale of one unit is 18 million dinar, which indicates that the profit earned from one unit is 82,765 dinar, i.e. the profit earned at the level of the Factory as a whole during the year was 5,628,020 dinar, a relatively small amount compared with the size and importance of the products produced by the Factory, which requires reconsideration of the cost management properly and reduced by following modern methods such as the application of Lean Accounting tools.

In order to measure the costs of value stream using Lean Accounting tools, it is necessary to convert the Factory into production cells. A proposed model for the costs of value stream in the Power structured factories under the Lean Accounting as shown in the following table:

Table 3. A proposed model for the costs of value stream in the Power structured factories under the Lean Accounting

S	Details	Costs of materials	Costs of wages	Costs of outside processes	Costs of facilities	Costs of support	Monuments	Total costs
i	Value stream manager	xxx						xxx
ii	Value stream assistant manager	xxx						xxx
iii	Secretariat	xxx						xxx
iv	Receiving the client's request	xxx						xxx
v	Planning for production	xxx						xxx
vi	Purchase of raw materials							
vii	Disbursement of raw materials for production	xxx						xxx
viii	Product structure cell	xxx	xxx		xxx	xxx		xxx
ix	Magnetic circuit cell	xxx	xxx		xxx	xxx		xxx
x	Coils cell	xxx	xxx		xxx	xxx		xxx
xi	Cable boxes cell	xxx	xxx		xxx	xxx		xxx

xii	Push toggles	xxx	xxx		xxx	xxx		xxx
xiii	Spiral pulleys cells	xxx	xxx		xxx	xxx		xxx
xiv	Heat measuremen t cell for the converter	xxx	xxx		xxx	xxx		xxx
xv	Oil pan cell	xxx	xxx		xxx	xxx		xxx
xvi	Oil level indicator cell	xxx	xxx		xxx	xxx		xxx
xvii	Pressure measuremen t valves cell	xxx	xxx		xxx	xxx		xxx
xviii	Product assembly		xxx					xxx
xix	Packaging		xxx					xxx
xx	Stores		xxx				Xxx	xxx
xxi	Marketing and distribution		xxx	xxx				xxx
xxii	After-sale services	xxx	xxx					xxx
	Total	xxx	xxx	xxx	xxx	xxx	Xxx	xxx

Source: Prepared by the researcher.

Table 3 shows that the costs of value stream in the Power structured factory include a set of elements: costs of materials wage, outside processes, facilities, support as well as monuments. These can be illustrated by the following:

First: Costs of Materials

The cost of the actual raw materials used in the Power structured factory during the year of research is 601,004,000 dinar. After applying the Lean Accounting, the cost of these materials will be 588,569,000 dinar. This means that there are cost savings of 12,435,000 dinar during the year. This results from the downsizing of production processes in addition to the use of cheaper but higher quality raw materials than the materials currently used in the Factory. The costs of the materials can be explained before and after the application of Lean Accounting through the following table:

Table 4. Costs of materials before and after applying the Lean Accounting of 2017

S	Details	Costs of materials before applying the Lean Accounting	Costs of materials after applying the Lean Accounting	Difference Decrease (increase)	Fields of costs decrease or increase
I	Product structure cell	48,338,000	57,998,000	(9,660,000)	Use of higher quality materials
Ii	Magnetic circuit cell	72,126,000	84,675,000	(12,549,000)	Increase of number of components
Iii	Coils cell	36,062,000	64,882,000	(28,820,000)	Improvement of coils quality
Iv	Cables boxes cell	84,114,000	76,778,000	7,336,000	Downsizing of production processes
V	Push toggles	32,446,000	59,006,000	(26,560,000)	Use of more solid materials
Vi	Spiral pulleys cell	38,769,000	50,602,000	(11,833,000)	Increase of number of pulleys
vii	Heat measurement cell for the converter	90,715,000	39,653,000	51,062,000	Downsizing of production processes
viii	Oil pan cell	80,412,000	33,664,000	46,748,000	Downsizing of production processes
Ix	Oil level indicator cell	56,987,000	59,769,000	(2,782,000)	Use of higher quality materials
X	Pressure measurement valves cell	61,035,000	48,935,000	12,100,000	Downsizing of production processes
Xi	Materials for after-sale services	-	12,607,000	(12,607,000)	After-sale services
	Annual total	601,004,000	588,569,000	12,435,000	
	Monthly total	50,083,000	49,047,000	1,036,000	

Source: Prepared by the researcher

It is clear from the above table that the cost of some production cells has increased, such as product structure cell, magnetic circuit, coils, push toggles, spiral pulleys and oil level indicator. The higher cost of these cells is due to the use of higher quality materials or increased number of components, but concerning the other cells, we notice the reduction of their costs because of the downsizing of production processes and use of lower raw materials leading to the same jobs required by the client, so the cost of materials is reduced to 588,569,000 dinar i.e. achievement of cost savings of 12,435,000 dinar per year and savings of 1,036,000 dinar per month.

Second: Costs of Labor:

The actual direct wages amounted to 502,622,000 dinar during the research year, equivalent to 41,885,000 dinar per month. The number of workers in the Factory reached 80 workers. When applying the Lean Accounting, it is possible to reduce the number of worker and the answer to this question is either to open new production lines in the Factory and to utilization from their capacities, or to be transferred to other Factories in the company, and we can clarify the number of workers proposed for the value stream in the Power structured factories and their cost under the Lean Accounting through the following table:

Table 5. Number of the employees proposed for the value stream in the Power structured factories and their cost under the Lean Accounting

S	Details	Number of workers	Cost (Dinar)
i	Value stream manager	1	14,455,000
ii	Value stream manager assistant	1	12,715,000
iii	Secretariat	2	13,674,000
iv	Receiving the client's request	1	9,856,000
v	Planning for production	2	23,426,000
vi	Purchase of raw materials	3	29,988,000
vii	Disbursement of raw materials for production	3	27,534,000
viii	Product structure cell	4	25,038,000
ix	Magnetic circuit cell	5	30,335,000
x	Coils cell	3	24,388,000
xi	Cables boxes cell	5	32,997,000
xii	Push toggle cell	4	24,099,000
xiii	Spiral pulleys cell	3	22,315,000
xiv	Heat measurement cell for the converter	2	12,622,000
xv	Oil pan cell	3	19,445,000
xvi	Oil level indicator cell	3	22,624,000
xvii	Pressure measurement valves cell	2	14,677,000
xviii	Product assembly	3	18,776,000
xix	Packaging	2	11,213,000
xx	Stores	4	20,786,000
xxi	Marketing and distribution	4	21,543,000
xxii	After-sale services	2	13,562,000
	Annual total	62	445,068,000

Source: Prepared by the researcher

The table above shows the number of employees required in the power structured factory when applying the Lean Accounting. The number of employees reached 62 workers at a cost of 445,068,000 dinar per year and the cost of 37,089,000 dinar per month after the direct wages were 502,622,000 dinar annually and 41,885,000 dinar per month. Wages are in the amount of 57,554,000 dinar annually and the amount of 4796000 dinar per month.

Third: Costs of Outside Processes:

The costs of outside processes are related to individuals outside the value stream whose stream is derived from their services. These are represented in the marketing and administrative costs that are charged to the stream according to the rate of utilization, and the share of the value stream of the Power structured factory manufacturer from external operations costs amounted to 24,508,000 dinar.

Fourth: Costs of Facilities:

The cost of the facilities is related to depreciations, rents, maintenance, security and protection services in addition to public utility costs. These costs are allocated to the value stream

of the power structured factory in question according to the percentage of utilization. The total costs of the facilities are 27,073,000 dinar. They are allocated to the production cells in the power structured factory as follows: Product Structure Cell 3,518,000 dinar, Magnetic Circuit Cell 2,667,000 dinar, Coils cell 2,422,000 dinar, Cable Boxes Cell 4,546,000 dinar, Push Toggle Cell 3,988,000 dinar, Spiral Pulleys Cell 3,112,000 dinar, Heat Measurement Cell for the converter 1,203,000 dinar, Oil Pan Cell 2,005,000 dinar, Oil Level Indicator Cell 1,904,000 dinar, Pressure Measurement Valves Cell 1,708,000 dinar.

Fifth: Costs of Support:

The support costs are related to equipment, spare parts, office equipment and miscellaneous costs incurred during the period. These costs are allocated according to the utilization of the value stream. The total support costs were set at 15,750,000 dirham, distributed to the production cells as follows: Product Structure Cell 1,728,000 dinar, Magnetic Circuit Cell 1,415,000 dinar, Coils cell 1,233,000 dinar, Cable Boxes Cell 2,503,000 dinar, Push Toggle Cell 1,879,000 dinar, Spiral Pulleys Cell 1,677,000 dinar, Heat Measurement Cell for the converter 1,104,000 dinar, Oil Pan Cell 1,235,000 dinar, Oil Level Indicator Cell 1,654,000 dinar, Pressure Measurement Valves Cell 1,322,000 dinar.

Sixth: Monuments:

The cost of monuments is related to the large warehouses used in the Factory which are used for more than one value stream. The share of the value stream of these costs is determined on the basis of a percentage according to the rate of utilization. The share of the value stream of the power structured factory during the year of research was 20,786,000 dinar.

Accordingly, we can clarify costs of value stream under the Lean Accounting through the following table:

Table 6. Costs of value stream in the power structured factory under the Lean Accounting of 2017

S	Details	Costs of materials	Costs of wages	Costs of outside processes	Costs of facilities	Costs of support	Monuments	Total cost
i	Value stream manager		14,455,000					14,455,000
ii	Value stream manager assistant		12,715,000					12,715,000
iii	Secretariat		13,674,000					13,674,000
iv	Receiving the client's request		9,856,000					9,856,000
v	Planning for production		23,426,000					23,426,000
vi	Purchase of raw materials		29,988,000					29,988,000
vii	Disbursement of raw materials for production		27,534,000					27,534,000
viii	Product structure cell	57,998,000	25,038,000		3,518,000	1,728,000		882,282,000
ix	Magnetic circuit cell	84,675,000	30,335,000		2,667,000	1,415,000		119,092,000
x	Coils cell	64,882,000	24,388,000		2,422,000	1,233,000		92,925,000
xi	Cables boxes cell	76,778,000	32,997,000		4,546,000	2,503,000		116,824,000
xii	Push toggle cell	59,006,000	24,099,000		3,988,000	1,879,000		88,972,000
xiii	Spiral pulleys cell	50,602,000	22,315,000		3,112,000	1,677,000		77,706,000
xiv	Heat measurement cell for the converter	39,653,000	12,622,000		1,203,000	1,104,000		54,582,000

xv	Oil pan cell	33,664,000	19,445,000		2,005,000	1,235,000		56,349,000
xvi	Oil level indicator cell	59,769,000	22,624,000		1,904,000	1,654,000		85,951,000
xvii	Pressure measurement valves cell	48,935,000	14,677,000		1,708,000	1,322,000		66,642,000
xviii	Product assembly		18,776,000					18,776,000
xix	Packaging		11,213,000					11,213,000
xx	Stores		20,786,000				34,678,000	55,464,000
xxi	Marketing and distribution		21,543,000	24,508,000				46,051,000
xxii	After-sale services	12,607,000	13,562,000					26,169,000
	Annual total	588,569,000	445,068,000	24,508,000	27,073,000	15,750,000	34,678,000	1,135,646,000

Source: Prepared by the researcher

Table 6 shows that the total value of the value stream during the year was 1,135,646,000 dinar equivalent to 94,637,000 dinar per month. During this year, the number of units produced (power structured factories) was 68 units, which means that the cost of the unit produced under the Lean Accounting during the year of research, will be 16,700,676 dinar (1,135,646,000 ÷68) after the cost per unit was 17,917,235 dinar, which indicates a reduction in the cost of the product of 1,216,559 dinar.

4.3. Role of Measuring the Costs of Value Stream in Cost Measurement in Al-Zawraa General Company

After measuring the cost of value stream using the tools of Lean Accounting in Al-Zawraa General Company/Power structured factory, the role of this measurement will be explained in the cost management and reduction. Before showing this role, the income statement will be prepared for the value stream under the Lean Accounting, as shown in the following table:

Table 7. Income statement for the value stream in the Power Structured Factory under the Lean Accounting of 2017

Details	Amount in dinar (Partial)	Amount in dinar (Total)	Percentage to sales revenue
Sales revenue (18,000,000)		1,224,000,000	100%
Less: Costs of value stream			
Costs of materials	588,569,000		48.8%
Costs of wages	445,068,000		36.36%
Costs of outside processes	24,508,000		2.01%
Costs of facilities	27,073,000		2.21%
Costs of support	15,750,000		1.29%
Monuments	34,678,000		2.83%
Total costs of value stream		(1,135,646,000)	92.78%
Net profit (loss)		88,354,000	7.22%

Source: Prepared by the researcher

i. It is clear from the above table that the sales revenue during the year of research was 1,224,000,000, or the total cost of the value stream was 1,135,646,000 dinar, thus the net profit would be 88,354,000 dinar. The percentage of each element of

the costs of value stream to sales revenue was 48.08$, 36.36%, 2.01%, 2.21%, 1.29% and 2.83% respectively, i.e. the percentage of the costs of value stream to sales revenue was 92.78%, but the percentage of net profit to sale revenue was 7.22%. The income statement can be explained for the value stream before and after the application of the tools of Lean Accounting, as shown in the following table:

Table 8. Statement of income for the stream of value in the Power Structured Factory before and after the application of the tools of Lean Accounting of 2017

Details	Before the application of Lean Accounting	After the application of Lean Accounting	Difference
Sales revenue of Power Structured Factory	1,224,000,000	1,224,000,000	-
Total costs of Power Structured Factory	(1,218,372,000)	(1,135,646,000)	82,726,000
Net profit of Power Structured Factory	5,628,000	88,354,000	82,726,000
Percentage of net profit to sales revenue	0.46%	7.22%	6.76%

Source: Prepared by the researcher

ii. It is noted in Table (8) that the total cost of the Power Structured Facory was before the application of the Lean Accounting of 1,218,372,000 dinar. After the application of the lean accounting, the costs decreased to 1,135,646,000 dinar, indicating that the costs were saved by 82,726,000 dinar. The net profit before the application of the Lean Accounting amounted to 5,628,000 dinar, which is equivalent to 0.46% of the sales revenue. After applying the Lean Accounting, the net profit will be 88,354,000 dinar, equivalent to 7.22% of the sales revenue. So, the increase in the net profit will be 82,726,000 dinar, thus the increase of the percentage of net profit to sales revenue will reach 6.76%.

5. Fourth topic: Conclusions and recommendations

5.1. Conclusions

iii. In terms of importance, the supply chain management has the highest degree of performance measurement, and then the agility, reliability, accountability, flexibility and cost criteria are important, respectively. Getting strategic decisions in supply chain management is a framework that needs a framework to meet industry standards. If the model is not appropriate in this regard, supply chain management cannot provide appropriate factors for the proper assessment of its activities.

iv. Costs of value stream are the costs associated with the value-added activities or resources of the economic unit and the client from R & D to client service, and the calculation of these costs requires dividing the economic unit into a set of value streams directed towards a specific objective.

v. Lean Accounting is a set of tools, methods and skills through which processes of continuous improvement, performance measurement, cost reduction, and disposal of losses can be carried out in a manner consistent with the concept of lean thinking and efficient practices applied in the economic unit.

vi. Costs of value stream can be measured using Lean Accounting tools by dividing the economic unit into value streams, then dividing each stream into business cells, and then calculating the cost of the value stream in relation to the cost of materials, wages, outside processes, facilities, support and monuments.

vii. There is a possibility of using the flexible accounting tools to measure and manage the costs of value stream in Al-Zawraa General Company/Power structured factory. A number of results have been achieved, as follows:

viii. The actual cost of the Factory's products reached 1,218,372,000 dinar during the year 2017.

ix. The cost of the value stream was measured using the flexible accounting tools. The total cost during the year of research reached 1,135,646,000 dinar. The number of units produced during this year was 68 units. This means that the unit cost will be 16,700,676 dinar, or 17917235 dinar. This refers to the cost reduction of the product is 1,216,559 dinar.

x. The net profit realized before the application of prudential accounting was 5,628,000 which is equivalent to 0.46% of the sales revenue. After applying the lean accounting, the amount became 88,354,000 dinar which is equivalent to

7.22% of the sales revenue. The increase in net profit will be 82,726,000 dinar, so the percentage of net profits to sales revenue will increase to reach 6.76%.

5.2. Recommendations

xi. The development of cost systems in a manner that is compatible with the requirements of the contemporary manufacturing environment and the use of modern methods and methods, the most important of which are tools of Lean Accounting that help to measure the cost of value stream in a way that helps economic units to manage and reduce costs.

xii. Application of the tools, methods and skills of Lean Accounting in order to continuously improve processes and products, measure performance, reduce unexplained costs and eliminate losses in line with the concept of lean thinking and lean practices.

xiii. Using tools of Lean Accounting to measure the costs of value stream and to divide the economic unit into value streams involving a set of (Production) cells, and then calculate the cost of value stream in relation to the cost of materials, wages, outside processes, facilities, support and monuments.

xiv. Al-Zawraa General Company in general the Power Structured Factory in particular have relied on the data of this research, following the specific methodology and initial steps to use the tools of Lean Accounting to measure the costs of the value stream in such a way as to help reduce costs effectively and efficiently.

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