

# The Role of Value Stream Costing in Reducing Product Costs: An Empirical Study

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Economic units have begun to realise an important fact. Traditional cost accounting systems may not be consistent with the administrative tools and techniques produced by lean thinking, a concept that economic units are trying to apply. This research explains the theoretical foundations of value stream technology, and the most prominent lean accounting techniques. It distinguishes activities that add value from those that do not, to exclude the latter. It is hypothesised that the application of value stream technology reduces costs, and enhances the perceived value of the customer. This study shows that the value stream cost approach deals with a specific number of value streams, unlike traditional cost systems that deal with a large number of products. Consequently, the volume of planning, preparing, measuring and controlling costs is less than the value of current costs.

**Key words:** *Lean thinking, lean accounting, value stream costing.*

## Introduction

The business environment is constantly changing. Also, competition between economic units is increasing. In light of this and the diversity of customer needs, traditional calculations of costs have become unable to meet the needs of decision makers, in providing appropriate and timely information. Consequently, the high costs of production and the weak management of resources efficiently and waste at the time, which necessitated facing this competition through modern and strategic methods, adopt the concept of rational thinking or what is known as lean accounting (Almusawi, Almagtome, & Shaker, 2019; Ali, Almagtome, & Hameedi, 2019). The value stream is one of its main tools. It represents the group of operations carried out by the economic unit, to meet customer need by reducing cost without compromising product quality. The adoption of the concept of good thinking, and the accompanying appearance of good or lean accounting that operates according to the value streams approach, is the result of several

introductions (Kbelah, Almusawi, & Almagtome, 2019). On the one hand, global markets have recently witnessed intense competition between economic units, in light of continuous environmental changes; on the other hand, the emergence of modern and strategic technologies in managerial accounting, cost accounting and changing customer tastes have contributed to the emergence of this management technology (Ali, Hameedi, & Almagtome, 2019; Almagtome, Shaker, Al-Fatlawi, & Bekheet, 2019). All of these changes have had a major impact on accounting. This makes traditional accounting methods, especially in cost accounting and management, obsolete. New accounting techniques and methods are required, to inform processes appropriately, achieve a rapid flow of products, reduce costs, and optimise the use of available resources for business units. Hence the need to achieve competitive advantage and keep abreast of developments and changes in competing markets.

## Literature Review

Economic units are beginning to realise that traditional cost accounting systems may not be consistent with the modern management techniques produced by lean thinking. The new concepts including lean accounting techniques. Economic units try to apply them, to meet customer desires for a product with a low cost, high quality and speed, when responding to the customer to advantage competitiveness and market survival. Horngren, Datar, and Rajan (2018) define Lean Accounting as a cost calculation that focus on value streams, not on the basis of products or divisions; creating customer value by eliminating waste in production (Horngren et al., 2018). Lean Accounting has also been defined as concepts designed to reflect financial performance which is better than the economic unit that implements those concepts in industrial processes, to obtain lean and loss-free production. According to Maskell, Baggaley, and Grasso (2011) Lean Accounting has two aspects:

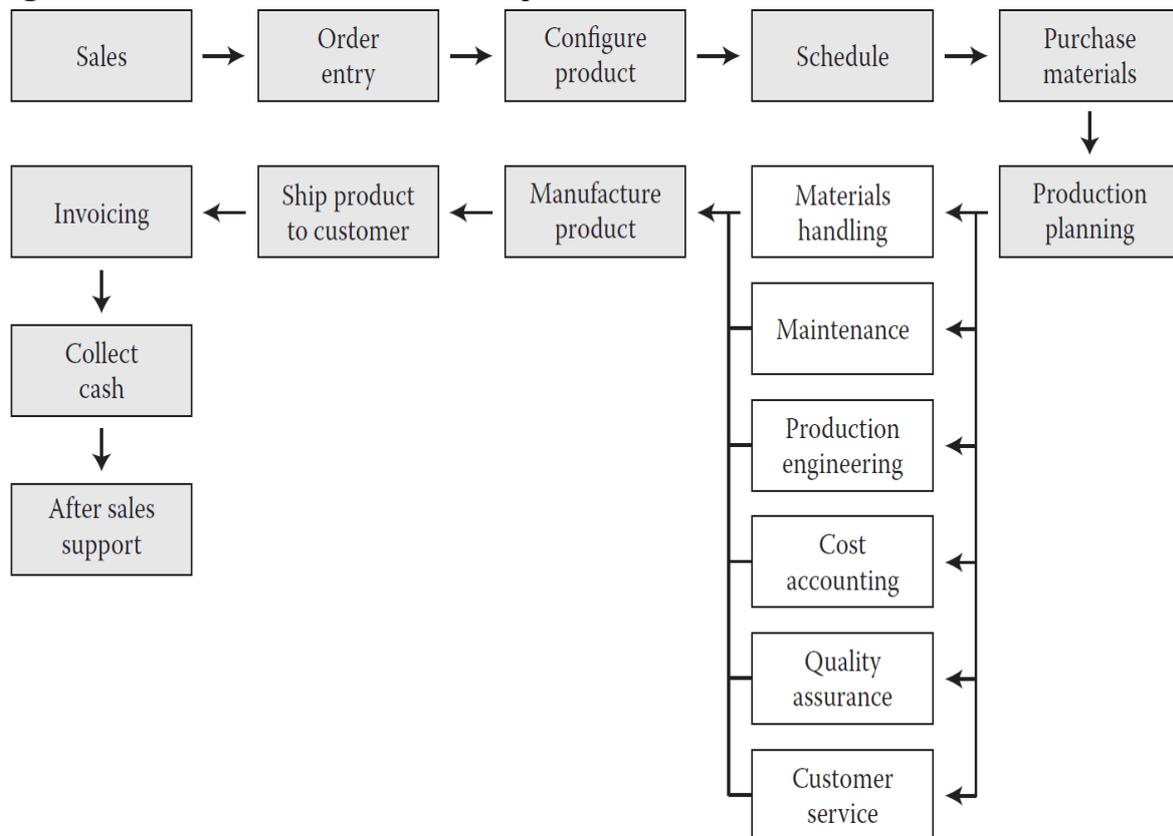
- The first refers to the application of lean concepts in accounting and controls, and in the measurement process, to reduce loss, accelerate procedures, remove errors and make procedures clear and understandable.
- The second refers to fundamentally changing traditional accounting, control and measurement systems, and achieving lean concepts, to be more appropriate to lean environments, in a manner that facilitates appropriate information for decision-making.

Therefore, Lean Accounting supports adding customer value, by calculating the total cost of the value stream but not the cost of a particular product or department, thus eliminating all production waste and informing control and decision-making. The term "value stream" was first used in the book *The Machine That Changed the World* (1990) by Womack and Jones (1997), as discussed by *Lean Thinking*. Martin and Osterling (2014) believe that the value stream is the sequence carried out by the economic unit to meet customer demand. The value stream represents all activities necessary to reach the desired customer value. It includes

obtaining customer requests, production, warehousing, delivery and supply activities (Carmignani, 2017; Henrique, Rentes, Godinho Filho, & Esposto, 2016; Al-Wattar, Almagtome, & Al-Shafeay, 2019). The value stream is the sequence required to design, produce and deliver a good or service to a customer, and includes the dual flows of information and materials (Li, 2014). Therefore, a value stream provides the product or service a customer desires. Steps that do not add value, represent losses, or are not wanted by the customer, do not form part of the value stream. The determination of value streams, and the processes involved in each stream, are difficulties in shifting towards this approach. In general, there are three value streams:

- 1- The value stream to supply customers' requests: One of the most important and most common types of value streams, it provides current products to existing customers. It includes the receipt, transportation, and transfer of raw materials, from the moment the customer's order is received, until the moment the product is ready for delivery to the customer (Hansen, Mowen, & Guan, 2007). Figure 1 shows the value stream for processing customer orders.

**Figure 1.** Value stream of customer's request



**Source:** Maskell, et al., (2011). “Practical Lean Accounting: A Proven System for Measuring and Managing the Lean Enterprise”, 2nd ed, 2011: 123).

In Figure (1), the value stream to process the customer's request represents all the activities necessary to supply the customer with goods and services, starting from receipt of the order and ending with after-sales services.

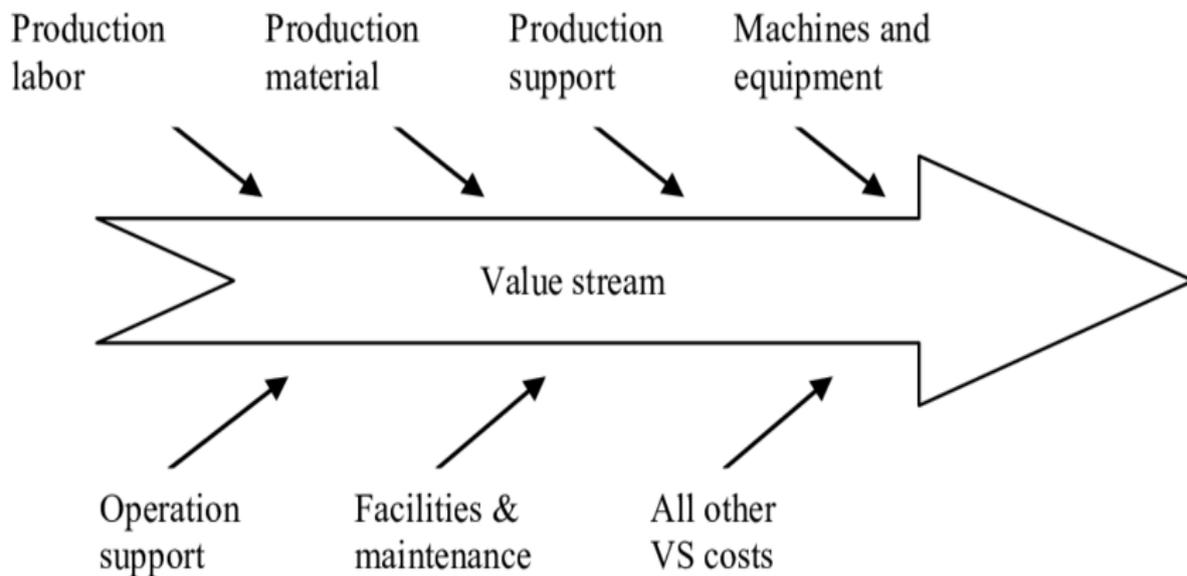
- 2- The value stream for developing new products: It focuses on producing new products for new customers, and requirements in the search for marketers, new designers and engineers for production processes.
- 3- Sales and marketing value stream: It focuses on acquiring new customers for existing products, and on the acquisition of existing customers for new products.

The value stream method, if applied, achieves several benefits for economic units, including the following:

- Improves product quality and increasing customer value and on-time deliveries.
- Provides correct, understandable, easy and timely financial information.
- Financially measures the elements of the process that affect the cost, and visually shows how cost is generated throughout the process.
- Helps reduce losses, rationalise cost, increase productivity and increase flexibility.

The use of costs of value streams began when lean manufacturing companies started to mature. That is because it reduces loss, by providing relevant, timely information to the value stream team. It is simple and everyone can understand where the financial information came from and what it means. It does not require complicated tracking of information. All financial data and reporting of each value stream are available, not merely for each production or product job contrary to standard costs, and value stream reports are submitted every week using the most recent cost information. All costs in the value stream are taken into account, when calculating the value stream. No direct or indirect costs are distinguished, because all costs in the value stream are direct costs. Costs outside the value stream are not included in the costs of the value stream (Gunduz & Fahmi Naser, 2017). Whereas, the costs that must flow in the value stream are those that create value only, while costs that do not add value should be excluded (Meudt, Metternich, & Abele, 2017). The costs of the value stream bridge the financial and operational aspects of the lean approach, which facilitates the transfer of information to management (Gracanin, Buchmeister, & Lalic, 2013). The costs of the value stream include all the costs of works, machinery, materials, support services, facilities, etc during a certain period, which are allocated on the basis of the value stream and not on the basis of products (Lacerda, Xambre, & Alvelos, 2016; Cesaroni & Sentuti, 2014) . Figure 2 shows the components of the total cost of the value stream.

**Figure 2.** Value Stream Costing



**Source:** Maskell, et al., (2011). “Practical Lean Accounting” A Proven System for Measuring and Managing the Lean Enterprise, 2nd ed, 2011: 177).

In addition, the costs of the value stream include the following: -

- 1) **Material costs:** They are generally calculated from the amount of materials purchased for the value stream during the week. Each time you bring materials into the economic unit, the costs are assigned to the value stream. The total cost of the materials stream value is the sum of everything purchased during the week. These costs must include raw materials, and under-manufactured production stock must be low and under good control. If the stock is low then the materials purchased during the week will be used quickly, and will accurately reflect the cost of materials for manufactured products during the week.
- 2) **Staff wages costs:** They are the sum of wages and employee benefits paid to people working in the value stream. The productive work includes all employees working in the value stream regardless of the type of work done such as production planning, customer services, marketing and sales, product design, quality assurance, material transportation, maintenance, and so on.
- 3) **Support or (supportive) costs:** These include spare parts, soft tools and other materials purchased for the value stream, using a credit card. Therefore, costs will be allocated directly to the profit centre, for the costs of the value stream. As for the costs of consumables, supplies and other similar daily expenses, their allocation to the value stream is usually based on physical area. This is to motivate the members of the value stream team to reduce the area used the value stream.
- 4) **Machinery and equipment costs:** These include the depreciation expenses of the machines in the value stream, in addition to maintenance costs such as spare parts, repairs and

supplies. The depreciation expense can be calculated from the fixed assets of the economic unit.

- 5) Facilities and maintenance costs: They are represented in the costs related to the use of the area such as expenses or rent, heating, electricity, security, building maintenance, insurance, etc; the only indirect costs that can be divided regularly between value streams using an appropriate basis. Generally they are allocated. These costs are based on the occupied square foot of each value stream, taking into account not only the area of the production area, but also the warehouses and offices of the employees working directly in the service of value streams.
- 6) Operations Support costs: These are called support costs or operations outside the value stream. They serve the plant as a whole and are difficult to load directly on the value currents. Therefore, they are not considered part of a series of streams value operations. So, they appear separately in the list of income value streams and include costs from administration, facilities, financial management, support personnel, information technology and human resources personnel not directly related to value streams. These costs need not be downloaded on value streams. Where reported and monitored separately, these costs are dealt with separately in a column of the Value Stream Income Statement, in order not to affect the accuracy of the TAI information.
- 7) Other costs: Includes costs such as office supplies, tools, equipment, travel costs, and daily direct costs allocated by the value stream. Product cost is calculated by dividing the total costs of the value stream by the number of units shipped, not produced.

In addition, the application of value stream costs is characterised by the following advantages:

1. Providing useful and accurate information. The costs of the value stream are the alternative that meets the needs of lean manufacturing units, and provide an opportunity to eliminate many transactions associated with the accounting of conventional costs (Timm, 2015: 49).
2. Achieving fairness in evaluating the performance of value streams. It carries each value stream with its actual costs, and almost completely eliminates indirect cost allocations.
3. Grouping products with similar characteristics together in one value stream. This reduces the volume of transactions, where large numbers of products are grouped in a small number of value streams. Planning, evaluating and monitoring performance are simplified, as are the processes of controlling materials, inventory and workers, measuring costs, and organising the structure of workers in the economic unit.
4. Costing the value stream, and thereby highlighting the areas of losses and opportunities for managing resources more efficiently, thus helping the search for the root causes of waste, and working to get rid of them.

On the other hand, there are many criticisms of the application of costs of the value stream.

They can be summarised as follows:

- Applying the value stream cost method accurately measures costs at the level of value streams, but it provides approximate estimates to measure the cost of each product in the value stream, which may negatively affect the decision-making process.
- The shift towards adopting a value stream method requires intellectual and cultural changes at the level of all members of the economic unit, which requires effort, time and costs such as that of seeking the help of experts, the costs of training employees, and others.
- Auxiliary costs are presented in a separate column outside the value streams. Decisions depend on the information of the value streams. This means that these decisions do not take into account the costs of the bonds, which may expose the economic unit to losses.

## Methodology

The research aims to explain the theoretical foundations of value stream technology. It also distinguishes between activities that add value, and those that do not, to exclude the latter. Accordingly, the study adopts a quantitative approach. It applies value path cost accounting in the General Company for the automobile industry. The State Company for Automotive Industry was established in 1976, according to the provisions of paragraph 2 of Article 4 of the Public Institutions Law of the Ministry of Industry and Minerals, number (90), and the decision of the Advisory Council for Manufacturing Affairs number (20) for the year 1976. It was previously a directorate affiliated to the General Company for Mechanical Industries, and according to Articles (21, 43) of the Public Companies Law No. 22 of 1997 was considered a public company under the name (General Company for the Automotive Industry). After that, the General Company for the Automotive and Equipment Industry was formed on 10/8/2015 after merging three companies (the General Company for the Automotive Industry, the General Company for Mechanical Industries, the General Company for Battery Industry). The Company is one of the subsidiaries of the Ministry of Industry and Minerals, and currently specialises in engineering industries, in most of its industrial activities. The capital of the company is estimated at (4,095,665,000) four billion, ninety-five million, six hundred and sixty-five thousand Iraqi dinars. To achieve the aims of the research, a basic hypothesis has been formulated that (*the application of value stream technology contributes to reducing costs and enhancing the perceived value of the customer*).

## Results

To apply the value stream to the reality of the lesson, five basic steps will be taken:

- The first step / defining value stream activities.
- The second step / value stream cost analysis.

- The third step / calculating the cost of raw, auxiliary and supplementary materials according to market prices.
- The fourth step / calculating the total cost of the product according to the value stream.
- The fifth step / achieving competitive advantage. Each of the previous steps will be clarified as follows: -

### Step 1: Defining Value Stream Activities

The product was identified and its details seen through interviews with the administrators, engineers, and technicians involved in manufacturing the product. Value stream activities were then identified. They were divided into (15) activities. Each performs a specific purpose or activity, as the schedule (1) shows:

**Table 1:** Value stream activities

<b>Productive activities</b>	<b>Production service activities</b>	<b>Marketing activities</b>	<b>Administrative activities</b>
Hammering and compressions	Training	Marketing activity	Financial and supervisory activities
Turning	Quality control		Legal activities
Welding	Design		Administrative activities
Dye and galvanisation	Research and development		
Assembly and readiness	Stores		
	Maintenance		

### Step 2: Analysis of the Value Current Costs

Following identification of the value stream activities, in this step, the costs of each value stream activity will be identified and analysed. These costs will be classified thus: -

- 1- Raw, auxiliary and supplementary materials.
- 2- Salaries and wages.
- 3- Commodity supplies.
- 4- Service supplies.
- 5- Extinction.
- 6- Other costs.

Interviews and inquiries were made by the researcher with both activities' officials and specialists in the company. This clarified the study sample and awareness of the actual needs of each activity, including workers, materials, and other types of costs, to better analyse costs. This analysis identifies any item of value-adding, and non-value-adding costs. It facilitates the exclusion of costs that do not add value, to then charge them in calculating profits and losses in the study sample company, and to not include it in the product cost. The following is an analysis of the value stream activities: -

**Table 2:** Cost analysis of value stream activities

Activity	Salaries and wages	Commodity supplies	Service supplies	Depreciation	Other	Total	Value added costs	Non-value-added costs
Hammering & compressions	298401881	119815	7899884	176912	0	306598491	77553385	229045106
Turning	584317665	1408728	17237101	15423546	0	618387040.5	117086078	501300962.5
Welding	187383957	10859688	6455399	5794665	0	210493709	84175698	126318011
Dye and galvanisation	301959308	10166256	10933106	9159479	0	332218149	83537673	248680476
Assembly and readiness	362329330	4235615	12742232	7100106	0	386407283	92795923	293611360
Training	86124815	107547	2797317	1961838	0	90991518	59398269	31593249
Quality control	824772825	4967750	25820189	4444242	0	860005005	127297910	732707095
The design	191517114	4630821	4501749	(754911)	0	199894773	53784997	146109776
Research and development	225308771	157198	5637361	2063285	0	233166614	79905341	153261273
Stores	491164786	4188353	16955918	7996734	0	520305791	121236621	399069170
Maintenance	698600811	2926653	16994601	7675674	0	726197740	133303502	592894238
Marketing activity	387807915	4586695	108189011	4715899	0	505299520	109178631	396120889
Financial and supervisory activities	433258063	13832729	26918589	4572427	667000	479248809	157226082.9	322032726.1
Legal activities	434985745	9472702	20262796	5962379	0	470683692	131275890	339407802
Administrative activities	322789511	2784159	17876824	2814550	857000	347122044	82207668	264914376
Total	5830722497	74444709	301222077	79106825	1524000	6287020179	1509963669	4777066510

Table (2) shows that the costs of salary and wages accounts constitute the largest percentage, as they amounted to about 93% of the total costs. It was found that there are a large number of redundant workers and employees, which necessitated that the management dispense with them, through interviews and inquiries with the activity's company officials and specialists. Thus, the total costs that do not add value: (4,777,066,510) dinars, including salaries, wages for transporting workers, service requirements, and extinctions. In addition, there are costs that are

irreplaceable, being necessary for the purposes of the activity. Table 2 categorises total costs into costs adding value and non-adding costs.

**Step 3:** Calculate the cost of raw, auxiliary and supplementary materials

**Table 3:** The cost of raw, auxiliary and supplementary materials

Details	Measuring unit	Quantity	Market price	Total value
Raw materials: -				
Trapped	Kg	199	650	129350
Tubes	Kg	93	650	60450
Angle	Kg	14	650	9100
Castings	Kg	55	650	35,750
The total cost of raw materials		361	650	234650
Auxiliary and supplementary materials: -				
Welding wire	packet	1	3500	3500
Base dye	Litre	1	1000	1000
Final dye	Litre	1.45	2000	2900
Thinner	Litre	1	1000	1000
Screw + nuts				18000
The total cost of supplementary and auxiliary materials				26400
Total value				261050

The above table shows many differences in prices, between what is proven in the company pricing lists for the study sample, and the prevailing prices in the market at the time of the study, taking into account the level of quality, origin and other specifications.

**Step 4:** The Total Product Cost Under Value Stream Costing

Based on the data extracted in the previous steps, the total cost of the products can be calculated based on the value stream technology. Table (4) reveals the total cost of the product according to the value stream.

**Table 4:** The total product costs under value stream costing

#	Activity	Costs that add value	The percentage of the agricultural machinery line (*)	(*) Share of agricultural machinery line	The ratio of the digger plow (**)	(**) Share of the digger plow
1	Hammering and compressions	77553385	100%	77553385	0.0003683756	28569
2	Turning	117086078	100%	117086078	0.0003683756	43132
3	Welding	84175698	100%	84175698	0.0003683756	31008
4	Dye and galvanisation	83537673	100%	83537673	0.0003683756	30773
5	Assembly and readiness	92795923	100%	92795923	0.0003683756	34184
6	Training	59398269	0.1783810635	10595526	0.0003683756	3903
7	Quality control	127297910	0.1783810635	22707537	0.0003683756	8365
8	The design	53784997	0.1783810635	9594225	0.0003683756	3534
9	Research and development	79905341	0.1783810635	14253600	0.0003683756	5251
10	Stores	121236621	0.1783810635	21626317	0,0003683756	7967
11	Maintenance	133303502	0.1783810635	23778820	0.0003683756	8759
12	Marketing	109178631			0.0000182993	1998
13	Financial + control	157226082.9	0.13762	21637453.5	0.0003683756	7971
14	Administrative	131275890	0.13762	18066188	0.0003683756	6655
15	Legal	82207668	0.13762	11313419	0.0003683756	4168
	The total cost of value stream activities					226237
	The cost of raw materials					234650
	The cost of supplementary and auxiliary materials					26400
	The total cost of the product according to the value stream					487287

Table (4) shows that the total cost of the product has reached (487,287) dinars. Thus, the cost of the product has decreased by (59,463) dinars, compared to what was in the research sample

company where the cost of the product was (546,750) dinars. This is due to excluding costs that do not add value and are not included in the cost of the product. It is a good indication that its effects on the price of the product will be reflected, if it is calculated by the company in this way, which allows the company to achieve a profit margin of 20% after it was profit margin was certified at only 9%. That is in addition to providing the appropriate information that helps management take decisions. It is also to be noted that the company's product has specifications equivalent to those of competing companies, which reflects on the company's position in the market and an increase in its market share.

## **Conclusions**

The value stream costing method achieves fairness in assessing the performance of value streams. It carries each value stream with its own actual costs, and almost completely eliminates indirect cost allocations. Further, the value stream technology is one of the important lean production tools that helps determine which steps add value, and which do not. It also helps to determine the places and points of waste and loss in production processes, in a manner that helps to remove processes that do not add value. The value stream method significantly reduces product costs, due to the exclusion of activities that do not add value, from the customer's point of view. According to the value stream method, the total reduction in the cost of the product is (59,463) dinars, after excluding the costs that do not add value, as the cost of the product according to the value current reached (487,287) dinars. The calculation of product costs, according to the value stream, reduces the cost of the product and then its selling price. It also informs decision-making by management. In addition, workers, especially in the costs division, are introduced to training courses about modern accounting techniques and methods that apply the concept of agility. Finally, it spreads the culture of aggravation among workers, and introduces them to lean accounting and its techniques, because of the advantages provided in rationalizing resource use, limiting activities that are not adding to value and excluding losses in all their forms.

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