



# THE EFFECT OF RATIONING THE PRODUCTION COSTS ON ENHANCING PROCESS DESIGN TO ACHIEVE COMPETITIVE ADVANTAGE: AN APPLIED RESEARCH IN THE IRAQI MECHANICAL FACTORY OF CARPETS

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## Abstract:

This study intends to reduce production costs in order to improve the competitiveness of units operating in Iraqi environments by enhancing process design. The mechanical carpet factory was chosen as a case study, and the findings were applied to all units in the same setting. We will collaborate on rationing production costs by investigating processes using rationalization methods to determine where to start and what the best way is to improve the design of processes and their outputs in terms of performance level, price, quality, and customer's satisfaction in order to achieve the research goal. The study reached to a number of conclusions, the most notable one is of no value activities that drive up manufacturing costs. These actions are difficult to avoid unless processes are better designed, prices are reduced, and new technology is implemented.

**Keywords:** Rationing the Production Costs, Improvement of Process Design

## INTRODUCTION

As a result of fast environmental changes and technical advancement, as well as renewal and change in customers' needs, production units encounter obstacles. To stay up with these changes and maintain market share, it is vital to employ strategies that will safeguard the company long-term viability and improve its competitive position. As a result, the need of rationing the production costs to enhance process design and obtain competitive advantage has become a research challenge.

### 1-1 Research problem

The research problem can be summarized in the following questions:-

- 1- Does rationing the production costs improve process design?
- 2- Does improving the process design contribute to focusing on basic activities and excluding unnecessary activities and achieving competitive advantage?

### 1-2 Research objectives

The research aims to achieve the following:

- 1- Distinguishing between the concept of cost rationing and the concept of cost reduction and the reasons for adopting any of them.
- 2- Improving the design of production processes for the mechanical carpet industry.
- 3- Statement of the contribution of improving process design through rationing the production costs in achieving the competitive advantage of the Iraqi carpet factory.

### 1-3 Research Hypothesis

The research hypothesizes the following:

(Rationing the production costs improves the design of operations by eliminating sources of waste and loss from non-value adding activities and raising production efficiency, which contributes to achieving the competitive advantage of units operating in the Iraqi environment)

**1-4 Research Methodology**

The inductive strategy was used to complete the theoretical component of the study by using scientific literature connected to the topic, and the descriptive analytical approach was used to complete the practical aspect by collecting and analyzing data.

**1-5 Spatial and temporal limits of research**

The researcher based his findings on the application of the applied aspect to the financial and cost statements and reports of the mechanical carpet factory for the years 2019-2020.

**Previous studies**

- A- Amro, Dana (2009) "The link between design management and gaining a competitive advantage." It is a field study of a sample of Jordanian building and construction firms. The objective of study was to demonstrate the role of design management in attaining design originality and innovation as well as customer happiness. It revealed a statistically significant correlation among design systems and obtaining a competitive advantage of the company.
- B- Arar, Rasha (2013) "An exploratory research of a sample of consulting engineering businesses in the Greater Amman metropolis on the influence of architectural design quality on achieving competitive advantage. Its goal was to demonstrate the relevance of good architectural design and its ability to provide a competitive advantage. It was discovered that there is a statistical association between management and engineers' perspectives on interior space design in accomplishing the company research sample for competitive advantage.
- C- Jagrory, Ali (2015): "Using cost accounting in rationing the production costs in the economic institution". A case study in the unit of gypsum and its derivatives. The study by Awlad Jalal from Algeria, which aimed to show the extent of the growth of the role and importance of cost accounting systems for the institution, and the extent of weakness of the existing systems currently serving the institution in light of a constantly changing environment. Furthermore, it was determined that Algerian institutions would be forced to adopt contemporary cost accounting systems as a means of rationalizing their production costs. It was determined that employing contemporary cost accounting procedures, which are more precise in assessing and rationalizing expenses and aid in the production of outcomes, was critical.

**2 THEORETICAL FRAMEWORK**

**2-1 Rationalization**

The term "rationing" expresses an ancient philosophy recently discovered and spread. The reasons for its spread are the weakness of the units traditional production systems to enhance their competitive position against foreign products. It aims to eliminate activities that do not add value, reduce the level of inventory, defective products and re-manufacturing costs while increasing production capacity (Al-Masharani, 2015: 20). It does not necessarily mean a reduction in spending rates per unit (Bin Marzouk, 2020:64)

On the contrary, the reduction, as the general meaning of it refers to the reduction of the total number of the amounts appearing in the financial and cost statements and statements. In this sense, it may not lead to a real cost reduction, but rather the opposite. For example, the reason for the decrease in cost may be due to the reduction in the quantities produced. This leads to its rise, not its decline (Al-Jabr, 1997: 187).

According to the researchers, rationing may be thought of as a technique that consists of a number of ways, each of which is chosen based on the status of the unit. It might be as simple as reorganizing your administrative organization without incurring any additional costs, or it could be as complex as bringing current technology to all manufacturing operations. This necessitates a cost rise in the medium and short term in order to minimize expenses afterwards by enhancing the quality of operations and outputs. As a result, the number of units produced and sold will increase, which will have an impact on costs and customer satisfaction, resulting in a competitive advantage.

**2-2 production costs**

Production is the primary function in industrial units, in addition to the function of marketing management, financial and human resources management. The production function consumes the largest part of the resources, as it plays an important role in achieving the competitive advantage of the unit by achieving the efficiency of the production processes, which represent the basic pillar of any production system. It represents the link between the unit and the customer, as it is the pillar of the unit aimed at achieving profits and excellence. (Erekat et al, 2012:32-33)

In the Iraqi economic units that apply the unified accounting system, production costs have been classified according to cost centers, as shown in the following disclosure:

Statement (1) Distribution of uses to cost centers

Cost Center Monitors					Usage items	
No.	Uses	Production (5)	Production services (6)	Marketing services (7)	Administrative services (8)	Capital services (9)
31	Salaries and wages	531	631	731	831	931
32	Commodity	532	632	732	832	932

	supplies					
33	Service supplies	533	633	733	833	933
34	Contracting and services	534	-	-	-	-
36	Land rent and interest	536	636	736	836	936
37	Absumptions	537	637	737	738	739
38	Transfer Expenses	538	-	-		-
39	Other expenses	-	-	-	839	-
Total						

Source: Financial Supervision Bureau, "The Unified Accounting System", second edition, 2011: 417  
 Statement No. (1) shows the diversity of cost elements and centers among production, service, marketing, administrative and capital cost centers. Therefore, the administration should not focus its attention on the costs that occur inside its factories only, represented by the production centers. This is a narrow focus, despite its importance, but it is only a part of the total costs, as there is another part of the costs that requires focus and attention, which is the marketing, administrative costs, and shipping products to customers. This is what modern cost accounting methods have focused on (Al-Batanoni, 2015: 249).

As for the reasons for the high production costs that need to be rationalized, they are as follows: (Nigel, et al, 2003: 140)

- 1- Wasting of production by producing larger quantities than the customers' needs.
- 2- Wasting of production processes as a result of the existence of activities and operations that do not add value and the obsolescence of machines.
- 3- Wasting in storage resulting from purchasing raw materials in quantities that exceed the production need, in addition to the stock of semi-manufactured and manufactured goods.
- 4- Time wastage resulting from the movement and movement of workers during unnecessary production processes that do not add value, as well as wasting time due to waiting for the next production stage, setting up machines, and sudden maintenance.
- 5- Waste during transportation, whether for raw materials inside the factory or during transportation of finished products, which may expose them to damage.
- 6- Wasting effort and costs as a result of correcting errors in production processes, and re-manufacturing products.
- 7- The waste of knowledge is caused by the failure to make optimal use of the intellectual capital.

**2-3 Methods used to rationalize the production costs:**

In order to improve production processes and their outputs, the units follow one or more methods of cost of rationing through which focus is placed on all their activities to achieve the greatest benefit at the lowest cost. They are as follows:

**1- Value chain analysis:** production costs are rationalized by studying and analyzing all value chain activities, as unnecessary activities and processes are identified and removed. Thus, this is reflected in reducing production costs while enhancing value-adding activities, which improves the efficiency of operations and improves the quality of products due to the quality of products, low prices, and customer's satisfaction. (Blocher, et, al., 2010: 12)

**2- Production on time:** It is based on the idea of production when there is an actual need, that is, it starts from the customers' requests ensuring the disposal of all goods as soon as production is completed. It is characterized by several advantages, including close coordination between work stations, facilitating the flow of goods, meeting customers' demands in a timely manner, high quality production and low cost. (Horngren et al, 2012:715) (Garrison, 2010)

**3- Six sigma:** a method aimed at continuous improvement in order to survive in a competitive environment.

**4- Process design:** It is the process of choosing the appropriate decision about the process flow path regarding converting raw materials into fully manufactured goods. The process design is accompanied by three decisions as follows: (Talib & Ghaly, 2019: 43)

- Determining and sequencing the activities.
- Determining the type of process used to convert inputs into outputs.
- Determining the type and nature of the machines needed for production.

**2-4 Competitive advantage:**

Competition is the behavior of a group of units that offer products, whose aim is to compete to win the largest share in the target market, where it seeks to attract the largest possible number of customers in its favor. This competition is embodied through the use of a group of methods such as improving the quality of products, the use of high technology, rationing the costs, good treatment of customers and others (Kunduz, 2015: 71).

**2-5 Characteristics of Competitive Advantage:**

The characteristics of the competitive advantage are as follows: (Buran, 2016: 31).

- 1- It stems from the customers’ needs and desires.
- 2- Actively contribute to achieving success and excellence through the optimal use of resources.
- 3- It works to achieve the appropriateness between the resources owned by the unit and the environmental opportunities.
- 4- Lead to building a basis for future improvements.
- 5- It is long-term and impossible to imitate by competitors.
- 6- It is derived from within the unit, and its effect is reflected on the efficiency of its performance of its activities, the value of what it provides, or both.

**2-6 Dimensions of competitive advantage**

**1- Cost dimension:**

Units that compete on cost must investigate and analyze their operations and activities carefully, exclude all losses, and work to raise their productivity level by investing in modern technology. (Jacobs & Chase, 2008:11)

**2- Time dimension:**

It means focusing on reducing the time and speed of designing new products and presenting them to customers in the shortest possible time. Delivery dimension is the basic basis for competition between economic units in the markets. The time dimension includes three aspects: the first is the speed of delivery, and the second aspect is the delivery at the agreed time. As for the third aspect, it is related to the speed of development, and is measured by the time required to design, produce and develop new goods or services (Mohsen and Al-Najjar, 2012: 59-60).

**3- Quality Dimension:**

The first two aspects include that the operations are designed to focus on a set of superior and unique characteristics, with high durability and reliability, while providing distinguished services to its customers. As for the second aspect, it is concerned with the stability of products, which measures the degree to which they meet the specifications and characteristics of specific designs. (Reid & Sanders , 2010 : 36 )

**Practical side**

First, the reality of production costs in the mechanical carpet factory will be presented through a statement of the distribution of uses to cost centers for the fiscal year ending on 31/12/2020, as follows:

Statement (2) partial disclosure of uses on cost centers for the year 2020

statement factory	No. & name of the account	Monitoring 5	Monitoring 6	Monitoring 7	Monitoring 8	Total monitoring costs
Mechanical carpets	31 salaries	1.070.800.285	892.053.002	-	-	1.962.853.287
	32 Merchandise	24.042.533	3.163.116	-	-	27,205,649
	33 service items	0	370.000	-	-	370.000
	37 extinction	27,019,037	5.594.515	-	-	32,613,552
	Total	1.121.861.855	901,180,633	-	-	2.023.042.488
Sales fairs	31 salaries	-	-	13.818.120	-	13.818.120
	Total	-	-	13.818.120	-	13.818.120
Administrative services	31 salaries	-	-	-	2.751.170.539	2.751.170.539
	32 Merchandise	-	-	-	13.813.845	13.813.845
	33 service items	-	-	-	93.141.097	93.141.097
	37 extinction	-	-	-	42.390.713	42.390.713
	39 previous years expenses	-	-	-	458.047.616	458.047.616
	Total	-	-	-	3.358.563.809	3.358.563.809

Source: Based on the costing division data for the year 2020

Statement No. (2) shows the costs of production control centers and production services for the carpet factory, as well as the total administrative centers represented by the public administration and marketing centers represented by sales fairs. As a result of the high production costs, the cost management reduces the cost per square meter of carpet by relying on different energy levels, as in Table No. (1) as follows:

Table No. (1) Energy levels and total expenses of the mechanical carpet factory for the period from 1/1 - 31/12/2020

Product Statement	Mechanical carpets			
	Expenses in dinar	Virtual (1230m <sup>2</sup> ) /dinars	Model (50000m <sup>2</sup> ) /dinars	Design (98000m <sup>2</sup> ) /dinars
Direct Expenses - Control 5	1.070.800.285	-	-	10.927
Direct Expenses - Control 6	892.053.002	-	-	9.103
Direct expenses - h 33	370.000	301	-	-
Standby	318.925	259	-	-
Other variable expenses	10.690.175	8.691		
Absumption	32.613.552	0	0	0
raw materials	-	15.012	-	14.537

Source: the statistics were based on the costing division data for the year 2020

Table No. (1) shows the energy levels of the carpet factory, which are represented by energy (virtual, model, and designed). In the event that the expenses are high, the costs division divides the design energy expenditure (98000 m<sup>2</sup>) to extract the square meter share, if higher. But in the event that the expenditure is low, the virtual energy (1230 m<sup>2</sup>) is used to measure the square meter share of carpets. Accordingly, the cost per square meter will be low compared to its real cost if the actual capacities were adopted as follows:

Table No. (2) The cost per square meter of mechanical carpets

Statement	Price by dinar
Direct Expenses - Control 5	10.927
Direct Expenses - Control 6	9.103
Direct expenses _ account 33	301
Standby	259
Other variable expenses	8.691
Absumption	0
Raw materials	15.012
Total	44,293

It should be highlighted that the cost per square meter of carpets was calculated incorrectly, since cost management used various energy levels to calculate the cost per square meter while zeroing the quantity of absumption. As a result, the researchers will calculate the real cost per square meter of carpets in the following paragraph to serve as a starting point for investigating the causes of high manufacturing costs:

Table No. (3) Energy levels and total expenses of the Iraqi mechanical carpet factory for the period from 1/1/2020 to 31/12/2020

Statement	Total cost in dinars	The cost of m <sup>2</sup> in dinars Production volume 1230 m <sup>2</sup>
Direct Expenses - Control 5	1.070.800.285	870.569
Direct Expenses - Control 6	892.053.002	725.246
Direct expenses _ account 33	370.000	301
Standby	318.925	259
Other variable expenses	10.690.175	8.691
Absumption	32.613.552	26.515
raw materials	16.196.547	13.168
<b>Total</b>	<b>2,023,042,486</b>	<b>1,644,749</b>

Source: The table is based on the costing division data for the year 2020

It is noted from Table No. (3) that the cost per square meter for the upper and lower carpets is (1,644,749) dinars. The cost per square meter amounts to (822,375) dinars. After the actual costs have been measured, the production processes will be presented according to their technological path to identify their activities and determine the reasons for their high costs as follows:

First activity: Engraving design: It includes several sub-activities as follows:

- 1- Buying a cartoon.
- 2- Initial perforation of the carton with the aim of stitching.

3- Perforating the inscription on the carton with a punching machine that depends on hardware programs. The technological path of the design activity can be shown as in Figure (1), as follows:

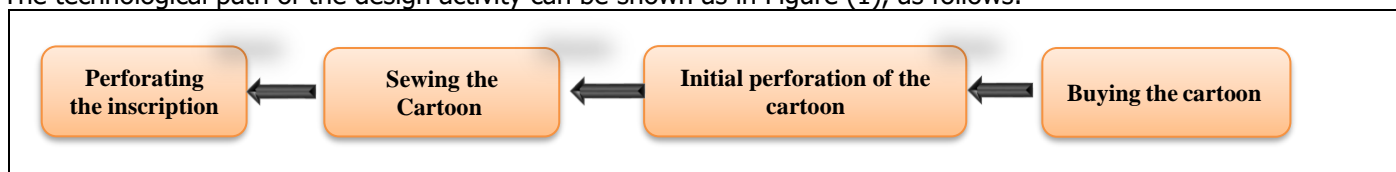


Figure (1) Technological path of design activity

Source: The scheme is prepared by the researchers depending on the field visit.

All activities shown in Figure (1) are non-added value. Table No. (4) shows its costs as follows:

Table No. (4) Determining the costs of the design activity

Activity completion time			Price by dinar	Statement
Sigma	Real	Regular		
2 months	6 months	4 months	0	Cartoon
			0	Yarning
			0	Hanging wire
			116.899.600	Salaries
			108.141.676	Tool Maintenance
			6.354.778	Absumption
			231,396,054	Total

It is noted from Table No. (4) the high costs of the activity and the long period of preparing the engraving, as it reaches (6) months. In order to reduce the cost, it is relied on designs that have been prepared for years and are of old designs that do not meet the tastes of customers, which causes an juxtaposing the production in stores.

**The second activity (preparations):** After receiving the production order, the large-sized spools are withdrawn from the stores, according to the type of yarn and the specified colors, and installed on the spinning machines to turn them into small spools that fit the design of the deliberate weaving machines. Table No. (5) shows its costs.

Table No. (5) The cost of the preparations activity

Quantity of Production per hour			Price in dinar	Cost
Sigma	Virtual	Regular		
2157.54 Kg	2.46 kg	kg 2160	15.983.782	Raw material
			112.223.616	Salaries
			9.011.806	Tool maintenance
			1.440.510	Fuel
			2.217.914	Absumption
			140,877,628	Total

It can be seen from Table No. (5) that the activity costs have risen despite being among the activities that is not added to the value, with a large deviation in the standard quantity of hourly production from the actual by (2157.54) kg / hour, which affects the production costs resulting from the delay in completing the activity. The cost of raw materials according to the financial statements for the year 2020 is (16,196,547) dinars. (212,765) dinars cost of gum latex.

**The third activity (mechanical weaving activity):** the outputs of the designs and preparation activities are the inputs of the textile activity. During the field visit to the lab, it was noted that its machines work with the mechanical Jacquard system, which takes engraving orders using the perforated carton. As for the process of sticking the weft, it is by means of the shuttle for the German machines or the reaper for the Belgian machines. In addition to the fact that changing the colors of the engraving is done manually by the workers. Table No. (6) shows its costs as follows:

Table No. (6) Textile Activity Costs

Machine productivity per hour			Price in dinar	Statement
Sigma	Virtual	Regular		
87.8 ²m	4.92 ²m	92.72 m²	331.994.864	Salaries
			32.731.888	boilers maintenance
			567.743.799	Tool maintenance
			775.659	Fuel
			12.951.166	Absumption
946.197.376	Total			

It is noted in Table No. (6) that the costs are high and the hourly productivity is low. If the design production quantity per hour is (92.72 m<sup>2</sup> / hour), while the actual production per hour is (4.92 m<sup>2</sup> / hour). That is, there is a negative sigma of (87.8) m<sup>2</sup> / hour.

**The fourth activity (setting and drying the back of the carpet):** It includes tying the production in the form of a production tape in preparation for passing it on a mixture of glue (latex) diluted with water. Figure (2) shows its sub-activities and agencies

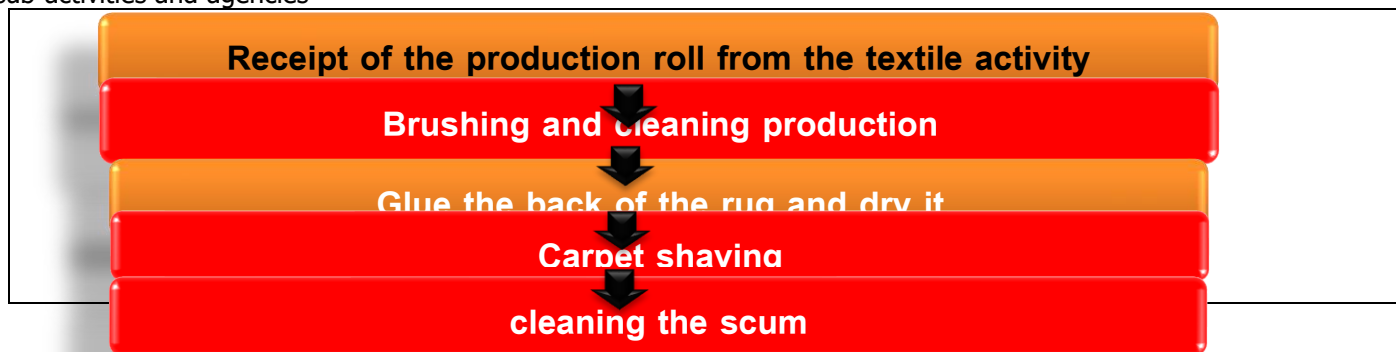


Figure (2) Sub-activities of the brushing activity

The activity of shaving the rugs is one of the activities that does not add to the top. It was found to avoid the defects of the weaving machines that result in the unevenness of the tufts of the rug. As for the brushing, it is done manually to rid the production of the clutter, and its cost can be measured as in Table No. (7)

Table No. (7) Determining the costs of the start-up activity

Sigma	Production per hour		Price in dinar	Statement
	Virtual	Designing		
26.11 m <sup>2</sup>	2.46 m <sup>2</sup>	28.57 m <sup>2</sup>	212.765	Latex glue
			116.899.600	Salaries
			207.271.546	Maintenance
			2.216.170	Fuel
			3.193.255	Absumption
			329,793.336	Total

It is noted from Table No. (7) that costs have increased with a negative deviation of 26.11 m<sup>2</sup> / hour, as a result of planning (7) working hours, but the actual (2) working hours as a maximum as a result of sudden stops. The cost of gum latex = (0.060 x 2,883 dinars x 1,230 m<sup>2</sup> = 212.765)

**Fifth activity (production cutting):** in which the roll is cut into the required measurements according to the design of the inscription. This activity is done manually, which results in problems due to inaccurate cutting.

Table No. (8) Determining production cut costs

Statement	Price in dinar
Salaries	28.055.904
Varieties	1.287.073
Total	29,342,977

It is noted that the cost of the activity increased, which amounted to (29,342,977) dinars. It is one of the non-added to the value activities.

**Activity Six (embroideries):** The side borders are embroidered, then sewed to the front and back of the rug. Table No. (9) shows the costs of my agencies

Table No. (9) Determining the costs of the embroideries and tools activities

Sigma	Production per hour		Price in dinar	Statement
	Virtual	Regular		
27.43 m <sup>2</sup>	28.57 m <sup>2</sup>	56 m <sup>2</sup>	46.759.840	Salaries
			9.011.806	Maintenance
			2.301.924	Absumption
			58,073,570	Total

Notes the low hourly productivity and high costs.

**The seventh activity (quality check):** It is done at the end of the production process. Table No. (10) includes the following costs:

Table No. (10) Determining the costs of the examination activity

Statement	Price in dinar
Salaries	42.083.805
<b>Total</b>	<b>42.083.805</b>

From Table No. (10) it is clear that its cost included the salaries and wages of the examiners only, as the examination is done by laying carpets on tables and inspecting it by the examiners and fixing their observations about it.

**The eighth activity: refurbishment:** in which the textile defects are repaired manually using a hook and yarn in colors according to the pattern of the carpet. Table No. (11) shows its costs as follows:

Table No. (11) Determining the costs of the refurbishment activity

Statement	Price in dinar
Salaries	140.279.520
Varieties	1.077.546
<b>Total</b>	<b>141,357,066</b>

It is noted that the costs of the refurbishment activity are high, although it is not added to the value.

**The ninth activity (packing, sealing and numbering):** The product label that includes the inclusion of the symbolic number, the product seal and the trademark are affixed, then the product is wrapped with perforated nylon bags.

Table No. (12) Determining the costs of numbering, packaging and transportation

Statement	Price in dinar
Packing and canning materials	420.456
Varieties	628.571
Salaries	102.871.648
<b>Total</b>	<b>103,920,675</b>

It is noted from Table No. (12) that its cost increased, as it amounted to (103,920,675) dinars. It was found that there are several activities that do not add value that affected the quality of the carpets and their high costs, starting with the mechanism approved by the designs, which resulted in the inability to dispose of the products because they do not meet the desires of customers in terms of the designs of their patterns, quality, price and time of display. The capabilities of modern technology are not available to enable it to respond quickly to the change in the tastes of customers. Thus, they accumulate their products and turn them into cost. This is what was confirmed by the financial statements and as in Table No. (13) as follows:

Table No. (13) Costs and items of inventory for a year

Statement	Cost in dinar		Variance rate
	2019	2020	
Complete production	6.766.434.368	5.938.844.945	(827,589,423)
Incomplete production	532.799.140	546.459.423	13,660,283
<b>Total</b>	<b>7.299.233.508</b>	<b>6,485,304,368</b>	<b>13,784,537,876</b>

It can be seen from Table No. (13) the significant increase in the costs of the complete and incomplete production inventory for the years 2020 and 2019. As for the reason for the decrease in the total production stock for the year 2020 compared to the year 2019 by (827,589,423) dinars. The administration donates part of the carpets to the state departments and incurs additional costs such as transportation and bedding costs. As for the inventory of incomplete production, it is noted that it increased for the year 2020 by (13,660,283), an increase from 2019. Accordingly, the activities can be classified in terms of adding or not adding it on the value, as shown in Table No. (14)

Table No. (14) Classification and Measurement of Activities Costs

Activity	Non-added to the value	Added to the value	Total cost of the activity
Designs	%80 185.116.843	%20 46.279.211	231,396,054
	Preparations	140,877,628	
Textiles	%20 189.239.475	%80 756.957.901	946.197.376
	Entrancing Brushing Shaving Cleaning	0	
%4 13.191.733		0	
%10 32.979.333		0	
%5		0	



	16,489,667		
Cutting	29,342,977	0	29,342,977
Embroidery and brocading	0	58,073,570	58,073,570
Checking	42,083,805	0	42,083,805
Refurbishment	141,357,066	0	141,357,066
Packing and numbering	0	103,920,675	103,920,675
Total	1,057,811,130	965,231,357	2,023,042,487

It is noted from Table No. (14) that there are several processes that affect the rise in production costs and the decrease in its quality. The total non-value-adding activities amounted to (1,057,811,130) dinars and (965,231,357) dinars for value-adding activities. The mechanism adopted by the plant to implement its operations makes it difficult to exclude non-added value activities except by working to improve the design of production processes by rationalizing production costs by introducing advanced technology. Accordingly, the following paragraph will include the costs of automating the laboratory environment, as in Table No. (15). Regarding the percentages in Table No. (14), they were determined through interviews with the specialized engineer.

Table No. (15) The cost of automating the work environment to rationalize production costs and improve process design

Statement	Price	Total cost
Investment cost:		
Machinery, equipment and spare tools, including the cost of training	8,633,000,000	
Mechanical and electrical equipment	55,000,000	
Adaptation and occupational safety	<u>140,000,000</u>	
total investment cost		<b>8,828,000,000</b>
Operational investment cost:		+
Industrial and civil services	40,000,000	
Variable and fixed costs	2,052,600,000	
		<b><u>2,092,600,000</u></b>
Administrative and marketing costs:		
Administrative costs 22%	246,809,608	+
Marketing costs 11%	<u>152,659,696</u>	
Total administrative and marketing costs	399,469,304	<b>399,469,304</b>
Total		<b><u>11,320,069,304</u></b>

Table No. (15) shows that management must first raise its costs in the medium term by (11,320,06934) dinars, necessary to automate the work environment, which will help it improve the design of its operations. The impact of rationalizing production costs on improving process design can be shown, as shown in Figure (3) as follows:

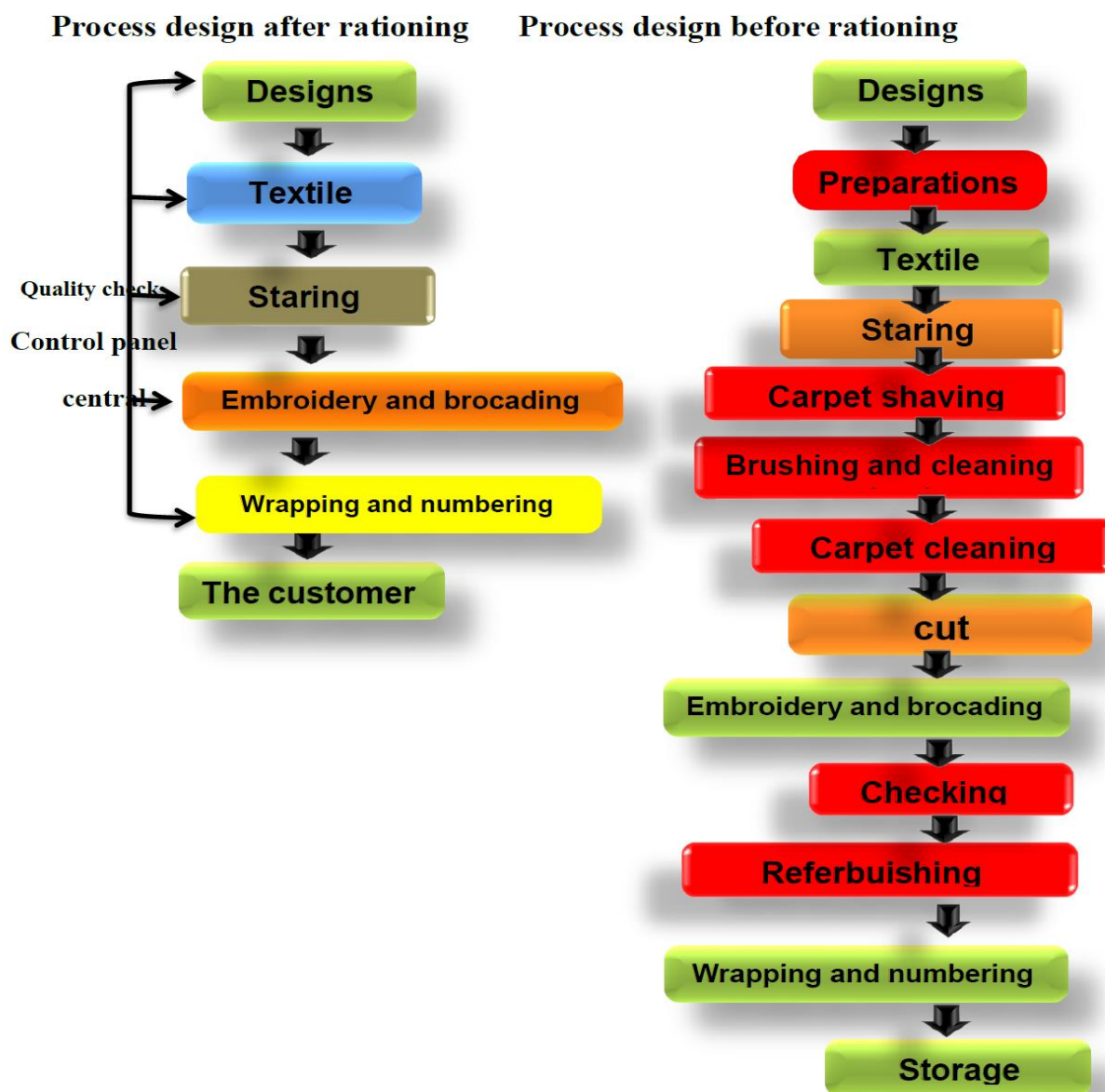


Figure (3) Comparative form of process design before and after production cost rationalization.

Figure (3) shows the impact of rationalization on improving the design of production processes for the carpet industry, as it shortened the production cycle by saving time spent in non-added value activities. It has contributed to the achievement of quality through the central control of the operations that characterizes modern technology instead of the previous mechanism of examination that takes place at the end of production operations. It is believed that improving the design of production processes will contribute to owning the dimensions of competition for the factory, as follows:

**1- Cost dimension:** the modern technology has brought about in changing the mechanism of work by deleting many activities that do not add value, as shown in Table No. (16) as follows:

Table No. (16) The effect of improving process design on the acquisition of the cost dimension for the carpet factory

Activity	Activity costs before process improvement	Activity costs after process improvement	Variance
Designs	231,396,054	46.279.211	185.116.843
Preparations	140,877,628	0	140,877,628
Textile	946.197.376	756.957.901	189.239.475
Entrancing	329,793.336	267.132.603	62.660.733
Brushing		0	0
Shaving		0	0
Cleaning		0	0

Cutting	29,342,977	0	0
Embroidery and brocading	58,073,570	58,073,570	0
check up	42.083.805	0	42.083.805
Refurbishing	141,357,066	0	141,357,066
Numbering and packaging	103,920,675	103,920,675	0
<b>Total</b>	<b>2,023,042,487</b>	<b>965.231.357</b>	<b>1.057.811.130</b>

It is noted that the improvement of the process design contributed to the deletion of unnecessary activities, which affects the cost of operations and their outputs, and thus the acquisition of the cost dimension.

**Time and delivery dimension:** Referring to Figure (3), it can be seen that the time and delivery dimension has been achieved through the change that improved process design brought about to shorten the carpet-making cycle between path length and complexity before improving process design. It includes several processes that do not add value imposed by the technical nature of the approved production process. Each sub-activity in the carpet industry is a major activity for a group of sub-activities, each of which has a time for completion, which exceeds the standard time for it as a result of continuous maintenance with production and the obsolescence of machines and others. As a consequence, the length of the production cycle and the delay in displaying the products in the appropriate season, which affected the decline in the customer’s demand for the factory products and his exit from the field of competition. On the other hand, it is noted that the design improvement process shortened many non-added value activities, which positively affected the speed of completion of operations and raising the hourly productivity of machines. This ensures the speedy fulfillment of the order in order to improve the capacity of the operations and to achieve the satisfaction of its customers. This is reflected in the laboratory acquisition of time, delivery and customer satisfaction.

**2- The dimension of flexibility and creativity:** it is noted that it is achieved through the specifications that characterized the proposed machines and as in Table No. (17) as follows:

Table No. (17) A comparison between the specifications of the current and proposed machines to rationalize production costs for the Iraqi Carpet Mechanical Factory

Feature	Suggested modern machines: type (RCE02 - 400 ) & ( RCI 03-400 )	Current approved machines: type ( ADR-62-400 )
Fabric structure	Multiple options	Fixed one
Fabric weight	The presence of several options for accuracy, smoothness and texture weight per square meter	The machine does not have options for fineness, fineness and texture weight per square meter
Colors	The possibility of entering multiple colors in one pattern, thus giving the beauty and clarity of the details of the carpet patterns	A certain number of colors.
Machine pitching	You do not need to prepare the spool	You need to prepare the bobbins of certain sizes to suit the machine installation.
Pattern designs	Through high-accuracy, fast and aesthetic software systems	Mechanical jacquard system with many mechanical holidays
Change patterns	advanced electronic systems	Manual systems
Speed of completion and delivery	High	Low

**3- Quality dimension:**

It was achieved through the accuracy of the operations of the proposed machines, which included a central control panel that controls the implementation of all production processes for carpets, reaching more than (98%), which contributed to the elimination of various types of defects and waste of resources. In addition to the fact that the quality inspection has become accompanies all operations instead of conducting it at the end of the production process, as was previously shown in Figure No. (3). The calculation of the accuracy of the operations can be stated as follows:

Operation accuracy ratio = 1 - normal damage rate

The accuracy of the operation = 1 - 2% = 98%

It is necessary to estimate the percentage of natural damage resulting from separating the upper and lower carpets with a maximum limit of (2%). Raising the efficiency of process design by rationalizing costs made it possible to acquire a dimension of quality by eliminating its problems by discovering and identifying any deviations that may occur during the implementation of operations through the control of the central control panel on the implementation.

## 4 CONCLUSIONS AND RECOMMENDATIONS

### 4.1 Conclusions

- 1- The carpet factory still relies on machines with outdated production systems
- 2- Overstocking of production in warehouses, due to the fact that the factory relies on old designs that do not meet the customer's desires and tastes.
- 3- The factory still uses the mechanical jacquard system with holidays and production problems such as its high cost, carton damage due to humidity and heat, which affects the quality of production.
- 4- The presence of activities that do not add value that are difficult to dispense with under the approved production systems, such as the activity of preparations, shaving the rug, refurbishing, cutting, cleaning, manual check and some of the sub-activities of the designs, and their cost amounted to (642,044,184) dinars.
- 5- An increase in the stock of complete and incomplete production for the years 2020 and 2019, reaching (5,938,844,945) dinars for the complete and (6,766,434,368) dinars for the incomplete.
- 6- Violation of the cost accounting system by working on zeroing the amount of waste and not charging the product with its share of it, as shown by the cost reports, in addition to relying on the three energy levels (actual, design, and planned) as a basis for measuring the cost per square meter of carpets.

### 4.2 Recommendations

- 1- Modernization of manufacturing processes by introducing machines with advanced production systems and high flexibility.
- 2- Adopting modern designs that meet the customers' desires to ensure that production is not overcrowded in stores.
- 3- Using (software) programs in designing inscriptions to ensure the speed of completion and the aesthetics of designs.
- 4- Working to exclude activities that do not add value by rationalizing costs by purchasing advanced technology.
- 5- Reducing all kinds of production stocks by adopting modern cost accounting methods such as production on time, as well as offering offers at discounts on carpet prices by exploiting social networking sites by advertising and marketing their products while providing services.
- 6- Committing to the cost accounting system and the unified accounting system with regard to determining the cost of products.

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