A PROPOSED MODEL FOR APPLYING AGILE MANUFACTURING IN UR ENGINEERING INDUSTRIES

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Abstract

The research dealt with one of the contemporary managerial accounting topics, which is the topic of agile manufacturing and a study of the extent of the applicability of this method to Iraqi industrial companies. The researcher touched upon the concept of agile industrialization after mentioning a brief history, principles, tools, characteristics and objectives. The researcher relied on the hypothesis that achieving a proposed model leads to better results in reducing product costs while maintaining the required quality level, which leads to enhancing the company's ability to compete and continue. As well as improving the effectiveness of performance by utilizing resources in a scientific and economic manner. As for the practical aspect of the research, it was represented by the application in Ur Engineering Industries.

Keywords: Agile Manufacturing, Value Stream, Cost Reduction.

SECTION ONE

I. INTRODUCTION

Today's economic institutions face double-direction challenges that make these institutions enter into difficult processes to balance these challenges to ensure their survival through improving their ability to market products at lower costs and with specifications that meet the requirements and expectations of the customer in order to maintain a market share.

Management accounting occupies an important role in the success of facilities, as it provides information that can help management in making decisions, by providing it with information that helps to analyze the strengths and weaknesses that exist in the facility's internal environment and try to get rid of weaknesses and enhance strengths, which requires Availability of accounting models that keep pace with modern manufacturing tools and systems that are in line with the continuous changes and developments in design and production processes and pressure on expenditures by reducing waste in manufacturing processes.

II. Research Methodology and literature review

First. Research Methodology

Research Problem

The development that took place in the business environment had major implications for changing the philosophy and methods of producing goods, as the organizations' reliance on accounting systems concerned with measuring and evaluating the financial performance of the facility in the short term without attention to improving financial performance in the long term, so the need for an accounting model was required It is in line with the modern manufacturing environment and helps to develop, adapt and expand agile manufacturing tools to accommodate developments taking place in order to achieve long-term financial goals as well as strategic goals which are to achieve sustainable development and that is reflected in improving the performance of the facility.

In light of this, the research problem can be formulated with the following two questions:

1. Does developing a proposed model provide objective information that helps the administration in planning and making decisions, tightening cost controls and producing goods suitable for use by the customer?
2. Does the suggestion of a model for applying agile manufacturing lead to the production of information necessary for making rational decisions at all administrative levels and identifying and diagnosing performance problems?

Research Objective

The research aims to achieve the following main objective:

Access is a suggested model for rationalizing costs in the industry with plans to control the factor of time, cost, and quality in light of the agile manufacturing environment, and an indication of the impact of this model on setting competitive policies for the company by producing products with the lowest cost and highest quality to gain customer satisfaction. It branches from the following objectives:

1. Highlighting the role of proposing a model for the application of agile manufacturing in supporting the effectiveness of measuring sustainable performance and its effect in reducing costs in light of new changes in the business environment and the requirements of the labor market and information that enables the company's management to take appropriate decisions.
2. Identifying the reality of cost systems in Iraqi industrial companies and the extent of their development and the extent of companies ’interest in these systems and defining practical measures to develop a lean manufacturing strategy in these companies, which leads to the production of products of high quality while taking into account the low costs and maintaining quality to win customer satisfaction.

Research Significance

The importance of the research stems from the importance of employing agile manufacturing technology in industrial activities. In addition to the reasons for applying this technology, such as economic openness and globalization of markets, therefore, it is necessary to adopt technologies that are in line with the modern business environment, which is characterized by intense competition by adopting modern methods of calculating costs and thus avoiding the use of traditional systems, and because the strategy of agile manufacturing has a direct impact in protecting and maintaining the environment and reducing Costs and their significant role in preserving the use of economic resources by employing more efficient and cleaner technology, which makes them consume the least amount of energy and resources. The research acquires importance by clarifying the impact of developing the agile manufacturing strategy on the performance of companies and providing recommendations that enable the company in question to know the importance of this technology and the available fields for its application.

Research Method

In order to achieve the goal of the research, the researcher will rely on:

1. Inductive approach: The researcher will rely on the reference research and extrapolate the previous studies included in the accounting thought in the field of cost accounting to cover the theoretical side.
2. The deductive approach: In order to interpret, analyze and apply the practical side, according to which the researcher moves from public to private through relying on data and information of one of the Iraqi Ministry of Industry and Minerals formations.

Research Hypotheses

In light of the research problem and in order to achieve its objectives, the research hypotheses were formulated as follows:

• **First Hypothesis**: Reaching a proposed model leads to better results in reducing product costs while maintaining the required quality level, which helps management in setting appropriate plans to control costs, tightening control over its components, making product pricing decisions, and comparing available options, which leads to enhancing capacity The company on competition and continuity.

• **The second hypothesis**: The process of proposing a model for the application of agile industrialization improves the effectiveness of performance by utilizing resources in a scientific and economic manner, which leads to a reduction in costs and negative environmental impacts on society and preserving the requirements of present and future generations.

Research Limits:

The research limits are as follows:

1- The researcher will not be exposed to Iraqi engineering industries companies except to the extent required by the research.

2- The study will be a theory with an applied study.

Second. Previous Studies

1. **Jason Aughenbaugh, 2004 study** entitled "**Agile Manufacturing in 2020: Managing Complexity and Uncertainly in Product Realization**".

The researcher pointed out that designers face challenges when designing products and systems. And that the market in the year 2020 will be more global and faster than today's markets. This is because it will be characterized by complex systems a lot, and markets that require more effectiveness, so the success will be in managing human resource systems for product systems and the interaction between different systems. Workers will face many challenges in using knowledge effectively to drive industrialization. He gave his recommendations on engineering management systems as a design for the 2020 methodology and then tried to explain how to model and simulate this approach. For active application, the organization's knowledge of that product in the year 2020 needs to adopt the entrance to the engineering systems, and this entrance enables to deal with the increasing complexity of the products, and the researcher concluded that the effective manufacturing project must adopt the new entrance in design, systematization and analysis of sub-problems. The researcher recommended that the engineering systems approach should be adopted to develop the product, use models, and simulate specific roles in order to reduce uncertainty.

2. **Marwa Ibrahim Rabee 2014 Study** entitled "**A Proposed accounting model for measuring and evaluating the sustainable performance of establishments that apply the manufacturing method without loss - with an applied study"**

The study aimed to reach an accounting model for measuring and evaluating sustainable performance in light of the integration of the manufacturing method without loss with the facility's interest in adopting environmentally friendly practices, as well as to reach a balanced measurement model for sustainable performance to achieve the goal of sustainable development. The study reached the necessity of expanding the role of the administrative accountant to help the establishment in finding new performance indicators to measure and evaluate the sustainable performance of the facility, as well as the need to expand the scope of management accounting to include matters related to sustainable development.

3. **Mohammed 2014 Study** entitled "**The ability to use agile accounting tools to reduce costs**".

The study aimed at identifying agile accounting, knowing its techniques and tools, identifying steps for their application to reduce costs, as well as defining practical procedures for applying agile accounting in Iraqi companies. The study concluded that the application of agile accounting tools has a high ability to determine the actual costs of production and eliminate the loss in production and administrative processes and the ability to serve all the beneficiaries of information and reduce storage of all three types (raw materials, production in operation and production of finished manufacture) to the lowest amount and increase flexibility Quality and speed will meet the demands of customers and the market. In a way that improves the performance of the company and its competitive position and give it a competitive advantage.

4. **Issa and Mohssin 2014 Study** entitled " **Agile Accounting Application of a proposed value stream model at Family Food Production Company**"

The study aimed to get acquainted with the possibility of applying modern manufacturing methods and agile accounting in industrial companies, especially the research sample and especially the value stream cost method, and the research concluded that the application of grace in the research sample is based on value streams and not on the basis of employment and for all the company's products in order to create value for customers as it needs The traditional organizational structure is undergoing significant change, which requires new metrics to measure performance and a new accounting system in order to measure the costs and revenues of value streams.

SECTION TWO

III. THEORETICAL ESTABLISHMENT OF AGILE MANUFACTURING

First. Historical Background and Concept

The first to launch the agile production system is Toyota Corporation, which is the leading company in the advanced application of the system, which aims to reduce waste. In 1950, waste was interpreted as any activity that does not lead to the product being presented to the customer in the required form and time (Al-Sawy, 2015: 9).

(Isa and Mohsen) defined the concept of the graceful as the maximum benefit from all the resources available to provide customers' requests according to their desire and at the right time and in the most effective way, while adding value to the products by reducing waste, loss or damage in all production processes (Karim and Abdel Aziz, 2014: 115).

Marwa Ibrahim Ahmed has defined him as a method or system characterized by a set of characteristics and features that can distinguish it from other manufacturing systems, which are:

the importance and support of senior management to its application and urging individuals working to meet the desires of customers, to start production if there is a need for the product , Reducing the time taken between receiving orders and delivering orders to customers, and finally reaching products with zero defects that are produced according to the customer's specifications characterized by the application of international quality standards (Ahmed, 27: 214).

From the foregoing, the researchers believe that the concept of agile manufacturing is a strategic approach as far as it relates to the operational method of industrialization, as it transcends it to include all facilities of the facility, as it emphasizes eliminating essentially the consumption of resources that do not add value to products and processes and to all types of resources, whether spatial (unnecessary storage, method The installation of machinery and equipment) or industrial such as (defects in products, excess treatment) or temporary such as (waiting, delay, unnecessary movements) or behavioral, which is related to not exploiting human capital to reach products that meet customers' needs with the required quality and time. So the Agile Manufacturing Environment focuses on many principles that enable it to satisfy customer desires and eliminate waste sources.

Second. The Principles of Agile Manufacturing

At a time when agile manufacturing is considered one of the most successful strategies to ensure the competitiveness of enterprises, as it is based on the use of highly trained workers at every production stage in order to eliminate waste and improve quality, it can see a complex system that focuses on delivery on time and maintaining the lowest stocks With less waiting time through continuous improvement (Abbas, 2016: 103).

Therefore, a number of researchers in contemporary literature (Ahmad, 2014: 27), (Kahit, 2015: 7) and (Rayes, 127-197) have identified a set of principles for agile manufacturing as follows:

Determination of value, value flow, production flow, production withdrawal, empowerment and qualification of the human element, the pursuit of perfection. The researchers believe that the principles of agile manufacturing focus on eliminating all aspects of loss and making the factory produce for sale. In other words, production is not based on expectations or decisions subject to personal rulings, but rather at the request of the customer, who is considered the basis in the production plans, in order to limit any step that does not add value, whether by the workers or by the machines, in order not to overproduce the production that causes loss. A lot of time and effort, as well as storage, which is a burden on industrial establishments, where it represents the most important types of waste and the importance of it being that it does not achieve value for the final product and helps to hide production problems due to the inability to identify errors first-hand, as well as what it causes from the consumption of space and high costs.

Third: Agile Manufacturing Tools

Agile manufacturing is based on many systematic tools and techniques necessary to implement the principles that, when used correctly, achieve the desired goals from introducing improvements to quality, reducing costs and delivering the final product to the time required by the customer, as well as being a monitoring and evaluation tool for agile production efforts and results . If it is used without a correct understanding, it can lead to the failure of agile production efforts in the facility (Silva, 2012: 40), and these tools are represented in (Kalit, 202015: 8), (Muhammad, 2013: 292) and (Al-Asadi, 2012: 50).

1. Value Stream Mapping.
2. Cellular Layout.
3. Workplace organization methodology (5s), i.e. five activities used to create a suitable workplace for Visual Control and agile manufacturing practice.
4. Kanban’s system for replacing raw materials using a drawing system, in which visual signs are used for workers to indicate the need.
5. Just in Time Production System.
6. Sound production from the first time (Quality at the source)
7. Small lot size
8. Standard Work,
9. Preventative Maintenance
10. Total productive maintenance
11. Visual Management
12. Continuous Improvement (Kaizen): It is represented in two main axes: The first is Kaizen Flow, which focuses on continuous improvement through the value flow. The second is Kaizen Point, which focuses on eliminating lost types of all value flows (Samurai, 2011: 89).

The researchers believe that the importance of the availability of principles and tools for the application of the agile manufacturing method, the success of its application depends on a number of other factors, which are called in some literature by informal relationships, which are not stipulated by a regulation or instructions, but are determined by successful administrative and leadership norms and methods, such as building a network It is a good relationship with customers and suppliers and involving them in preparing production plans and explaining goals for them, because it is of great importance in fulfilling their obligations towards the facility, as well as strengthening the relationship with subordinates, listening to their proposals and implementing what is good from them in order to enhance their loyalty to the facility and motivate them to do more Efforts for the purpose of implementing the objectives set and which should be clear to them.

Fourth. Agile Manufacturing Properties

The agile manufacturing system is characterized by a number of characteristics mentioned by a number of researchers (Kahit, 82015: 8) and (Muhammad, 2013: 292) as follows: -

1. The customer leads the production system.
2. It adopts the system of authorized teams, which are the production teams responsible for making their own decisions, such as stopping the production line in case of defects.
3. The constant pursuit of perfect or perfect proximity.
4. Use the least possible assets at every stage of the production processes.
5. Flexibility to install machines and equipment according to the requirements of different products with small batch flow.
6. Use visual management to monitor.
7. Removal of all activities that do not disturb the value of the final product and that are wasted that must be removed.
8. Establishing a culture among workers that is not to produce defective parts and that there is no need for stocks.
9. The team manages all activities and operations horizontally.
10. Building a chain of partnership relations between suppliers and customers.
11. On-time production, source quality, preventive and comprehensive maintenance, flexible materials and prompt preparation.

In light of the foregoing, the researchers believe that the characteristics of agile manufacturing are based on the necessity of an integrated leadership philosophy adopted by industrial companies based on empowering authorities and developing the capabilities, skills and culture of workers in productive laboratories on the style of agile manufacturing and focus on creating value for the customer and disposal of activities that do not add value and work according to The rule that quality is the responsibility of everyone, not just the departments or divisions of quality, due to the multiplicity of customer needs, so that companies with their products can compete with the goods produced in the local market and imported from outside the country.

Fifth. Goals, benefits and limitations of agile manufacturing: (Muhammad, 2013: 292), (Abbas, 2016: 103) and (Ali, 2016: 319).

A. Objectives and benefits of lean manufacturing: Objective and benefits of lean manufacturing

- The Mekong study shows a set of goals and benefits for agile manufacturing as follows:
- Reduced loss and damage Defects & Wastages Reducing
- Reducing Cycle Time Reducing times
- Reduced Inventory Levels Reducing
- Labor Productivity Improving
- Efficient utilization of equipment and space
- Flexibility
- Output Increased

B. Determinants of Agile Manufacturing Success:

One of the studies (Morteza, 2018: 2) showed that establishments when implementing the agile manufacturing method integrate all activities that affect the production of the commodity and up to its delivery to customers, so the study showed the need to distinguish between the internal factors from those determinants and the external factors where they were issued (23 Specific to Agile Manufacturing Success. After presenting these determinants to a team of experts who observed the overlap of those determinants with each other and after discussions, I consider that seven independent determinants of the success of agile manufacturing are as in the following table:

(Availability of financial resources, support for management and commitment, jurisdiction of information technology, integration of the supply chain on a large scale, simplicity of the production process, human resources management, supportive culture), and the study itself found that support for management and commitment, availability of financial resources and information technology efficiency are considered to be at the lowest level of Hierarchy or as an infrastructure for agile manufacturing application So industrial enterprises must provide these resources to facilitate other success factors such as human resource management, production process simplicity, supportive culture, and supply chain-wide integration (Morteza, 2018: 17).

The researchers see that the determinants, whether they are external determinants or internal determinants, they are influenced by a group of other factors related to the economic and social system and awareness among members of society as it is also linked to the competitive, legal and organizational environment inside and outside the company as they all work to increase the chances of the success of the application of agile manufacturing and enhance customer confidence in the company's products This increases their competitiveness and helps them obtain financing and generate profits.

SECTION THREE

IV. PRACTICAL PERSPECTIVE

2.1.The nature of work in the company, the research sample

The winding wire factory was chosen as the proposed model because especially the Ministry of Electricity requires its products.

First: About the factory:

The factory produces according to international standards (317.8 IEC) and its production is used in (winding electric motors, manufacturing electrical transformers). It also produces rectangular winding wires isolated with one or several layers of paper according to the international standards IEC, which is used in the manufacture of electrical oil transformers, and the process of manufacturing the wires through three stages of production:

- **The First Stage (Pulling Unit):**

The pulling unit consists of several pulling machines:

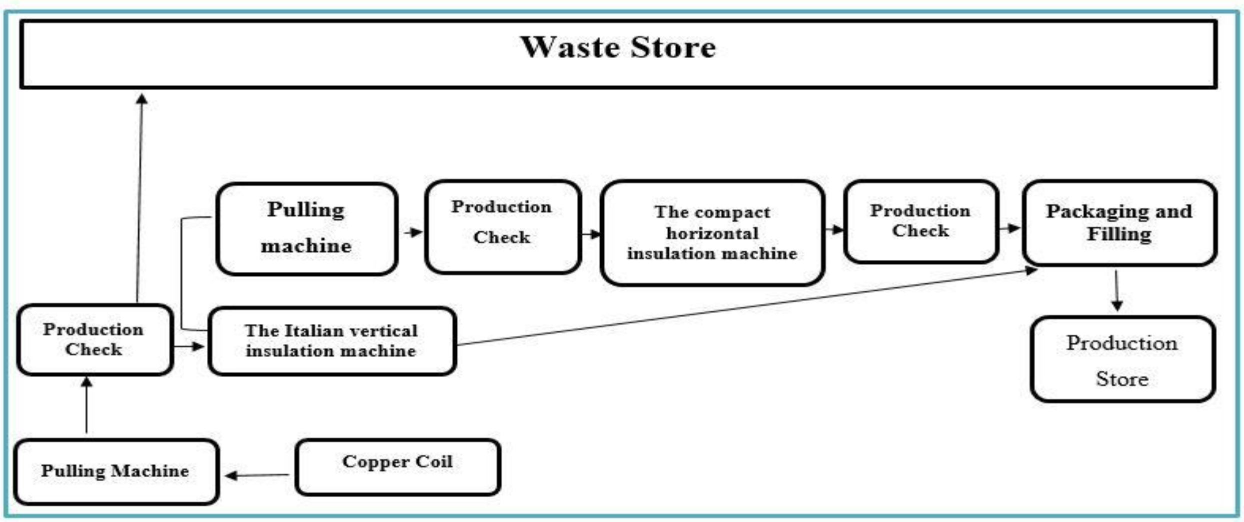
Pulling Machine M85	Moderate Pulling Machine	Pulling Machine M30	Pulling Machine M30 A	Pulling Machine M 15-B	Pulling Machine M 15-C

- **Second stage (Isolation unit):**

The first compact horizontal insulation machine	The second compact horizontal insulation machine	The Italian vertical insulation machine	The sixth horizontal insulation machine	Insulation machine The first vertical	Austrian insulation machine	Rectangular wire insulation machine

Each of the above machines is specialized in isolating specific measurements of drawn copper, and each machine contains more than one production line.

The following figure shows the technological behavior of the drawing and isolation units:



This unit consists of several production machines, which are:

Cement Bricks Pulling Machine	**Rectangular Wire Rolling Machine**	**Fermentation Furnaces**	**Nitrogen Generation System**	**Insulation Machine With Paper**

The following figure shows the technological behavior of the rolling unit to produce rectangular wires:

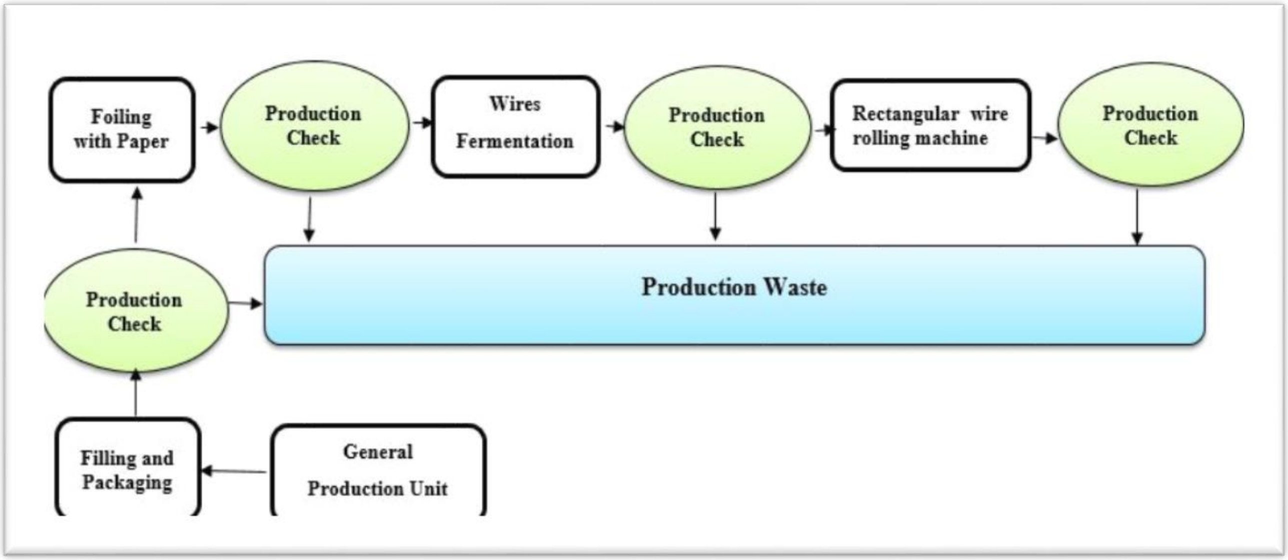


Fig.2

The Technological Course of the Rolling Unit to Produce Rectangular Wires

- Second: The duration required to produce one unit of the product (tons of copper insulated with enamel):

  The following table shows the time needed to produce one ton of copper insulated with enamel

Table (1)
The time needed to produce one ton of copper insulated with enamel

No.	Process Name	*The Operator*	*Duration Average*	*Notes*
1.	Request for raw material or assistance	Factory management	One hour	A raw materials exchange document is prepared and certified by the concerned departments
2.	The arrival of the primary or auxiliary material	Production notes and forklift driver	half an hour	Send the forklift to the warehouse with an application document to bring the materials
3.	The stage of introducing the material into the production process	Production notes and respective machine operator	One hour	-

4.	The stage of copper drawing from (8) mm to (2) mm	M85 drawing machine	From an hour to an hour and a half	In this process, the copper coil is welded or welded (8) mm, and the production is in the form of a copper coil (1) ton per copper coil.
5.	Isolation stage	Italian insulation machine	(1) Tons / 24 hours	Production shall be in the form of copper insulated with enamel on plastic rollers, at a weight of (90) kg per spool, and at a rate of (11) spools per production ton.
6.	The arrival of the primary or auxiliary material	Quality Control Lab	2 hours / ton	The inspection time for each production reel ranges between (10-12) minutes
7.	The packaging stage and the transfer of production to the ready production warehouse	Packaging and production transfer department	2 hours / ton	The process of packing and wrapping the production with paper and nylon material and placing it inside plastic containers and then transferring it to the complete production warehouse

- **Third: - Factory operating systems, working days, and stopping work:**

1. The number of working days and stopping work in the factory during the year 2018:

Table No. (2)

The number of Operation and stopping days

Details	Operation Days	Stopping Days	Days of the Year	The percentage of working days of the year (1/3)
Coiling Wire factory	300	65	365	82

By analyzing the data in the table regarding the number of actual work days and stops during the year, it is noted that the percentage of actual days of work in the factory reached (82%) of the year, which is considered an acceptable percentage, whereas:

A. The number of working meals (2) one morning meal working for (7) hours and the second evening working for (14) hours because its work is on a shift basis, so the total working hours will be (21) hours.

B. The lost work times for the two daily working meals, which are (50) minutes of attendance, (38) minutes of initialization of machines, (50) minutes of rest and (60) minutes of departure, this time was calculated based on views and through personal inquiries with employees.
C. Thus, the total lost time is (3.3) hours per day, equivalent to (198) minutes, which represents (15.7%) of the total daily working hours of (21 hours), which leads to increased costs, as this time corresponds to it. Wages paid to workers.
   D. D- The actual working hours during the day for the two working hours are (17.7) hours / day (14-14 hours).
   E. Providing the total number of available hours = 300 days × 21 hours × 98 = factor 617.4 thousand hours.
   F. The actual work hours = 300 days x 17.7 hours x 98 workers = 520 380 hours.
   G. Productive hours = 89 tons x 32 hours = 2848 hours.
   H. Unproductive hours = 300 days x 3.3 hours = 990 hours.
   I. Hours of idle energy = 617400- (2848 + 990) = 613562 hours.
   J. Energy-producing ratio = 0.46%.
   K. Percentage of unproductive energy = 0.16%.
   L. The idle energy ratio = 99.38%.

By analyzing the workers 'annual capacity, we note that the ratio of the unemployed energy of the workers is significantly high compared to a very small percentage of the produced energy, which means a significant increase in the percentage of unexploited energy represented in the activities of workers not adding value, and this leads to a significant increase in the amount of wages that are considered *Fixed Costs*, which of course represents a waste of laboratory resources.

2. Standard cost rates and selling prices for laboratory products

Product Name	**Measuring Unit**	**Standard Cost in Thousand Dinar**	**Sale Cost Thousand Dinars**
Thin winding wires	*Ton*	*9675*	*11500*
Heavy winding wires	*Ton*	*8750*	*11000*

- **Fourth: Available and planned productive capacities and amount of deviation:**

The following table shows the design, available and planned productive capacities of the plant during the year 2018 and the amount of deviation in planning:

Table (4)
Design capacities available, planned, and actual

Design capacity Ton	**Available capacity ton**	**Planned capacity Ton planned capacity**	**Deviation in planning Ton**	**Actual production Ton**	**Actual to production ratio %**
6214	3200	500	2700	89	17.8

The information confirmed in the above table indicates a planning deviation of (84%) of the available capacities, while the actual implementation rate (17.8%) of the planned energies, due to the company's inability to provide the raw materials and assistance needed for the production process, which caused In deviating the planned productive capacities from the available capacities, as:

- Ratio of produced energy = 89/3200 = 2.8%
- Percentage of idle energy = percentage of available energy - the proportion of energy produced.

  = 100% - 2.8% = 97%.
- Energy available in standard time = 3200 tons x 32 hours = 102400 tons
- Standard time for actual production = 89 tons x 32 hours = 2848 hours
- Lost time = 520 380 hours - 2848 hours = 517532 hours
- Actual production time = 520,380 hours ÷ 89 tons = 5847 hours
- lost time per ton = 5847 hours - 32 hours = 5815 hours

By analyzing the energies mentioned, it was found that:

✓ There is a great discrepancy between the available capacities for the plant and the actual production.

✓Significant increase in lost time at the laboratory level, which amounted to (517,532 hours), which indicates the failure to utilize the available resources in an efficient manner, which reflected on the increase in lost hours at the level of one ton, which amounted to (5815 hours).

Fifth: - Problems and obstacles that lead to the emergence of activities that do not add value:

The most important problems facing the production process in the factory and lead to the emergence of activities that do not add value are the following: -

1- Excessive production:

2- Lost handling time: There are long distances between the factory and warehouses.

3- Lost work time

4- Lost time in machines

5- The instability of the electrical current in the laboratory, which affects the increase in damage to the raw materials used in the production process.

6- The instability of the cooling system in order to maintain a low temperature.

7- The instability of processing the industrial services required in the production process (water, compressed air, electricity) negatively affects the stability of production.

8- Failure to prepare on time for all production requirements, such as rollers, plastic containers, bases, wooden boxes, paper, and nylon packaging.

Sixth: - Application of the proposed model.

The value flow of the winding wire mill

The agile manufacturing strategy of the winding wire factory lies in doing the following two steps:

The first step: - Convert the winding wire factory to production cells.

The second step: - Value flow numbers for the winding wire factory.

We will review the above steps in detail below:

1- Converting the winding wire plant into production cells.

The presence of the materials request and the arrival of raw materials sections, despite the fact that they represent the first step of any production process, are among the activities that do not add the value of being the bureaucracy and routine used in traditional manufacturing methods, as well as the possibility of replacing them in a graceful manner without negatively affecting the production process.

That is why researchers see when converting production units into cells that routine procedures governing the two stages of requesting raw materials, their arrival, and their merging with the stage of introducing materials into the production process are exceeded, as they serve this stage, by providing raw materials inside the laboratory, especially since the area of the laboratory helps with that, and this is done Achieving agile at the time of handling and workers.

A- The raw materials request cell, preparing it and entering it in the laboratory.

B- Copper withdrawal cell, insulation with enamel material and examination.

C- The storage packaging and transportation cell.

2- Setting the flow value of the laboratory.

After turning the factory into production and service cells, the value flow can be prepared in the form of successive production steps and it consists of (entering purchase orders, purchasing materials, material handling, research and development, quality control, quality management, maintenance, human resources, legal affairs, financial affairs, information center Cell for requesting materials, preparing and entering them for the production process, cell for withdrawal, isolation, packaging with enamel and examination, cell for packaging and transportation for the store, marketing, operations related to preparing lists of sales and collecting cash, warehouse management) and the following figure shows the value flow of the plant:

PRODUCTION STEPS AND ACTIVITIES SUPPORTING THE VALUE FLOW										
Enter purchase orders	Purchase materials and handling	research and development	Quality control	Quality Management	Maintenance	Accounting	Cell for requesting materials, preparing them and entering them in the laboratory	Withdrawal cell, isolation, enamel packing and examination	Cell packaging and transportation for the store	Marketing

Fig. No. (3)Value flow for winding wires

After that, the number of workers in the cells will be determined as in the following table:

No.	Production Cell	Current Workers Number	Suggested Workers Number	Workers agility rate%
1.	Cell for requesting materials, preparing them and entering them in the laboratory			
	Laboratory Administration	1	1	-
	Factory manager assistant	1	-	100
	Forklift driver	2	1	50
	Technician	5	2	60
Total		9	4	56
2.	Pulling cell, isolation, enamel packing and examination			

	M85 towing machine	10	9	10
	middle drawing machine	10	9	10
	M30 drawing machine	4	-	100
	M30A Towing Machine	3	-	100
	M15-B drawing machine	3	-	100
	M15-c drawing machine	1	-	100
	The first compact horizontal insulation machine	1	-	100
	The second compact horizontal insulation machine	8	10	-
	Italian vertical insulation machine	1	-	100
	Sixth horizontal insulation machine	1	-	100
	The first vertical insulation machine	1	-	100
	Austrian insulation machine	1	-	100
	Rectangular wire insulation machine	1	-	100
	Block machine (1) block	1	-	100
	Rectangular wire rolling machine	1	-	100
	Fermentation ovens	1	-	100
	Nitrogen generation system	1	-	100

	Paper insulation machine	8	4	50
	Inspection Division	67	41	39
Total			10	9
3.	Cell packaging and transportation for the store			
	Packaging Machine	9	5	44
	Press machine	7	4	43
	Forklift driver	1	1	-
	Store staff	5	2	60
Total		22	12	45
Overall		98	57	42

Source: Preparing the researcher through an interview with the factory management and workers

Since the working hours inside the winding wires factory are calculated on the basis of the workers hours, because the work of the machine is related to the work of the worker and from what was observed in the factory there is no machine that works without the intervention of the worker, so the following will be calculated: -

The working hours determined within the daily lab plan are (7 hours) for the morning meal and (14) hours for the evening meal, as work is on a shift basis, while the average daily working hours are (17.7) hours after subtracting the lost time of (3.3) which includes the period of attendance and departure of workers And preparing machines for work and resting workers, while the number of days of actual work during the year is (300 days)

After determining the number of workers for the cells, the annual cells energy available in hours can be calculated at the level of each of my agency cells:

A- The material request, processing and insertion cell for the laboratory 17.7 hours x 4 workers x 300 days = 21240 hours

B- The intake, isolation and packaging cell with enamel and examination 17.7 hours x 41 workers x 300 days = 217710 hours

C- The warehouse packaging and transportation cell 17.7 hours x 12 workers x 300 days = 63720 hours

So, the work capacity after applying the agile manufacturing strategy is equal to: -

21240+ 217710 + 63720 = 302670 hours annually.

Where the number of employees was reduced, after it was (98) workers, it became after the graceful (57) workers, thus reducing the amount by (41) workers, and the reduced time is calculated as follows: -

Energy before agile manufacturing strategy = 300 x 17.7 x 98 = 520 380 hours

Reduction amount = 520 380 - 302670 = 217710 hours

Calculation of costs for the production of winding wires in the traditional manner: -

The value flow costs will be presented according to the traditional method, based on the actual data of the company for the year 2018 and the following table showing that: -

Table No. (6)
Weekly costs flow for the value of the winding wire factory for May 2018 according to the traditional method

Cost Elements	**Monthly**	**Weekly**
raw materials	408595670	102148918
Work wages	83148296	20787074
T. s. G. M.	6288081	1572020
Cost of manufacture	498032047	124508012
Marketing and administrative expenses	148008194	37002049
Total cost	646040241	161510061

Preparing the income statement for the value flow of the winding wires factory at the same mentioned levels, as follows: -

Table No. (7)
The weekly income of the winding wires factory was revealed in May 2018 according to the traditional method

Statement	**Monthly income**	**Weekly income**
the sales	508131000	127032750
Cost of manufacture	(498032047)	(124508012)
Gross profit	10098953	2524738
Marketing and administrative expenses	(148008194)	(37002049)
Net loss	(137909241)	(34477311)

Calculation of the value flow costs for winding wires after applying the proposed model: -

After the weekly costs of the winding wires were presented according to the traditional method, the costs will be presented and the income statement for the same period according to the proposed model (and according to the data in the appendix), as follows:

Table No. (8)
Weekly costs flow value for Wire Coiling for May 2018

Services cell	Raw Materials	Wages	Facilitation	Total
Value flow manager		212113		212113
Associate Director of Value Flow		212113		212113
Value flow administrator		212113		212113
Enter orders		212113		212113
Material purchase and handling	102148918	636339		102785257
research and development		212113		212113
Quality control		212113		212113
Quality Management		212113		212113
Maintenance		424226		424226
Accounting		424226		424226
Cell for requesting materials, preparing them and entering them in the laboratory		848452		848452
Withdrawal cell, isolation, enamel packing and examination		8696633		8696633
Cell packaging and transportation for the store		2545356		2545356
Marketing		424226		424226
Preparing sales lists		424226		424226
Store Management		424226		424226
The facilities			5211009	5211009
Total	102148918	16332701	5211009	123692628

Source: prepared by the researcher

The income statement for the value flow of the above-mentioned laboratory, as follows: -

Table No. (9)
Weekly income statement for the value flow of the winding wire factory for May 2018 according to the proposed model

Statement	Sums
the sales	127032750
raw materials	(102148918)
Work wages	(16332701)
The share of the facilities	(5211009)
Profit flow value	3340122

A comparison of results can be presented under the traditional method and results under the proposed model, and the following table shows that:

Table No. 10
Comparing the Results under the Traditional Method and the Results under the Accounting Method for Developing Agile Manufacturing

Statement	***Period/ Amount***	***Within the traditional style***	***Within the proposed model***	***Result***	***Percentage %***
Working hours of machines	Per ton	32 hours	18,5 hours	Decrease (13,5) hours	42
Production cycle time	annual	520 380 hours	301468,5	Decrease (218911,5) hours	42
Available energy for the critical resource	Per ton	0.73 tons	1,46 tons	0.73 tons	100
The time required to fulfill the customer's request	Monthly	56 days	33 days	Decreased (23) days	41
Total cost	weekly	161510061 dinars	123692628 dinars	Decrease (37817433) dinars	23
One unit cost	weekly	18458293 dinars	14136300 dinars	Decrease (4321993) dinars	23
Net profit / loss	weekly	(34477311) dinars	3340122 dinars	Converting from loss to profit	—

Through the above table, the apparent effect of applying the proposed model was revealed, through the decrease in costs by (23%) and by the same percentage, the cost per unit of production decreased, which led to a shift in the result of the activity from a loss of (34477311) to achieving a profit of (3340122). Thus, the application of the proposed model has a clear impact on eliminating activities that do not add value and whose costs are not related to a causal relationship with the flow of value regardless of the classification of those costs, whether direct or indirect or mixed, and to give a realistic picture to the administration that helps it in making rational decisions and promotes The company's ability to compete in the markets and obtain a market share, thus providing information that helps the board of directors, executive management and stakeholders to evaluate and measure sustainable performance if this strategy is applied in a scientific and practical way. In this way, the researcher has proven the research hypothesis, which indicates that "reaching an integrated accounting approach to develop agile manufacturing strategy leads to better results in reducing product costs while maintaining the required quality level, which helps management in setting appropriate plans to control costs, tighten control over its components and make decisions Product pricing and comparison between available alternatives which leads to the enhancement of the company's competitiveness and continuity.

SECTION FOUR

V. CONCLUSIONS AND RECOMMENDATIONS

First. Conclusions

1. The application of agile manufacturing in the production process according to the value flow map leads to achieving competitive advantages and improving the performance of the company, because this helps to determine the steps that add value and that do not add value, as well as identifying places and points of waste and loss in production processes and disposal of them, which It reflects positively on performance in general.

2. Increased calls for the development of management accounting methods due to the inability of traditional systems to overcome the tremendous benefits generated by agility, represented by the highest quality and shortest time and human and material energies available.

3. The graceful method is not only limited to productive operations, but can also be applied to all aspects of the company, including administrative accounting, cost accounting and financial accounting.

5. The most important elements of developing a lean manufacturing strategy are to provide staffs and employees with multiple skills to carry out agile (productive and accounting) operations, in addition to the necessity of supporting senior management and providing financial credits to reach the desired results that the company aspires to.

6. The proposed model represents the steps and requirements that must be provided by any establishment that wants to implement the agile manufacturing strategy. These steps and requirements are applied gradually and depend on the administration’s adoption of the grace philosophy and providing the resources necessary to move from the payment system based on the extensive production method and traditional accounting to the withdrawal system. Agile-based and agile Accounting.

Second. Recommendations

1. Direct the company's attention by focusing and getting acquainted with modern management accounting methods that help it provide financial and non-financial information so that the company can meet the needs and desires of customers in terms of quality, price and delivery on time and provide high flexibility in diversifying sales and developing them constantly.

2. The company must replace the traditional production systems that rely on the extensive production system with the graceful production system that depends on the withdrawal system, due to the multiplicity of customer needs and the changing forms and benefits of products so that it is not allowed to manufacture typical products in large quantities, and this requires the adoption of modern systems and tools such as agile manufacturing And agile accounting so that the company with its products can compete with locally produced and imported goods.

The company has made a change in the organizational structure based on divisions to an organizational structure based on agile systems that are based on value flows and the preparation of a value flow map for its production and service process in order to determine the places of waste and loss and to determine the value-added and non-value-added activities.

4. Paying attention to the basic factors for success, namely cost, time, flexibility, quality and creativity, whose impact is reflected in achieving customer satisfaction.

5. Increase interest in the value flow map by means of a system that shows the activities, steps and procedures of each work cycle, which includes the numbers of workers, machines and machines, cycle time, transfer times and time available to work in the form of flowcharts that are easy to understand.

6. The company must work to comply with the needs and desires of customers because this helps to increase the company's ability to compete in the markets and obtain a market share. Focus on customer satisfaction to achieve the company's competitive advantage as customer satisfaction and earn loyalty to the product and the company is the essence of achieving a competitive advantage.

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VI. APPENDICES

1- Calculating the average monthly wage for a worker:

The average monthly wage for a worker = 83148296/98= 848452 dinars

2- Calculating the costs of the value flow chart:

A- Wages of the value flow manager = 848452 x 1 worker = 848452 dinars ÷ 4 = 212113 dinars

B- Associate value flow manager = 848452 x 1 worker = 848452 dinars ÷ 4 = 212113 dinars

C - Value flow administrator = 848452 x 1 operator = 848452 dinars ÷ 4 = 212113 dinars

D - Entering applications = 848452 x 1 worker = 848452 dinars ÷ 4 = 212113 dinars

E- Purchase of raw materials and handling:

• The cost of raw materials = 11674162 x 35 tons = 408595670 dinars ÷ 4 = 102148918 dinars

• Wages = 848452 x 3 workers = 2545356 dinars ÷ 4 = 636339 dinars

F- Research and development = 848452 x 1 worker = 848452 dinars ÷ 4 = 212113 dinars

G- Quality control = 848452 × 1 worker = 848452 dinars ÷ 4 = 212113 dinars

H - Quality management = 848452 x 1 worker = 848452 dinars ÷ 4 = 212113 dinars

I- Maintenance:

• Factory share of spare tools = 1601642 dinars ÷ 4 = 400411

• Wages = 848452 x 2 workers = 1696904 dinars ÷ 4 = 424226

J- Cell for requesting raw materials, preparing and entering them into the production process:

Wages = 848452 x 4 workers = 3393808 dinars ÷ 4 = 848452 dinars

K- Pull-insulating, enameling and inspection cell:

Wages = 848452 x 41 workers = 34786532 dinars ÷ 4 = 8696633

L- Warehouse Packaging and Transport Cell:

Wages = 848452 x 12 workers = 10181424 dinars ÷ 4 = 2545356

M- Accounting = 848452 x 2 workers = 1696904 dinars ÷ 4 = 424226

N- Marketing = 848452 x 2 Factors = 1696904 Dinars ÷ 4 = 424226

Q- Preparing sales lists and collecting cash = 848452 x 2 workers = 1696904 dinars ÷ 4 = 424226 dinars

A- stores = 848452 × 2 workers = 1696904 dinars ÷ 4 = 424226 dinars

Q- Facilities: It includes the costs of extinction, the costs of public goods, and the costs of commodity inputs that benefit the value flow.

(First) extinction: - the laboratory's share of extinction = 16630562 dinars ÷ 4 = 4157641

(Second) Garage: - The garage is a service activity that is used to provide a transportation service for workers in the company. The factory’s share of this service = 413256 dinars ÷ 4 = 103314 dinars

(Third) Al-Kisawy: - The factory's share of employees' compensation = 47,397 dinars ÷ 4 = 11849

(Fourth) Nutritional: - The laboratory's share of the food = 13982 dinars ÷ 4 = 3496 dinars

(Fifth) Fuel and oils: - The factory's share of fuel and oils = 956581 dinars ÷ 4 = 239145 dinars

(Sixth) Miscellaneous: The factory's share of the miscellaneous = 953013 dinars ÷ 4 = 238253

(Seventh) Transfer expenses: - plant share = 688430 dinars ÷ 4 = 17210

(Eighth) Miscellaneous service expenses: plant share = 1140811 dinars ÷ 4 = 285203

and from what the researchers noted that other costs such as administrative and marketing costs are not related to a causal relationship with the production laboratories, as they will be treated as general costs that appear in the income statement prepared at the company level.