World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 33, April, 2024
ISSN: 2749-3628,

THE IMPACT OF THE LEAN MANUFACTURING SYSTEM ON THE COMPETITIVE ADVANTAGE OF COMPANIES - A FIELD STUDY IN INDUSTRIAL COMPANIES IN ANBAR GOVERNORATE

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Article history:

Received: 30th January 2024
Accepted: 21st March 2024

Abstract:

The research aims to test the impact of the lean manufacturing system through its elements (process flow, value engineering, time management and comprehensive quality) on the competitive advantage of Iraqi industrial companies. A sample of (4) industrial companies operating in Anbar Governorate was selected to analyze the reality of the lean manufacturing system and its impact on the sustainable competitive advantage of these companies using a questionnaire form designed for this purpose. The research results concluded that a lean manufacturing system is an approach to production management that uses technology and automation to improve the flexibility and efficiency of manufacturing operations. The lean manufacturing system has several positive effects on the sustainable competitive advantage of the companies under study, and there is a need for there to be more clear attention in terms of using modern manufacturing systems, which have an important impact on the economic, social and environmental aspects of each event, whether related to the company itself in terms of its competitive value. Between other companies or related to customers or the product itself.

Keywords: Lean manufacturing system, competitive advantage, Sustainability

1- INTRODUCTION

The developments that have occurred in the business environment, especially in the technological field, as well as customer requirements for various products and digital control in manufacturing processes, have resulted in the emergence of modern systems in manufacturing, including the lean manufacturing system. The Fourth Industrial Revolution is one of the most prominent factors that resulted in digitization and intelligent operation of industrial systems. In increasing productivity, improving quality and efficient use of resources and industrial processes (Kashif & Muhammad & Waqar, 2023, 1), and (Scott, 1987, 10) believes The operation of such systems (lean manufacturing system) enhances responses to the requirements of comprehensive manufacturing control, productivity and adaptability to production and tends to be better than traditional manufacturing systems as operators (lean manufacturing system) have greater independence and discretion in intervening in the system. Therefore, leaders adopted this system as an important tool to enhance and develop performance and make it a permanent feature to achieve the goals of their organization, enhance its position in the market and empower it. lean is a good characteristic in creating and designing

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Vol. 33, April, 2024
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lean social and environmental systems, and this statement supports what he proposed (Vivek & Masaru & Miguel, 2017, 14) They believe that lean allows for the rapid deployment of resources where they are needed, which is an urgent necessity for both innovation and strength. Thus, it will lead to less damage and faster recovery. Since smart manufacturing capabilities depend on levels of technical development, integration, and automation that far exceed traditional manufacturing processes, on the other hand, there will be new vulnerabilities, and the lack of security will raise double concerns about the security of these systems. (Nilufer & Stephen, 2018) state that the complexity of manufacturing systems, the move toward increased autonomy, and the shortage of manufacturing system security experts all affect the effective security of manufacturing systems. To develop effective security solutions, the research and industry communities need to work together and focus on effective, robust, reliable and low-cost security solutions that can handle the uptime of current and future manufacturing systems.

The issue of the survival and growth of companies is extremely important to corporate management, and this requires searching for strategies and plans that ensure this. In light of the development that accompanies the business environment, companies must have a competitive advantage that puts them at the forefront of the market, but this often depends on the method of manufacturing and how Reducing its costs and providing flexibility for companies to meet market requirements at the required speed, at the lowest cost, and with the least amount of waste associated with the use of resources, thus eliminating activities that do not add value and enhancing activities that add value. From this standpoint, the research problem lies in how Iraqi companies' adoption of lean manufacturing systems affects achieving a sustainable competitive advantage.

Recently, companies have begun to focus on implementing modern manufacturing systems, including the lean manufacturing system, which in turn will lead to improving many aspects of financial and administrative performance, which will be reflected in the quality of the products and the company's reputation. In addition, there have been many studies since the emergence of the lean manufacturing system that have dealt with the study of manufacturing systems, but only a few of them have focused on studying the impact and relationship between the lean manufacturing system and sustainable competitive advantage in industrial companies in Iraq, especially in Anbar Governorate. These factors are the main motivations for conducting this research and filling the research gap in this field. Accordingly, the first goal of our research is to demonstrate the impact of the lean manufacturing system on sustainable competitive advantage in the companies under study. It also explains the extent to which the companies in question apply the lean manufacturing system. In addition, it indicates the ability of the companies in question to create and maintain a competitive advantage for a long time. Here, four dimensions of the lean manufacturing system are highlighted: process flow; process engineering; Time and total quality tool. As far as the researchers know, this study is the first of its kind to be conducted in the companies under study in Anbar Governorate. Our current research focused on Iraqi industrial companies in Anbar Governorate, where the five largest and oldest factories in this geographical region were selected (see Table 1).

2- Theoretical framework; Previous studies and hypotheses

Previous studies:

Study by (Soleymanizadeh et al;2023 : 1258-1265) entitled (Digital Twin Empowering Manufacturing Paradigms: Lean, Agile, Just in Time, Flexible, Resilience, Sustainable)

The study aimed to demonstrate the impact of advanced manufacturing technology, sensing and analytical capabilities, and comprehensive planning on sustainable competitive advantage**. The study examined** a group of factors consisting of 200 survey studies of the impact of advanced manufacturing technology, analytical capability AC, sensing capability SC, and comprehensive planning PC on sustainable competitive advantage**. It concluded The study** indicated that the four factors had a positive impact, which indicates the existence of a relationship with a positive impact on achieving sustainable competitive advantage**.**

Study by Al-Tamimi, Iyad Jassim Zaboun, Saad, Salma Mansour, 2022: 170) entitled (Employing the lean manufacturing system to achieve a competitive advantage using cellular manufacturing technology: an applied study in the General Company for Textile and Leather Industries - Leather Factory - Laboratory (7))

The study aimed to demonstrate the impact of employing the lean manufacturing system to achieve a sustainable competitive advantage**. The study examined** a sample of the leather factory No. (7) of the General Company for Textile and Leather Industry. The study concluded that applying the lean manufacturing system achieves the goals of the economic unit in obtaining a sustainable competitive advantage from By eliminating waste resulting from excessive work completion time as well as high costs resulting from the unjustified increase in the number of workers.2-1. lean manufacturing.

A study (Sobhi, Aya Taher, 2021: 327) entitled (The role of flexible manufacturing strategy in achieving competitive excellence)

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Vol. 33, April, 2024
ISSN: 2749-3628,

The study aimed to establish the relationship between the flexible manufacturing strategy and achieving competitive excellence**. The study examined** a group of fertilizer companies and compared public sector and private sector companies in terms of the number of employees, the size of profits and production**. The study concluded** that there is a relationship with a positive impact of the flexible manufacturing strategy on achieving excellence. Competitive.

The concept of lean manufacturing goes back to the philosophy that characterized the Japanese administration through its management of all matters in all fields, as most organizations seek to achieve excellence to ensure their continuity and growth in the long term, as they have become operating in an environment characterized by competitiveness, which prompted them to adopt manufacturing systems that suit the environment and is considered a system. lean manufacturing is one of the most successful systems, as European and American organizations noted the significant superiority of Japanese companies over them as a result of their application of this system, as this term was introduced before (Womack, James, Daniel & Roos, Daniel) They invented lean manufacturing in their book (Machine That Changes The World), in order to describe the emerging model of this manufacturing using the Toyota production system, as Toyota was the pioneer in manufacturing methods that aim to reduce the resources that are taken from the individual product to The process of flow through the integration of the production process, as lean manufacturing is the process of eliminating waste in all stages of production and stimulating production in all processes that add value and raise the quality of the product, as well as doing things for all activities that do not add value to the product from the customer's point of view and focusing on production. On time and with high quality. (Al-Jumaili, 2021: 399) (Al-Nasser, 2022: 60). Nilsson discussed lean manufacturing as a common manufacturing tool used to continuously improve processes, through which productivity can be increased, time reduced, and competitive advantage created (Nilsson, 2018: 9). While Ghali defined it as a philosophy whose goal is to eliminate waste and reduce processes that do not add value with the aim of continuous improvement and achieving customer satisfaction (Ghali, 2018: 7). As defined by Dhayanithi & Suresh, it is the process of eliminating time and unnecessary steps from raw materials to the final product and from the idea to implementation and ordering. (Dhayanithi & Suresh, 2019: 10). Alyousef also defined it as an integrated technical and social system whose goal is to eliminate bullying by reducing the discrepancy between the supplier and the customer (Alyousef, 2019: 7). Parfenova also defined it as one of the manufacturing philosophies that is used in the process of producing high-quality products for the purpose of reducing cost, time, and effort (Parfenova, 2019: 18). Deshmukh & Vider also defined it as a management philosophy based on the philosophy of continuous improvement of operations, either by reducing unwanted activities or increasing customer value (Deshmukh & Vider, 2020: 4). Bhat & Bahandarkar also defined it as a philosophy whose focus is on improving performance, quality, practices, and processes (Bhat & Bahandarkar, 2020: 20). From the above, researchers can define lean manufacturing as (a manufacturing philosophy through which the company seeks to increase value for the customer through the use of a set of techniques, tools and principles that work to eliminate waste in all its forms and thus reduce time, cost and effort and increase efficiency and quality, which reflects positively on the company's profitability. And its continuation in the future in a way that makes the company a sustainable competitive advantage among its peers from other companies.

When addressing the concept of lean alongside sustainability, this concept has gradually shifted from referring to a single area of stability to a dynamic and continuous system, which more accurately captures the essence of the real world. Through an evolutionary approach, it is difficult to envision a state of equilibrium given the large number of factors typically involved in such complex systems, all of which are constantly changing. A lean system must be able to accommodate disturbances due to the uncertainty and unpredictability of the system. The concepts of the cycle of adaptation and ecological resilience incorporate this impression of dynamism and allow for continued adaptation and transformation as one of the best ways to confront uncertainty. In 2002, Carpenter proposed the following three possible aspects of resilience: (1) response to disturbances; (2) the ability to self-regulate; and (3) the ability to learn and adapt. Additional critical characteristics of a lean system are presented within a framework referred to as "lean thinking." The ability to adapt and transform are essential features of a lean system. (Walker and all., 2004) defined convertibility as "a means of defining and creating new stability landscapes through the figure number (.....).Adaptation Cycle The idea of the adaptation cycle of resilience embodies the concept of continuous change, which has been expanded into the resilience literature. The adaptation cycle consists of four stages, namely exploitation (r), conservation (K), release (Ω), and reorganization (α), as shown in the figure (...). The front loop of the process usually occurs over a longer period of time than the other, involves a transition from exploitation/growth to conservation, and is characterized by increasing interconnectedness and stability. After the conservation phase, the system disintegrates in a loop back to the release phase and then reorganizes to reach the growth phase, completing the cycle (Vivek & Masaru & Miguel, 2017, 17).

World Economics & Finance Bulletin (WEFB)
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Vol. 33, April, 2024
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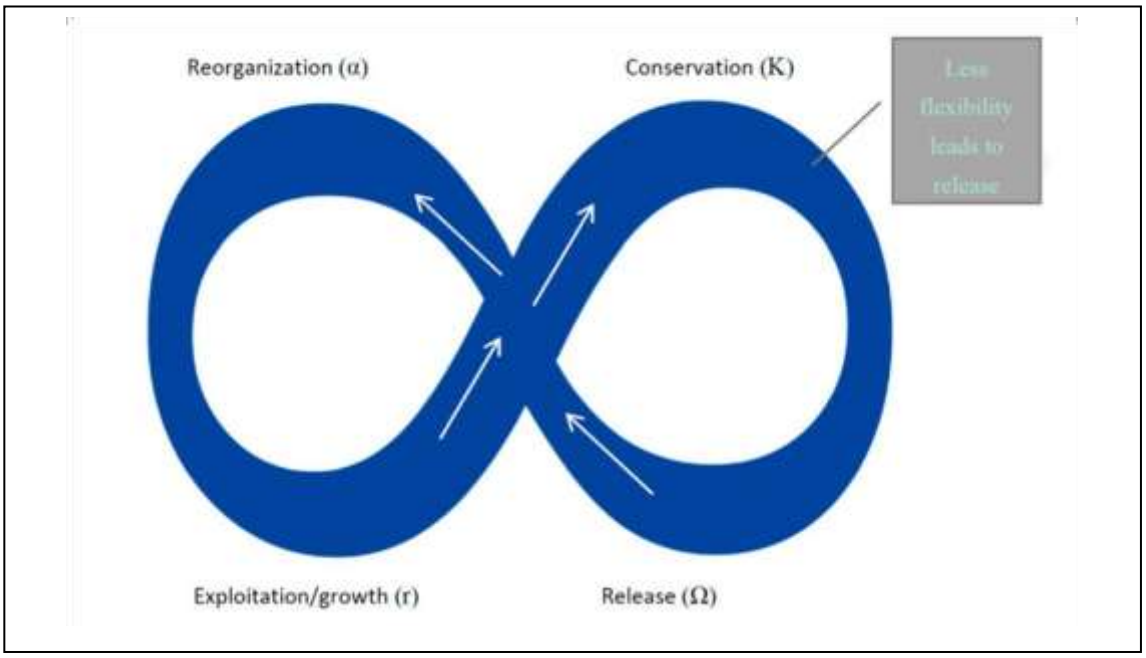

2-2. Objectives of lean manufacturing:

There are many goals for lean manufacturing, and these goals include the following: (Khalil, Shaheen, 2022: 438)

1- Improving quality: This is done by understanding customers' needs and designing processes that meet their desires and expectations, which leads to maintaining competitiveness in the market.
2- Eliminating waste: This is done by eliminating or reducing all activities that do not add value to the product or service.
3- Reducing time: It is considered one of the most important steps and methods through which the organization seeks to reduce costs and eliminate waste.
4- Reducing costs: This is done by producing products according to customer requests and at the right time.

2-3. Principles of lean manufacturing:

Lean manufacturing is based on a number of principles, including the following: (Abdul Razzaq et al., 2021: 140) (Al-Shawadfi, 2022, 576):

1- Determine the value: The value can be determined by reflecting what the customer wants and not what the organization thinks, as the value changes with the change in the preferences and desires of customers, so goods and services are designed and provided according to the customer's desires and preferences.
2- Defining the value stream: It means the sequence or stages of the product's life from the raw materials until they reach the final customer. It includes all the steps, treatments and tasks that add value and aims to eliminate activities and steps that do not add value.
3- Creating value that generates flow options: Stoppages in the value chain are one of the reasons that generate waste. Therefore, flow is one of the main factors for eliminating waste, as it is possible to determine the resources needed for each step of the production process.
4- Pull: It means producing products that are used by the customer, and it represents a short-term response to demand rates, as it can achieve flexibility in the design of goods and services in the short term.
5- Perfection: Perfection requires continuing the process of continuous improvement in order to achieve the organization's goals and achieve perfection for the customer. This requires knowledge of every step of the value chain, which leads to the provision of goods and services at the right time and at appropriate prices. The following figure shows the principles of lean or lean manufacturing:

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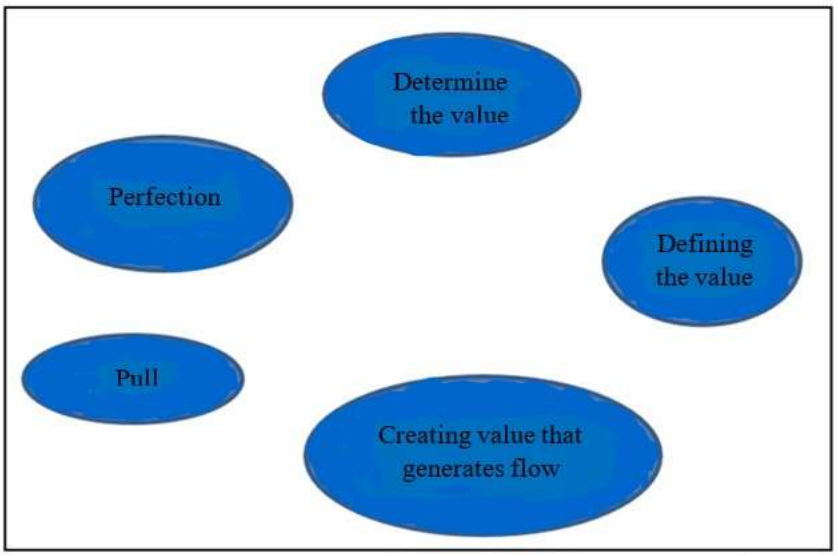
ISSN: 2749-3628,



3.Sustainable competitive advantage

Sustainable competitive advantage is considered one of the modern ideas. This idea appeared in (1984) when (DAY) proposed different types of strategies that would help maintain a competitive advantage. The term Sustainable, Competitive Advantage appeared in (1985), when Porter discussed The basic types of competitive strategies that an organization can have (Hoffman, 2001:11). Despite this, Porter did not provide a formal definition of sustainable competitive advantage, while Barney (1991) presented a concept about sustainable competitive advantage, including continuity of benefits, application of modern strategies, and value creation in a way that does not coincide with potential competitors, as they cannot imitate it. This advantage is linked to the extent of the ability to The establishment is required to create and maintain a competitive advantage for the long term, as sustainable competitive advantage is affected by several factors, including the size of the market, access to customers and resources, and what restrictions are imposed on the strength of competitors. (Hakkak & Ghadsi, 2015: 300). Kang also explained that sustainable competitive advantage can be determined by the internal resources that the facility possesses and the competitive position within the relevant industry. (Kang et al; 2020: 4). While Hung suggests that an organization's possession of rare, valuable, and non-substitutable resources puts it in a position to have a sustainable competitive advantage (Hung et al; 2015: 4).

There are many definitions of sustainable competitive advantage, as Afuah defined it as the ability of an enterprise to achieve profits greater than the average profit in the competitive market. (Afuah, 2009: 17). While Low & Proveen defined it as something positive that distinguishes the establishment and its products from its competitors in the markets from the point of view of customers and users (Low & Proveen, 2010: 64). Ehmke also defined it as an advantage that an establishment gains over competitors by providing the greatest value to customers, whether through reducing prices or providing additional services and benefits that justify its high prices. (Ehmke, 2011: 5-1). While (Nguyen & Tran) defined it as the assets, capabilities, and characteristics that the company possesses, which are difficult to replicate or imitate, and help the company achieve advanced and superior positions over competitors in the long term. (Nguyen & Tran, 2021: 201). While (Fadil, Al-Amiri) defined it as the ability through which the company can outperform competitors in the competitive market through the distinguished services it provides and meet the requests and desires of customers in unique ways that are difficult to imitate. (Fadil, Al-Amiri, 2022: 56). It is also defined as a set of offensive or defensive measures whose goal is to create a competitive center within the industry through which the organization can practice its activities with other competitors. This is done by constantly striving to provide support for its competitive strategies through modern methods that enable it to keep pace with developments in the market. (Al-Ghanam, 2022, 583) It is also known as the fact that an organization does its work better than competitors or differently from them, which helps the organization increase its market share and thus increase profitability. (Najat, Marwa, 2021: 21). Through the above, researchers can define sustainable competitive advantage as the ability of an establishment to possess competitive

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 33, April, 2024
ISSN: 2749-3628,

ability through its ability to adopt effective competitive strategies, through which it emphasizes distinction and difference from the rest of the competitors. It can also confront its competitors, increase its market share, achieve profits, and create value for customers in a way that ensures its survival and continue.

3-1. The importance of sustainable competitive advantage

(Nadarajah) believes that sustainable competitive advantage is a mechanism that works to increase and maximize the resources of enterprises in a way that achieves optimal exploitation of current business opportunities by exploring other resources to ensure the sustainability of their future competitive position according to the foundations of durability and the possibility of repeating them, given that sustainability is a process characterized by dynamism and not stability, but rather embraces change. Positively and continuously. (Nadarajah, 2013: 54). While (Hosseini) states that the possibility of maintaining profits in the competitive market is through the establishment possessing a sustainable competitive advantage because one of its conditions is the use of appropriate strategies, the purpose of which is to create a competitive advantage through effective environmental integration and organizational resources and the use of its intellectual resources or what is called intelligence. Natural. (Hosseini et al; 2018: 2). Sustainable competitive advantage is considered a positive indicator of the establishment's policy in order to gain a competitive position in the market by obtaining a higher market benefit than competitors and increasing sales volume. (Al-Gharabawi et al., 2021: 36).

3-2. Determinants of sustainable competitive advantage

Companies seeking to obtain a sustainable competitive advantage must take into account and take into account a group of factors or determinants, which are, as mentioned by (Musadieq & Benny Hutahayan, 2023: 9-10), technological innovation; knowledge management; Dynamic capacity and organizational flexibility: These determinants are very important for the technology industry because changes in the regulatory environment are inevitable in this industry. Technology develops from time to time, and this is due to digitization, which will ultimately lead to a change in supply and demand. Therefore, the flexibility and responses of companies that rely on... Organizational agility plays an important role in determining whether they succeed or fail in this business. For companies facing intense competition and constant changes in the business environment, organizational agility is considered a key competency.

3-3. Dimensions of sustainable competitive advantage

The dimensions of sustainable competitive advantage can be stated in the following points:

1- The environmental dimension: The environmental dimension is considered one of the competitive priorities of companies because it contributes to reducing the repercussions caused by productive activity in various components of the environment, and these repercussions are social, cultural, economic, and political (Di az et al; 2011: 121).
2- Quality dimension: Quality is considered one of the core competitive advantages and represents the company's strength and its primary goal because it enhances its competitive position through it. (Ward, Imran, 2021: 434).
3- Delivery dimension: It means adopting accuracy and speed in delivering the product and service to the customer, as the organization seeks to reduce the time involved in the process of delivering the product to the customer by reducing, decreasing, or reducing the period between receiving the order and delivering the product to the customer. (Nadarajah, 2013: 54).
4- Service Dimension - Product Flexibility: Service or product flexibility expresses the ability of organizations to respond to special changes in the business environment by reducing cost, effort, time, or performance during the product development period. (Ward, Imran, 2021: 434).
5- The cost dimension - size flexibility: It expresses the company's ability to change performance results by changing the production rate quickly and with high efficiency. (Ward, Imran, 2021: 435).

3-4. Indicators for measuring competitive advantage:

There are many financial and non-financial metrics that are used to measure competitive advantage, including the following: (Tarekh et al., 2023: 13-14)

1- Profitability measure: It is considered one of the measures that are used as an indicator of the extent of the company's success in achieving its goals, as high profitability is evidence of the good advantage that the company enjoys, and low profitability is a negative indicator and evidence of weak competitive advantage, and what is taken into account is that it does not take into account future profits.
2- Market share: The market share that the company obtains in the competitive market is the measure that reflects the company's competitiveness and profit in the short term.
3- Manufacturing cost: Manufacturing cost is considered one of the important measures, as this cost being higher than the price or profit of the product is evidence that the company does not have a competitive advantage and vice versa.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 33, April, 2024
ISSN: 2749-3628,

4- Productivity: Productivity works to measure the efficiency and effectiveness of value chain activities and the role it plays in transforming inputs for production into finished products, but what is criticized for it is that it does not meet the advantages and disadvantages of the cost of these inputs. Also, the outputs are measured in physical units and it also does not explain the attractiveness of the products that are displayed.

Research hypotheses

(H0): There is no significant effect of lean manufacturing systems on sustainable competitive advantage.
(H1): There is a significant effect of the elements of the lean manufacturing system on sustainable competitive advantage. The following sub-hypotheses fall under it:
H1a: There is a significant effect of process flow on sustainable competitive advantage
H1b: There is a significant effect of value engineering on sustainable competitive advantage.
H1c: There is a significant effect of time management on sustainable competitive advantage.
H1d: There is a significant effect of comprehensive quality on sustainable competitive advantage.

Research limitations

The limits of the research were limited to examining the impact of lean manufacturing tools on sustainable competitive advantage, and the spatial limits were industrial companies in Anbar Governorate - Iraq.

The applied aspect of research

First: Description of the research population and sample

Our research deals with an industrial community composed of government industrial companies. The General Company for Glass and Refractories, the Fallujah Cement Factory, the Al-Qaim Cement Factory, and the Kubaisa Cement Factory were chosen as the field for our research. These economic units were chosen as they are among the largest factories in Anbar Governorate and possess technical cadres with long experience in their field of work. A simplified definition of these companies can be reviewed as shown in the table below:

Table No. (1): An introductory summary of the research sample

Company No	Company Name	Date of Establishment	Production type	Number of production lines	Production started	Design capacity
1	Fallujah Cement Factory	1978	White cement	3	1984	291,000 tons/year
2	Kabisa Cement Factory	1981	Ordinary Portland cement	2	1984	2000000 tons/year
3	Al-Qaim Cement Factory	1986	Cement resistant to sulfur salts	1	1989	1000000 tons/year
4	General Company for Glass and Refractories	1971	Production of glass, refractories and ceramics		1972	22700 tons/year

Source: prepared by the researchers

A sample of employees in senior departments and specialists in the field of manufacturing and production will be selected from the owners of these economic units to answer the paragraphs of the questionnaire designed to meet the objectives of the research.

Second: The research sample

The researchers relied on the purposive sampling method in selecting the sample through which elements are selected from the study population who have the ability to provide information about the research problem in an accurate and objective manner. A number of (35) individuals were selected, and below is the full description of the sample selected for the research.

Table No. (2) Details of the research sample

Economic unit	Number of sample	Senior management of the unit	Production units	Manufacturing units

World Economics & Finance Bulletin (WEFB)
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Vol. 33, April, 2024
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Fallujah Cement Factory	9	2	3	4
Kabisa Cement Factory	9	2	3	4
Al-Qaim Cement Factory	8	2	2	4
General Company for Glass and Refractories	9	2	3	4
Total	35	8	11	16

Source: prepared by the researchers

Third: Research variables and building the mathematical model

The research relies on one (independent) explanatory variable, which is (lean manufacturing system), and is decomposed into sub-factors, which are (process flow, value engineering, time management, and comprehensive quality), and one dependent variable, which is (sustainable competitive advantage), where a questionnaire was built. A survey (questionnaire) of these variables according to a five-point Likert scale, as this form includes a number of paragraphs that are compatible with the objectives and problem of the research to be able to generate useful results. The lean manufacturing system includes (23) items, while the competitive advantage includes (15) items. On this basis, a mathematical model can be built for the research through the following:

$$SCA_i = \alpha_i + \beta_1 PF_i + \beta_2 VE_i + \beta_3 TM_i + \beta_4 CQ_i + \varepsilon_i \quad \text{.....Model 1}$$

whereas:

- SCAi: Sustainable competitive advantage.
- αi: regression constant.
-: ß1-4 Regression coefficient for independent variables 1-4.
- PFi: Process flow.
- VEi: Value engineering.
- TMi: time management.
- CQi: comprehensive quality.
- εi: Error Term.

Fourth: Statistical methods

To achieve the objectives of the study and reach results that enable us to accept or reject the hypotheses that were formulated for this study, we relied on a number of scientific research methods, as shown below:

1- Descriptive statistics

This approach is known as the tool that deals with the phenomenon as it actually is and as it should be at the same time without the researcher's intervention in it and is available for study and measurement, where the arithmetic mean and standard deviation were used to describe descriptions of the study variables and according to the data obtained. The results of the descriptive statistics for our research variables can be reviewed in Table No. (f) below:

Table No. () Description of the research sample

Descriptive Statistics			
Variables	N	Mean	Std. Deviation
Operations Flow			
A lean manufacturing system improves process flow by reducing obstacles and interruptions in the manufacturing chain, resulting in greater flow of materials, work, and information.	35	1.8286	.45282
The lean manufacturing system eliminates any unnecessary activity or waste in the production process.	35	1.8286	.61767
It removes excess inventories, additional costs and production overruns, improving flows	35	1.7714	.64561
Lean manufacturing increases the quality of products in a way that ensures continuity of flows.	35	2.0286	.70651
Lean manufacturing grows sales and increases the facility's market share.	35	2.0000	.84017

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Vol. 33, April, 2024
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Total	**35**	**1.891**	**0.652**
Value engineering			
Lean manufacturing analyzes the product or process to determine the true value of components and functions at the lowest costs, with greater quality, and in an efficient manner.	35	2.0286	.70651
Lean manufacturing works to raise the quality of the product or service in a way that meets the customer's desire.	35	1.9429	.90563
The use of lean manufacturing fosters innovation in products and processes.	35	1.8571	.97446
Lean manufacturing works to understand the needs and desires of the customer, which creates added value.	35	2.0286	.85700
Lean manufacturing evaluates options in terms of gathering information, developing and measuring alternatives for manufacturing products.	35	1.8857	.63113
Lean manufacturing evaluates and develops ideas in relation to a complex business environment and thus creates opportunities for creativity.	35	1.8000	.71948
Total	**35**	**1.923**	**0.7990**
Time management			
Lean manufacturing works to manufacture products based on need accurately and in a timely manner.	35	1.8286	.85700
Applying a lean manufacturing method leads to reducing the cycle time of the production process.	35	1.9429	.68354
Lean manufacturing works to reduce any unnecessary or wasted time in production processes and increase the efficiency of time use in operations.	35	1.8571	.60112
Improve feeding timeliness by supplying the production line with materials and components at the ideal time that matches actual production and needs.	35	1.9714	.70651
It reduces the costs of delay in delivering products to customers.	35	2.1143	.96319
It gives flexibility in changing production lines and achieving better timing.	35	2.0000	.80440
Total	**35**	**1.952**	**0.7692**
comprehensive quality			
Lean manufacturing contributes to improving quality through manufacturing processes that are sustainable and free of defects.	35	1.9429	.76477
Lean manufacturing works to meet the customer's needs and improve their experience by achieving customer satisfaction and meeting their expectations.	35	2.1143	.83213
It promotes continuous improvement and sustainability, which enhances process development and increases efficiency and quality.	35	1.8857	.71831
Measures, monitors, analyzes performance and corrective actions.	35	1.9143	.70174
Encourages employee participation in improving processes and submitting proposals to improve efficiency and quality.	35	2.0571	.83817
The use of lean manufacturing leads to increased customer satisfaction and increases the organization's ability to retain them by improving product quality.	35	2.0000	.76696
Total	**35**	**1.985**	**0.7707**
The total sum of the dimensions	**35**	**1.938**	**0.7478**
Sustainable competitive advantage			
Our company adopts large-scale techniques and optimal investment of our resources.	35	2.0857	.70174

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 33, April, 2024
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Our company pays great attention to increasing employee productivity to reduce costs without harming the environment.	35	1.9429	.80231
Our company constantly monitors all expenses to constantly reduce them.	35	1.9429	.87255
Our company relies on obtaining price advantages from our suppliers to reduce costs while maintaining sustainable resources.	35	2.0571	.76477
Our company adopts imitation of competing products to save innovation costs.	35	2.2000	.86772
Our company has very advanced production techniques and the best competitors.	35	2.2857	.85994
Our company offers clean products that retain customers and gain new customers.	35	2.0000	.72761
Our company constantly enters new markets that are difficult for competitors to reach.	35	2.2000	1.02326
Our company has accurate inspection and control devices that prevent errors.	35	2.3429	.99832
Our company constantly introduces products with new dimensions and technologies that are different from competitors.	35	2.0286	.78537
Our company adopts the philosophy of excellence by penetrating a specific market sector.	35	2.2000	.99410
Our company has the ability to control costs when serving specific customers.	35	2.2000	.79705
The effectiveness of our company's activities for a specific market increases when it penetrates target markets with clean products.	35	2.1429	.69209
Our company's efforts are focused on marketing its products to a specific market.	35	2.3429	.93755
Our company has a distinct ability to penetrate a specific and targeted market with harmless products.	35	2.0571	.80231
Total	**35**	**2.1352**	**0.841**

Source: prepared by the researchers

Through the hypothetical mean of our research, which is represented by the number (3) and extracted from (1+2+3+4+5 / 5=3), and since our research is based on a five-point Likert scale that includes the items (1: strongly agree; 2: agree; 3 (Neutral; 4: Disagree; 5: Strongly disagree) The results of the arithmetic mean for the responses of our sample members are less than the hypothesized mean, the more the sample's responses are consistent with the statements presented, and from the table (..) it is clear to us that the arithmetic means for all The dimensions of the lean manufacturing system are (1.93) with a standard deviation of (0.74); We note that the dimension (process flow) is the dimension that most closely matches the level of response, as the average response reached (1.891), followed by the dimensions (value engineering, time management, and comprehensive quality). Also, the average of the sample members' responses to the paragraphs of the sustainable competitive advantage axis was (2.13), with a standard deviation of (0.84).

2- Validity of the measuring instrument

The researcher relied on testing the validity of the measurement tool in terms of its ability to measure what it was designed for and that the tool is free from measurement errors, whether random or systematic. In measuring the validity of the research tool, the researchers relied on both the validity and reliability of the questionnaire through the Cronbach's Alpha scale (Cron Bach's Alpha).) which takes values ranging from (0-1) is correct. If there is no stability in the data, the value of the coefficient will be equal to zero, and vice versa, there will be stability in the scale. Below are the results of the validity of the measurement tool for our research:

Reliability Statistics	
N of Items	Cronbach's Alpha
38	.932

From the table (..), we can see the results of the validity test for all variables of our research. The test results showed that the value of Cronbach's Alpha is (93%), and these values mean a high degree of reliability. Therefore, it can be said that the standards on which the study relied to measure the lean manufacturing system and sustainable

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 33, April, 2024
ISSN: 2749-3628,

competitive advantage have internal consistency in their statements, which enables us to rely on these answers in achieving the objectives of the study and analyzing its results.

3- Normal distribution test:

To ensure that the data is distributed normally, meaning whether the sample studied represents the population from which it was drawn, and whether we can generalize the results to the population as a whole. The Shapiro-Wilk test was used to test the normal distribution of our research data, and the measurement criterion to prove the normal distribution of the data is that the value be (50.0<sig). With this result, we will follow the parametric tests. We can show the results of the normal distribution of our research data according to the table below:

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sustainable competitive advantage	.125	35	.186	.967	35	.367
Lean manufacturing system	.138	35	.088	.950	35	.117

a. Lilliefors Significance Correction

We note from the table above that our research data follows a normal distribution, as we note that the sig values of the Kolmogorov-Smirnov test, as well as the sig values of the Shapiro-Wilk test, all came greater than 0.05, and for this reason we will rely on parametric tests.

4- Simple and multiple linear regression:

To analyze the research data and reach the result of the effect between the independent variable and the dependent variable, we relied on estimating regression parameters. Determine the coefficient of determination (R2) to identify the ability of the independent variable in explaining the dependent variable. The T-test is also relied upon to measure the extent of the existence of a statistically significant relationship between the independent variable and the dependent variable. According to this test, the probability value (Prob) of the estimated parameter is compared with the level The significance is 5%. If the probability value is greater than 0.05, the null hypothesis is accepted, and therefore the parameter is not statistically significant. However, if the probability value is less than 0.05, the null hypothesis is rejected and the alternative hypothesis is accepted, meaning that the result is a statistically significant relationship between the independent variable and the dependent variable.

Fifth: Results of statistical analysis

1- Results of hypothesis testing

By using multiple regression testing to demonstrate the impact of the elements of a lean manufacturing system on the sustainable competitive advantage of the companies under study, we found the following:

Model	R	R Square	Adjusted R Square	Change Statistics				
				R Square Change	F Change	df1	df2	Sig. F Change
1	.626[a]	.391	.072	.391	41.664	4	30	.004

It is clear from Table No. (...) that the calculated F value was positive (41.66) and that the statistical significance value was 0.004, which is less than 0.005. Since the rule states (when the probability value is less than 0.005, the null hypothesis is rejected and the alternative hypothesis is accepted), we therefore conclude that the elements of the lean manufacturing system (process flow, value engineering, time management and comprehensive quality affect the competitive advantage of the companies under study) and we point out that The direction of the relationship is positive, according to the test results. In addition, to examine the quality of our model, we found that the value of R2 reached (39%), meaning that the selected variables explain 39% of the change in companies' competitive advantage, and the remaining percentage of change is due to other factors.

ANOVA[a]

Model	Sum of Squares	df	Mean Square	F	Sig.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 33, April, 2024
ISSN: 2749-3628,

1	Regression	7.392	4	1.848	41.664	.004[b]
	Residual	33.322	30	1.111		
	Total	40.715	34			
a. Dependent Variable: Sustainable competitive advantage						
b. Predictors: (Constant), Total quality, process flow, time management, value engineering						

The results of the table (...) indicate that there is no problem of multicollinearity between the independent variables, through what is shown in the results of the inflation factors (VIF) for all independent variables, where all their values were shown to be less than (5), which means that there is no high or complete correlation. Between them.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.026	.891		.029	.977		
	Operations Flow	.435	.386	.207	1.126	.005	.805	1.243
	Value engineering	.054	.394	.027	.138	.000	.734	1.362
	time management	.063	.279	.043	.227	.002	.763	1.311
	comprehensive quality	.650	.317	.367	2.049	.049	.851	1.176
a. Dependent Variable: Sustainable competitive advantage								

The results in the table (...) indicate, according to the opinions of the study sample members, that there is a statistically significant effect of the variables (process flow, value engineering, time management and comprehensive quality) on the variable of sustainable competitive advantage, where the value of (B) for the regression coefficient for the independent variables reached (0.435; . 0540; 0.063; 0.650) respectively. It has a significant effect at a significance level less than (0.05). The significance of that effect is confirmed by the calculated F value, which reached (41.664), and it has a significant impact at a significance level less than (0.05). This means that a single unit change in the elements of the lean manufacturing system (process flow, value engineering, time management and comprehensive quality) will lead to an increase in the sustainable competitive advantage of the companies under study with a regression coefficient (B) value of (0.435; .0540; 0.063; 0.650) on straight. This confirms the validity of the hypotheses (H2a, H2b, H2c, H2d), and therefore a decision can be made to accept the second main hypothesis, which states (the elements of a lean manufacturing system affect sustainable competitive advantage).

2- CONCLUSION

Our research aims to examine the impact of the flexible manufacturing system on sustainable competitive advantage, taking into account three elements of the flexible manufacturing system, which are (process flow, value engineering, time management and comprehensive quality). A sample of industrial companies in Anbar Governorate (4 companies) was selected for analysis. The reality of the flexible manufacturing system and its impact on the sustainable competitive advantage of these companies. They used a questionnaire form designed for this purpose, containing 38 items that were answered by the research sample. The study concluded that the flexible manufacturing system (Lean Manufacturing System - LMS) is an approach to production management that uses technology. and automation to improve the flexibility and efficiency of manufacturing operations. We concluded that a flexible manufacturing system has several positive effects on the sustainable competitive advantage of the companies under study. This effect can be divided into several elements, according to our research. In terms of process flow, a flexible manufacturing system allows companies to change production quickly and easily to meet changing market needs. This helps companies adapt to shifts in demand and changes in requirements quickly, enhancing flexibility in the flow of operations; In terms of value engineering, the flexible manufacturing system works on analyzing the product or process in addition to analyzing the customer's desires in a way that creates for the manufacturing system a clear engineering image through which the product's efficiency can be increased and its costs reduced. As for time management, the flexible manufacturing system

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 33, April, 2024
ISSN: 2749-3628,

has the ability to quickly reconfigure production, allowing companies to bring products to market faster than competitors, which enhances their ability to interact with customer needs effectively. As for the comprehensive quality element, automation in the flexible manufacturing system reduces human error and contributes to improving the quality of products and reducing its costs, which leads to increased customer satisfaction and maintaining a good reputation. All of these elements have been proven by the results of our research to have an important impact on sustainable competitive advantage. On this basis, we recommend that there be more clear attention in terms of the use of modern manufacturing systems, which have an important impact on the economic, social and environmental aspects of each event, whether related to the company itself in terms of its competitive value among other companies or what is related to customers or the product itself. Our current research opens future research horizons that can be conducted by researchers. They are as follows:

- The impact of comprehensive automation of manufacturing systems on the pillars of sustainable development.
- The impact of modern manufacturing systems on the market value of companies - a case study.

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