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Enhancing Engineering Technology Production according to the philosophy of (Jidoka) Japanese - An analytical study of a sample of managers and heads of departments in the Electricity Department of Babylon Governorate

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Abstract
The research focused on studying the nature of the relationship and its impact between production engineering techniques and the Japanese philosophy of JIDOKA. The research problem revolved around an important question: How can production engineering techniques be enhanced through the Japanese philosophy of JIDOKA in the selected sample? To address this, managers and department heads in the Electricity Department of Babil Province were purposefully chosen as the research sample. Various statistical methods and software, including SPSS and Excel, were employed. The research yielded several conclusions, the most significant of which was the significant impact of positive reinforcement of production engineering techniques on improving and evaluating productivity through the structures, machines, equipment, tools, and manufacturing processes that form the foundation of quality in the field. One of the key recommendations endorsed by the research was the necessity of optimal investment in production engineering techniques and directing them towards fulfilling the hidden societal requirements while increasing awareness of the agile-oriented Japanese philosophy of JIDOKA in the research community.
Keywords: production technology engineering, philosophy (JIDOKA)

Introduction
The world is facing radical changes at an accelerated pace in all aspects, especially in manufacturing, over the past decade. This has led to an increasing amount of administrative, industrial, and technological research examining the emerging situation. The concept of environmental thinking has been declared as an industrial era characteristic in the last decade of the previous century. Subsequently, a scientific approach and practical application focusing on resource efficiency during production processes emerged. The aim of the current research is to formulate a strategic vision to identify the possibility of implementing production engineering techniques in local manufacturing institutions in order to keep pace with countries that are attempting to implement the concept of a sound organization. The research is concerned with all aspects related to its criteria, system, and related concepts, which have gained wide acceptance in the civilized world as one of the pillars of environmental sustainability and ecological balance due to their coherence with the requirements of clean energy sources. The research also attempts to identify the gap in the requirements for its

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activation between the available resources and necessities within the local institution while recognizing the values related to the culture of cleaner manufacturing and emphasizing the interpretation of the steps of implementing its production system. This is achieved through the activation of its methodology, components, and procedures, and adherence to its specified criteria, as it is one of the means to counteract negative impacts on the environment, reduce resource and energy consumption, and streamline raw materials in order to obtain distinguished outputs. This approach aims to minimize and eliminate all forms of waste. Thus, the research takes a direction of presenting intellectual concepts to enhance these techniques and then attempts to outline strategies for their implementation within the capabilities of the Electricity Department in Babil Province. It also identifies the necessary requirements for their implementation. Accordingly, the research is structured as follows: the first chapter addresses the research methodology, the second chapter focuses on the theoretical framework of the research, the third chapter covers the practical framework of the research, and the fourth chapter presents the research conclusions and recommendations.

Chapter One: Research Methodology

Firstly: Research Problem

The entry of production engineering techniques is considered one of the avenues for radical change aimed at rethinking the methods and approaches of organizations. This is evident in its suitability for the Iraqi environment, which faces difficulties and almost complete stagnation. It is also the most appropriate among other approaches and applications at present. The research focuses on maintaining a high level of quality, achieving excellence in light of modern technologies, and consequently preserving the universe, humanity, and the environment, which are integral parts of the value system in the manufacturing environment.

Therefore, the scientific necessity called for examining the possibility of applying production engineering techniques in the reality of the province. This highlighted the need to use modern scientific methodology to study the current situation, identify alternatives, and propose implementable solutions. The research problem was identified by raising the following questions:

1- What is the role of production technology engineering in promoting the Jidoka philosophy in the research sample?

2- What is the nature, type and influence of the relationships between engineering and production techniques in promoting the Jidoka philosophy in the research sample?

Secondly: Research Significance

1-Academic Significance:

The research holds academic importance by clarifying the concept of production engineering and its techniques, as well as the concept of the JIDOKA principle, through providing a theoretical framework that encompasses both topics. Additionally, the research raises thought-provoking questions that require discussion and exploration. This is a crucial aspect for researchers to delve into and draw conclusions, which can serve as a basis for proposing suggestions that can benefit professionals in the field of production management and operations.

2-Field Significance:

The field significance of the research lies in measuring the impact of production engineering and its techniques, along with the JIDOKA principle, among the research sample. It aims to assess their

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effectiveness in optimizing resource utilization and reducing waste in the concerned organization. By investigating this aspect, the research contributes to enhancing operational efficiency and sustainability within the organization.

Third: Research objectives

1- Statement of knowledge foundations and basic concepts of production engineering techniques.

2- Presenting a field study in the Electricity Department (Babil Governorate), the research sample, on how to use engineering production techniques, and presenting a number of proposals and recommendations to improve the situation in the researched department on the subject of the research.

Fourth: Research Hypothesis

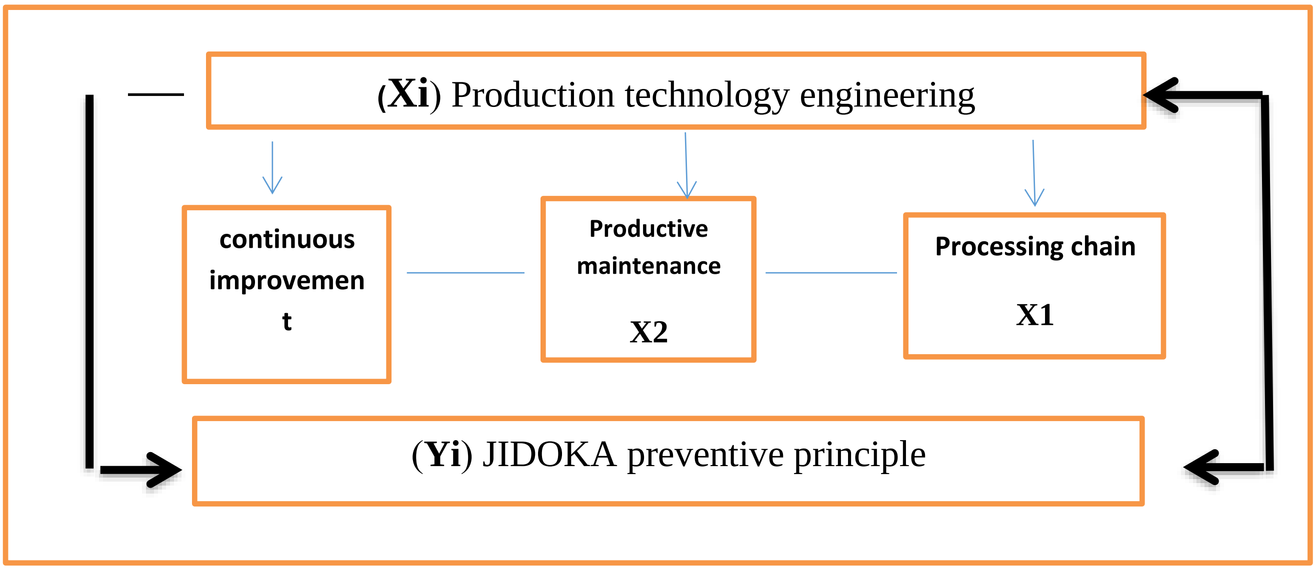
Within the framework of the hypothetical research scheme, the following hypotheses emerge:

1- The first main hypothesis: - There is a significant correlation between the engineering of production techniques and the Japanese principle of Jidoka.

2- The second main hypothesis: There is a significant effect between the engineering of production techniques and the Japanese Jidoka principle for the Electricity Department in the governorate, the research sample.

Fifth: - Hypothesis plan

For the purpose of contributing to defining the research objectives, a plan must be formulated that identifies the research variables and the connections that exist between its components, in a way that is consistent with the research problem, its objectives, and its hypotheses, as shown in Figure (1).



The source prepared by: - Researcher Figure (1) the hypothetical scheme of the research

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Sixth: - Limits of the research

1 - Time limits: The time frame for conducting the research extended for the period of time from (1/4/2023) until (1)/7/2023) which included field visits in the department, direct observation, interviews, and review of documents and documents.

2- Spatial boundaries: The Electricity Department - Babylon Governorate was chosen as a site to conduct the field study.

Seventh: Methods of collecting information and data: Information was obtained from Arab and foreign sources and reputable scientific journals, and we relied on a relative questionnaire to collect information about the reality of the department under study.

Eighth: The community and the research sample

The research attempted to study the nature of the relationships between the variables to identify the extent of the relationship and influence between the research variables. The research targeted a sample consisting of (23) managers (department heads, division managers, and unit managers) in the Electricity Department in Babylon Governorate, according to the questionnaire distributed to the sample members to know the level of their opinions. And their ideas about the research variables, and the answers were collected from the sample and analyzed statistically through the statistical program SPSS. Table 1 below shows the sample characteristics.

Table No. (1): Sample characteristics

Variables		Repetition
Age group	Less than 31 years	4
	40-31	11
	41-50	8
	51-60	
Gender	male	17
	female	6
Academic achievement	High School	-
	Bachelor's	9
	diploma	11
	Master's	3
	Ph.D	-

The results presented in Table (1) showed the characteristics of the sample in terms of gender, education level and age group. In terms of gender, the department focuses on hiring males at a greater rate compared to females, as the number of males in the department reached (17), while the number of females was (6), and this indicates the nature of work requirements within the department. As for the age group, the table indicates a great focus on appointing managers with an age group of more than 31 years, and this indicates interest in youth energies on the one hand, and experiences on the other hand, to accomplish work efficiently and quickly. As for academic achievement, the department focuses on employing holders of advanced diploma and bachelor's degrees, as they obtained the highest number (9) and (11), respectively.

The second topic/theoretical aspect

First: Production technology engineering

1- The concept and importance of production technology engineering

Lockamy (2010, 141) indicates that Engineering Technology (ET) is an entirely new field of manufacturing science, showing professionals how to achieve added value through production flexibility and customer focus. With the aim of integrating production processes in the department using advanced technologies, and improving worker efficiency. These technologies are the field of manufacturing science that deals with building modern production systems that adopt complex value chain techniques, while the efficiency of workers is trained in the use of comprehensive production techniques engineering methods. Business plans, data, operations, locations, employees and events within the department. He added (Wil, 2010:59) that it is a system based on the quality of production and the lowest cost by removing all forms of waste and building a strong foundation for the quality of the production process, as it represents an integrated and advanced system based on the philosophy of production and generating value for the customer with interest in reducing Costs. (Rao, 2012:577) believes that the engineering of production technologies indicates the ability and response to changes in the dynamic environment, according to which companies are seeking to obtain the engineering of competitive technologies in the twenty-first century, as modern companies are exposed to increasing pressure on To find new strategies for effective competition In the global market, production technology engineering is a system to enhance the organizational capacity to supply high-quality products and services, and as a result acts as an important factor to increase productivity, also defined as the ability to improve product efficiency steadily and consistently Rapid response to changes in the target market. (Bhaskar) ,2014,24). (Lilian, 2015, 12) emphasized that production technology engineering is a practical application of scientific principles in an innovative way to design and develop processes and improve structures, machines, equipment, tools, manufacturing processes and intended functions under the specific conditions of production. Accordingly, the engineering of production techniques gains its importance by influencing production processes in the industrial and economic arena, as efficiency can be achieved without integration between the concept of engineering and production techniques, and all workers must participate in knowing the elements of production processes, given that processes are the engineering focus of the company that They interact With other functional areas, from suppliers of raw materials to providing goods and services to the customer. Gunay (2018:8) sees them as semi-administrative projects that include production engineering in a radical way for any organization's operations in order to achieve continuous changes in manpower, structure, information technology, production, and coordinated performance, as well as making improvements in service, quality, and cost. Thus, production technology engineering is a synthesis of a number of ideas that flow into the management of operations and critical tests in methods of studying time and movement, managing work networks, and on-time demand, all of which focus on ease and simplification. Zomparelli (2018: 1649). While (Bayomy, 2020:5) added that the objectives of production technology engineering were as follows: -

-Rethinking of the company's operations and reorganization on a cost-based line
-Replacing traditional processes with advanced technology
-Simplification in a world that could have gradually become ever more complex
-Building new patterns of business organization
-Continuously change to keep pace with ongoing environmental changes
-Culture around new technology that can be accepted.

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(Chupryna, 2022, 115) pointed out the importance of engineering production techniques, which was represented by the following: -
-The competitive advantage it provides the organization if applied efficiently
-It is a type of advanced strategy
-It enables the organization to adopt advanced technology
-It can be applied in all organizations, whether service or production, and in all areas of life.
Leung (2018, 387) added that many organizations that adopt the application of the principles and concepts of production technology engineering want to achieve a number of benefits that can be achieved through this strategy, including: -
- Increasing the organization's ability to introduce advanced technologies and work methods that ensure that work is completed quickly, accurately, and with less effort and cost. (Maximum value added)
- Confronting the fluctuations that the organization's efficiency and effectiveness factors are exposed to very quickly. (Low material loss)
-High flexibility in providing services with the best quality, which enhances the organization's ability to compete. (Using a low shot)
- Eliminate all activities that cause the loss of financial and material resources (low environmental impact).

2- Dimensions of production technology engineering

The topic of production technology engineering is one of the modern topics at the level of contemporary administrative thought, as the real beginning of the emergence of artificial intelligence production is linked to the Fourth Industrial Revolution, which shed light on the facts, foundations, and philosophy of this technology as one of the realistic and real solutions to maximize production outputs, enhance profits, and improve quality and production (Zhang, 2018: 4020). Production technology engineering has an identity that can be shown through the three dimensions below, and these dimensions will ultimately be determined by the research and applications that may appear in the future, as production technology engineering depends on the following dimensions: (Turki, 2021: 55)

<u>1- Supply chain</u>

Supply chains are modern systems that require coordination, as they consist of all the organizations that move goods and services from the source of raw materials to the final customer. The supply chain is longer than the distribution channel because it includes the flow of materials from suppliers to producers to consumers, while the distribution channel begins with producers and is part of the overall supply chain (Motade, 2011: 211). Krajewski emphasized that supply chain management is efficient management practices. Which, if applied according to the standard plan, will have one or more capabilities compared to its competitors, and these capabilities are low prices, high quality, higher reliability, and less time for delivery. These capabilities, in turn, support the overall performance of the economic unit and can lead to raising levels of economic performance, customer satisfaction, and gaining their loyalty because they It is characterized by competitive priorities, low cost, high quality, and timely delivery (Krajewski, 2013: 392). Stevenson, 2018: 655, believes that supply chains are the flows of materials, final products, information, and money associated with the chain that add value in the up and down flows through the suppliers. organization, sales representatives and end customers. While (Niroomand, et.at, 2018:2) stated that the supply chain

is a combination of some facilities such as (suppliers, factories, distribution centers, retailers, and customers), which has a significant impact on reducing costs and improving the quality of goods and services for customers. Schroeder (2018:347) explained that there is a set of standards to measure the performance of the supply chain, as follows:
1- Cost: Where the cost from the operations management point of view generally refers to the unit cost of the good or service.
2- Quality: Where quality can be measured in several ways, including the performance of the commodity or service, conformity to specifications, and customer satisfaction.
3- Time: The total supply chain production time is just the sum of the production times (cycle times) for each of the supply chain entities.
4- Delivery: Where delivery depends on whether the commodity is custom-made or intended for storage.

2- Productive maintenance: -

Productive maintenance is of great importance in maintaining the work of the machines and preventing the sudden stop of the machines. One of the most important questions we face is when do we do the maintenance? The answer to this question requires the use of scientific methods in determining the optimal maintenance period. The research relied on two methods in calculating this period. It shows times of failure. (Almomani, 2012: 472. Assid, 2015: 478) believes that maintenance is simply the work that must be done in order to maintain the accuracy and continuity of the machine's operation and return it to its normal state after a defect occurs in it. Das Adhikary pointed out (2016: 352) One of the first studies in the Arab world that dealt with the concept of maintenance was a study conducted by the researcher Ahmed Kamal Muhammad in 1979 about the management of maintenance services in industrial facilities. Studies and research continued, and in 2004 the researcher (Young Keith) studied the possibility of improving programs Productive maintenance through the use of reliability-based maintenance. Darghouth (2016:2) showed that there are a group of types of productive maintenance, including:
A - Corrective maintenance: These are the necessary repairs to machines when they stop working for any reason.
B - Preventive maintenance: - It is a set of steps that are taken to prevent interruptions that result in a major loss for the company. In other words, preventive maintenance concerns periodic inspection and taking the necessary measures to carry out services, which reduces the possibility of interruptions.
C- Predictive maintenance: It is a type of modern maintenance that depends on future expectations.
D - Comprehensive productive maintenance: This type of maintenance was invented by the Japanese. It is a system that combines preventive maintenance and predictive maintenance, and thus the organization maintains its machines by keeping them in a working condition.
He confirmed (Basri, 2017:3): The maintenance department is responsible for preparing the standard maintenance work, which is divided into two parts: -
A- Routine maintenance: It includes all standard maintenance and repairs that can be carried out within each periodic maintenance, such as examination and inspection, cleaning, oiling and lubrication.

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B- Specialized maintenance works: These works are determined based on inspection reports during operational operations during the specified period, and the implementation of these works may require making some modifications or replacing some parts.

3- Continuous improvement: -

The philosophy of continuous improvement (CI) has emerged and developed as a result of the need and necessity felt by the Japanese for excellence and excellence in global markets. It was introduced and applied by (Masaaki Imai) in the year (1986) to improve efficiency, productivity, and the Japanese ability to respond at Toyota Carmaker to the increasing competition. Under the pressure of globalization, since then, continuous improvement has become part of the Japanese manufacturing system and has contributed significantly to the success of manufacturing. Dibia (2012:370)), and thus the roots of the method of continuous improvement (kaizen) began for the first time by the Japanese, as this philosophy appeared and developed as a result of the Japanese feeling of superiority over others in the global markets because they are the pioneers in this field, so the term (kaizen) is the word Japanese in origin and consists of two syllables: (kai), which means good change, and (zen), which means for the better. It relies on both the scientific method using statistical quality control and adaptation to the values, beliefs, and traditions of the organization that focuses on preserving workers. Sanchez (2014:1001)), and (Singh, 2015:78) explained that continuous improvement includes individuals, equipment, materials and procedures, and that its basic idea is to improve processes, which is achieved through the participation of working individuals in developing new suggestions and ideas in the organization. He added (Dudin, 2015, 44) Continuous improvement is a formal, integrated process necessary to identify and implement developments in operations. Kumar (2018: 2678) emphasized that the primary goal of continuous improvement is the approach or program that constantly seeks to improve all processes by improving the level of quality, delivery, reducing lead times, improving productivity, customer satisfaction, reducing cost and defects, and thus achieving complete mastery. (Magadha, 2020:6) indicated that continuous improvement seeks to improve performance by following a work mechanism as follows:-

A- Using benchmarking technology, through which one can search for the best applications and practices in the field of industry among competing companies in a way that reflects achieving the best performance.

B- Monitoring and controlling operations through the use of some measures, such as reducing the percentage of spoilage and reducing the product turnover time.

T- Improving processes efficiently and effectively, being able to be modified, and also having the ability to solve problems.

D - Continuous examination of activities and operations that do not add value with the aim of reducing or eliminating them.

Second: The principle of jidoka.

A Japanese principle that aims to enhance the participation of employees with the administration and hear their voices for the purpose of improvement and to develop solutions to the deficiencies as one of the modern management theories to empower the employees, which will ultimately lead to increased productivity, improvement of service quality, raising the level of job satisfaction for employees and raising the level of organizational effectiveness (Dilanthi, 2015:). He added (Sanders, 2016:811) that the word Jidoka may be a bit strange because it represents a Japanese principle of

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the Toyota company that allows workers to pull the rope and stop the car manufacturing process when noticing any defect and the use of machines and machines with human intelligence, as they form the basis of building in the field of quality. It also prepares the principle of preventing pollutants, improving behaviors, procedures and practices of production and consumption in a sustainable manner, recycling and taking environmental measures.

While (kamne, 2016:33) believes that the main philosophy of the jidoka principle is to reduce losses and waste, the jidoka principle was mentioned for the first time in the late eighties in an international study related to the automotive industry. The basic idea of the jidoka principle is to use the least of everything compared to mass production, less human effort, fewer working hours, less space in the factory, and so on. The thing that requires less defects, because the materials that the company owns need to be used in an effective manner. This principle is not only related to machines, as all production resources are included in the company, for example (workers, capital, energy). Today, the concept of manufacturing is used. Lean as a picture of this principle in many different areas with regard to improvements, so the lean is the continuation of various improvement programs such as total quality management, where he confirmed (Richard, 2016:107) that jidoka is a multi-dimensional scientific approach consisting of production with a minimum of loss or damage with identification and solution Problems with smooth flow without interruption, comprehensive maintenance of equipment, adoption of comprehensive quality systems, as well as empowerment of the workforce, which has a positive impact on the competitive performance of organizations, as it includes (quality, cost, rapid response, and flexibility). In order to achieve the highest level of benefit by collecting performance standards, which include cost, quality, reliability and flexibility, which give indicators of high diversity in products, as well as addressing activities related to technology, equipment and machinery through continuous improvement, stock fluctuation (Jit), response and customization system. (Sahai, 2019: 1023) pointed out that the principle of Jidoka is of great importance, which can be summarized as follows: -

1- The Jidoka principle is considered one of the best programs for total quality management, as it represents a basic weapon to face the challenges of the market and organizations.

2- The jidoka principle represents an important criterion in the industrial and production field because it has the ability to identify successful organizations from others, because these organizations are able to develop manufacturing models and components in order to efficiently achieve their goals and strategies.

3- The principle of jidoka is a positive indicator towards enabling organizations to occupy a strong position in the market by obtaining a larger market share than their competitors, which means that they will have more loyal customers compared to competitors on the one hand and increase their profits on the other hand.

And it expands (Gernaey, 2020:947) to indicate that the goal of the jidoka principle is to reach complete mastery by continuing to make improvements in the production processes of the organization, despite the difficulty of reaching complete mastery, but it is a major goal that must be achieved, and one of the most common goals With this principle, it is:

(Reducing costs, customer satisfaction, improving quality, eliminating activities that do not add value, achieving complete mastery)

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(Ejaz, 2020:283) pointed out that the principle of jidoka leads to reducing production costs through improving and coordinating production networks, and that there are three main factors that have a role in determining the principle of jidoka: -

1- (Product) Excluding every activity that does not lead to an increase in the added value of the product or service

2- (Market) Commitment to a high level of quality in all aspects of the organization's activities

3- (Production factors) Commitment to continuous improvement in all the company's activities or production units

The third topic (the practical aspect)

First: Coding and describing the study variables

The research consists of two main variables: the independent variable, which is the engineering of production techniques, which was measured by three sub-dimensions, and the dependent variable, which is the principle of jidoka (one-dimensional). Therefore, it is necessary to code these variables and their sub-dimensions in order to facilitate dealing with them, especially at the level of analyzing their data and referring to them in interpreting the results. Table (1) shows the variables and their sub-dimensions, the number of items that measure each dimension and their symbols in the statistical analysis.

Schedule (1)

Coding and describing the study variables according to their dimensions

Variables The main one	dimensions sub	Indicator symbol statistic	The number of paragraphs
Engineering Technology Production	Processing chain	SC	5
	Productive maintenance	PM	5
	continuous improvement	CI	5
philosophy of (Jidoka)	One-dimensional		

Second: Testing face validity and content validity

Measuring validity is one of the necessary foundations that must be verified when creating a scale for any academic phenomenon. Testing the face validity and content validity of the scale is one of the oldest and most common types of testing behavioral measures (Retterax et al., 2007: 238), as face validity is used to measure the extent of the ability to The questionnaire measures the research variables through an initial examination of the contents of the scale and its items, meaning that the validity of the scale is one of the important matters and the main steps that must be taken when designing a specific scale to study any behavioral phenomenon (Potter & Donnerstein, 2009: 264).

Third: Testing the normal distribution of data

This test is used to ensure the fairness of the data and to ensure that it follows the form of a normal distribution and within its limits or not, which gives the researcher the freedom to choose the appropriate analytical methods for this data, as the researcher can use parametric methods in testing

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and analysis if the data is subject to a normal distribution, but if it is not subject to If the data are normally distributed, it is necessary to adopt nonparametric methods in testing and analysis.

Fourth: Confirmatory structural validity test

The aim of conducting the confirmatory factor analysis test is to ensure the validity of the theoretical constructs of the research variables and their accuracy in the field. In conducting the confirmatory factor analysis, the researcher used the statistical program (SPSS V.23), and for the purpose of evaluating the structural model resulting from the outcomes of the confirmatory factor analysis, two criteria must be verified: (Schumacher & Lomax, 2010:169): -

1- Parameter Estimates

Parameter estimates represent standard regression weights or saturation ratios, which are the values shown on the arrows that link the dimensions to the items that measure them, as parameter estimates are acceptable and feasible if their values exceed (0.40).

2- Model Fit Indices

Model conformity indicators are used to measure the extent to which the structural model achieved through the sample data conforms to the established standards, that is, to verify that the data obtained are consistent with the hypothesized model for measurement according to certain standards.

Table (2)

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N	*Indicators*	*Match quality ratio*
1	df & CMIN The ratio between values	CMIN/DF < 5
2	Comparative Fit Index (CFI)	CFI > 0.90
3	Incremental Fit indices (IFI)	IFI > 0.90
4	Tucker-Lewis Index (TLI)	TLI > 0.90
5	Root Mean Square Error of Approximation (RMSEA)	RMSEA < 0.08

Source: Byrne, B. (2010) " ***Structural equation modeling with AMOS: basic concepts, applications, and programming*** " 2nd ed , Taylor & Francis Group, U . S . A ., P.73-85

Fifth: Descriptive analysis of variables:

First: Description of the production technology engineering variable and its diagnosis

1. After the processing chain:

Table (3) shows the results of descriptive statistics for the supply chain dimension, which is represented by five field indicators (SC1 - SC5), where the overall weighted arithmetic mean for this dimension was (3.844), the standard deviation (0.613), the relative coefficient of variation (15.95%), and the relative importance (76.88%)), and this indicates that the agreement of the sample members on this dimension was high, which confirms that the department has the capabilities to achieve low prices, high quality, higher reliability, and less time for delivery, and these capabilities

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in turn support the general performance of the economic unit and can lead to raising the levels of economic performance within the governorate.

Table (3)
Descriptive statistics for the supply chain dimension

paragraphs	MEAN	S.D	%CV	Importance Relativ %ity	Arrangement of paragraphs
The supply chain helps the department find alternatives to ensure the flow of resources	4.005	0.737	18.40	80.10	1
The supply chain provides a state of readiness to change and remove activities that do not add value in the department	3.833	0.869	22.68	76.65	3
The department is keen to establish good relations between suppliers and external customers	3.727	0.908	24.36	74.55	5
The department has the ability to understand and interpret suppliers' behavior in various production situations	3.833	0.806	21.03	76.65	2
The department has the ability to adapt the processing pattern to suit production situations	3.823	1.001	26.19	76.46	4
SC The general average dimension of the supply chain	3.844	0.613	15.95	76.88	-

Source: Prepared by the researcher based on program outputs(SPSS V.23 ; Microsoft Excel)

2-dimension production maintenance:

Table (4) shows the results of the descriptive statistics for the productive maintenance dimension, which is represented by five field indicators (WM1 - WM5), where the total weighted arithmetic mean for this dimension was (3.894), the standard deviation (0.680), the relative coefficient of difference (17.47%), and the relative importance (77.88%)), and this indicates that the sample's agreement on this dimension was high, which confirms that the department performs periodic examinations and takes the necessary measures to carry out services, which reduces the possibility of interruptions.

Schedule (4)
Descriptive statistics for the productive maintenance dimension

paragraphs	MEAN	SD	CV%	Importance	Arrangeme

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				Relativ %ity	nt of parag raphs
The department applies maintenance standards because it reduces production defects	3.837	0.987	25.71	76.75	5
The department cares about maintenance because it reduces the percentage of production downtime	3.857	0.955	24.76	77.13	4
The department helps, through periodic maintenance, to detect defect sites in the production stages	3.866	0.899	23.26	77.32	3
Regular maintenance keeps the product flowing within the circuit	3.885	0.923	23.76	77.70	2
The maintenance process leads to the exploitation of lost time within the department	4.024	0.829	20.60	80.48	1
The general rate of the productive maintenance dimension, PM	3.894	0.680	17.47	77.88	-

Source: Prepared by the researcher based on program outputs(SPSS V.23 ; Microsoft Excel)

3- After continuous improvement:

Table (5) shows the results of descriptive statistics for the continuous improvement dimension, which is represented by five field indicators (CI1 - CI5), where the overall weighted arithmetic mean for this dimension was (3.844), the standard deviation (0.613), the relative coefficient of variation (15.95%), and the relative importance (76.88%) This indicates that the sample members' agreement on this dimension was high, which confirms that the study's sample department is interested in continuous improvement activities in terms of developing the capabilities and skills of its employees, production activities, improving the capabilities and technological capabilities adopted in it, and the nature of production processes and how to constantly update them.

Table (5)

Descriptive statistics for the continuous improvement dimension

paragraphs	MEAN	SD	CV%	Importance Relativity %	Arrangement of paragraphs
The department has the ability to adopt quality concepts to ensure improvement in product specifications	4.005	0.737	18.40	80.10	1

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The department emphasizes the proper implementation of tasks and making continuous improvements	3.833	0.869	22.68	76.65	3
The department adopts field inspection indicators to improve the quality of its outputs	3.727	0.908	24.36	74.55	5
The department constantly audits the goals achieved through continuous improvement activities	3.833	0.806	21.03	76.65	2
The department develops employees' continuous improvement skills (problem solving and decision making)	3.823	1.001	26.19	76.46	4
The overall rate of the continuous improvement dimension CI	3.844	0.613	15.95	76.88	-

Source: Prepared by the researcher based on program outputs(SPSS V.23 ; Microsoft Excel)

Second: Description of the variant of the Jidoka philosophy and its diagnosis:

Table (6) shows the descriptive statistics for the main Jidoka variable. It achieved an arithmetic mean of (4.002), its standard deviation value was (0.498), and a coefficient of variation of (12.44%). The relative importance achieved reached (80.04%), and this indicates that this variable has At a high level of importance, according to the answers of the sample members, and these results indicate a high level of agreement among the members of the sample surveyed regarding the existence of the dimensions of production technology engineering in the field, which confirms that the study's sample department is interested in possessing and adopting the dimensions of production technology engineering through its interest in achieving low prices, high quality, and reliability. Higher and shorter delivery time through the supply chain, and it must periodically inspect and take the necessary measures to carry out services, which reduces the possibility of interruptions through production maintenance, and direct its continuous efforts in implementing continuous improvement activities.

Table (6)
Descriptive statistics for the Jidoka variable

paragraphs	MEAN	SD	CV%	Importance Relativity %	Arrangement of paragraphs
Processing chain	3.923	0.579	14.76	78.47	3

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Production maintenance	3.965	0.548	13.83	79.29	2
continuous improvement	4.119	0.605	14.70	82.37	1
General average of Jidoka	4.002	0.498	12.44	80.04	-

Source: Prepared by the researcher based on program outputs(SPSS V.23 ; Microsoft Excel)

Sixth: Testing the study hypotheses

First: Testing the correlation hypotheses

1- Testing the first main hypothesis (there is a significant correlation between engineering production techniques and the Japanese principle of jidoka):

The results of Table (7) indicate that there is a significant positive correlation between the engineering variable of production techniques and the jidoka principle, as the value of the correlation coefficient between them was (0.551**), and this value indicates the strength of the direct relationship between these two variables at a significant level (0.01).) with a degree of confidence (99%). Based on the above, this relationship can be explained by the fact that the Electricity Department, the sample of the study, is interested in the dimensions of production technology engineering and gives the required attention in terms of supporting continuous improvement activities, especially at the level of production operations, and seeking to adopt productive maintenance programs to maintain environmental requirements, reduce costs, and update its information at the level of production. All activities, organizing the scheduling of production operations, and maintaining the flow of production lines would enhance the department's directions in achieving the Jidoka principle.

Based on the above, the first main hypothesis can be accepted.

Table (7)

Correlation coefficients between the engineering of dimensional production techniques and the Jidoka principle

Variables		continuous improvement	productive maintenance	supply chain	engineering, production techniques
Jidoka principle	Pearson Correlation	.431**	.405**	.425**	.551**
	Sig. (2tailed)	.000	.000	.000	.000
	n	23	23	23	23

Source: SPSS V.23 output.

Second: Testing the direct effect hypotheses

2- Testing the first main hypothesis (there is a significant effect between the engineering of production techniques and the Japanese Jidoka principle):

By observing Table (8), it is clear that there is a positive and significant effect of the production technology engineering variable in achieving the Jidoka principle, as we note that the results of the model conformity indicators were within the acceptance rule assigned to them, as they reached a

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value of (RMR = 0.041), which is less than the specific acceptable range. Its adult (.080). It is also clear that the value of the standard influence factor reached (0.55), which means that the production technology engineering variable affects the Jidoka principle by (55%) at the level of the district sample of the study. This means that changing one unit of deviation from the engineering of production techniques in the study's sample district will lead to a positive change in the Jidoka principle by (55%). This value is considered significant because the value of the critical ratio (C.R.) shown in Table (36) of (9.530) is a significant value at the significance level (P-Value) shown in the same table.
Based on the above, the second main hypothesis can be accepted.

Table (8)
Paths and parameters for testing the impact of production technology engineering on achieving the Jidoka principle

Paths			المعيارية S.R.W.	Estimate	S.E.	C.R.	P
Jidoka principle	<---	Production technology engineering	.551	.591	.062	9.530	***
SC	<---	Production technology engineering	.729	.974	.063	15.361	***
PM	<---	Production technology engineering	.756	1.119	.067	16.636	***
CI	<---	Production technology engineering	.760	1.067	.063	16.864	***

Source: SPSS V.23 output.

Fourth: Conclusions and recommendations
First: - Conclusions
1- The viewpoints of researchers and engineers specialized in this field differ on the standards of production technology engineering due to the difference in their philosophical orientations and specializations.
2- The results showed the validity of accepting the second main hypothesis, which includes (there is a statistically significant effect of engineering production techniques in the philosophy of jidoka, depending on the results of the statistical analysis.
3- The variables of production technology engineering did not receive sufficient attention in the department, as it appears in the weakness of the training programs and the failure to adopt the dimensions of technology engineering, and the reluctance of this department to accept studies and research that go into the field of these technologies.

4- The company's lack of interest in modern production systems (principle of jidoka (Toyota methodology) to raise production efficiency and develop the skills of engineers, given that this is related in particular to the levels of engineering of valuable production technologies and quality provided by them.

Second: Recommendations

1- Urging the Department to adopt the engineering of production techniques as variables that contribute to the measurement of production and study them that help us in formulating criteria for evaluating the value activities of the product. The results indicated that there is a positive significant effect between the variables.

2- The need to provide the variables of engineering production techniques in the department and confirm its role in improving productivity in modern production programs that are in line with production techniques, and to prepare reports and research that delve into productivity improvement standards.

3- Focusing on the impact of engineering production techniques in consolidating positive moral relations between the department's departments and employees to achieve integration in production processes and reduce costs.

4- The importance of promoting modern production systems (principle of jido) The Toyota methodology and its impact on enhancing production efficiency, providing a sense of its importance, and being objective in formulating goals and ways of applying the engineering variables of production technologies.

5- It is useful for all employees in the researched department to submit to the idea and ethics of clean manufacturing, not to resist change towards its standards, and to increase the level of preventive awareness (jidoka) because it is a philosophy that preserves the universe.

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