



The role of modern manufacturing systems in process Design

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Abstract:

The aim of the research to measure the correlation relationship between modern manufacturing systems and process design and measure the effect by adopting the regression; the research consists of two main variables, which are modern manufacturing systems and process design; it was applied in the production lines of the General Company for Construction Industries, There is a sample of managers, engineers, technicians, administrators, and some workers were selected to fill the special questionnaire with (70) forms which distributed and (65) were approved suitable for use, For data analysis the correlation coefficient was adopted to measure the relationship and regression analysis to find out the effect, Using (SPSS), So the first hypothesis for the research was rejected, that was stated (there is a correlation relationship between modern manufacturing systems and process design).

Paper type: A field study in the General Company for Construction Industries.

Keywords: modern manufacturing systems, process design.

Introduction:

The need to pay attention to modern and advanced technologies is increasing day after day, As the world since the last decade of the last century until now many rapid and tremendous developments, which included many areas. Large and rapid changes have occurred in the modern manufacturing environment, As a result of the rapid and great technical progress in the field of information technology.\

As companies provide better quality products than their competitors, and over that product quality is mainly related to product design and manufacturing processes, so the factory must be arranged dynamically from the facilities to allow easy and efficient use of the available resources and then easiest of monitoring to the production design process.

The main research problem is (Is there a correlation relationship between modern manufacturing systems and the production design process in the General Company for Construction Industries), And the main aim research is included (analyzing the correlation relationship between modern manufacturing systems and process design), a sample consisting of (65) employees in the General Company for Construction Industries was selected, The questionnaire form was also adopted as a research tool.

In this regard, the research may consist of four sections; the first included the theoretical framework of the research, while the second was the research methodology and with regard to the third the applied aspect of the research, and finally the fourth included results and recommendations.

The first: The theoretical framework**1-1 Modern manufacturing systems**

Industrial companies seek to use modern technologies in manufacturing and to organize production processes, and then increase and improve productivity at low total costs. The most modern manufacturing systems that have appeared or the so-called self-automated technologies are:

1-1-1 Group technology: an analysis of product processing processes to identify similar functions processing (Curry and Feldman, 2009: 117) and he knows it, Bozer, They assemble parts of various sizes into families based on similarity in manufacturing processes and design characteristics (Bozer, 2010: 100).

1-1-2 Cellular manufacturing system: It is the organization of workers, machines, and equipment that are spread in different departments and reorganizing them into small groups to focus on making a group of interconnected products (Heizer and Render, 2011: 338) Or, it is the gathering of products with similar characteristics into families to produce them as groups of machines as well as the employees in families on the basis of size, shape, production processes or technological behavior (Krajewski et al., 2007: 318)

1-1-3 Material handling systems: It is a technology self-propelled that deals with the transportation and handling of materials, though it can increase the efficiency of storage and retrieval and the movement of materials within the plant. Examples of this technology are storage and self-recovery systems, as it is a driverless transport medium that is fed with electricity and directed under special programs to work sites Different (Heizer and Render, 2011: 340).

1-1-4 Flexible manufacturing systems: They are systems that facilitate the control of machinery and equipment and enable companies to handle materials and machines with electronic signals, as they can be changed easily. The operator simply downloads a new program when necessary to produce new and different products, and it does not require much work to operate it (Heizer and Render, 2008: 275).

1-1-5 Computer-assisted manufacturing: It is a technology that uses specialized computer programs to direct and control manufacturing equipment, and each machine in the system has the ability to select and process a number of tools according to programmed instructions and provides a high degree of flexibility in the implementation and control of manufacturing processes.

These processes produce a commodity or service automatically through an operational design, so production and securing their supplies to control production and quality, and automated processing for offices means that an integrated computerized manufacturing system works without direct human intervention, which is a very advanced system and is applied in many production institutions, Many benefits to the organization, the most important of which is increased consumer satisfaction to increase productivity, better use of resources to improve quality, and others (Curry and Feldman, 2009: 120).

1-2 Process Design:

Design is an activity to determine the physical form of the commodity or the processes that take place in the organizations and direct responsibility for product design in some organizations may not be the essence of the operations management functions, but in most business organizations, especially in the production department, the operations department undertakes the design of the product or its redesign and the necessary adjustments to it according to For different environmental variables and the competitiveness and profitability of organizations partly depend on the design and quality of products, so the relationship of product innovation with process technology is very important; In addition, speculation about the nature of innovation can place the organization in more competitive positions than one that does not anticipate these events.

The design of the production system also depends to a large extent on the design of the products, so designing the products in a certain way may be expensive, but the cost may decrease a lot when it is designed in another way (Pufa and San, 1999: 599), In this regard, the factors affecting the design of the process are:

1-2-1 Process focus option: This option deals with different products, and often the measurement time to manufacture the products is relatively long and the interval between completion of each product (Slak, 2004: 111) because the large volumes in the production lines are associated with standard products making the linear flow possible to produce according to customers' demands (Karajewski and Ritzman, 2005: 117).

1-2-2 amount of flexibility of the required resources: They are high volume resources and low branching processes, so there is no need for flexibility in order to use resources efficiently, and we may need more efficient processes to produce only one product (Karajewski and Ritzman, 2005: 117).

1-2-3 The amount of vertical integration: It is the amount that the production system deals with in companies through a whole series of operations, from obtaining raw materials to delivery of the final product to the customer, where the greater the scope of the production system in companies from processing raw materials, inputs and outputs, the greater the amount of vertical integration, as the company must implement Some of its operations on its own or dependent on external width, so that it has little vertical integration. As for a company that sells to customers through its distribution system, it enjoys a great deal of vertical integration (Karajewski and Ritzman, 2005: 110); there are two types of vertical integration (horizontal integration: this system covers the pre-production stage, i.e., placing orders, operating planning and post-production operations, and vertical integration: achieving the integration of design or engineering Systems using a computer and computer-assisted manufacturing to cover the whole process from design to product production and shipment) (Karajewski and Ritzman, 2005: 119).

1-2-4 Customer participation: It is the process of interaction and cooperation between customers and institutions to develop and add improvements to products, or design new products that help the organization enter the labor market with competing organizations, and maintaining customers is an important and fundamental factor for organizations. Ways to increase long-term client retention and long-term profitability for the organization to survive (Iruka & Ateke, 2014: 62)

Customer engagement manufacturing is also important for producing fast, low-cost products to reduce inventory and forecast sales (Haizer and Render, 2001: 240).

1-2-5 Capital intensity: It is a combination of machines and human skills in production processes and depends on the use of large volumes to justify high fixed costs inefficient operations (Karajewski and Ritzman, 2001: 117).

The second: Research methodology

2-1 research problem:

- 1) Is there a correlation relationship between modern manufacturing systems and the production design process in the General Company for Construction Industries?
- 2) Is there an impact of modern manufacturing systems on the production design process in the research sample company?
- 3) What is the extent to which modern manufacturing systems have been adopted in the company in question?

2-2 research importance:

- 1) Finding frameworks, contents, and then applicable standards that would employ modern manufacturing systems in designing the production process in the General Company for Construction Industries.

2) Standing on the applied reality of designing the production process by adopting modern manufacturing systems in the company, the research sample, and the levels of its application at the present time.

3) Submit proposals regarding the two research variables in light of the results reached.

2-3 Research objectives:

1) Analyze the correlation between modern manufacturing systems and process design.

2) Measuring the impact of modern manufacturing systems and the process design.

2-4 Research procedures and model: The questionnaire was designed according to Likert's five-point scale consisting of five weights (strongly agree, agree, not sure, disagree, and strongly disagree), and the questionnaire consisted of two axes. The first variable: Modern manufacturing systems included (15) questions divided into five paragraphs for each paragraph, three questions According to the model (Rabi, 2014: 59) (Heizer et al., 2017) and the second variable, the process design consists of (15) questions distributed into five paragraphs for each paragraph, three questions according to the model (Zhou and Qiu, 2010: 65) (Slack et al., 2014) and to test validity and reliability, the validity factor of the questionnaire was approved using the reliability root whose value was (70). To measure reliability, the Guttman L equation was adopted, which amounted to (72%). Figure (1) shows the research model that was built:

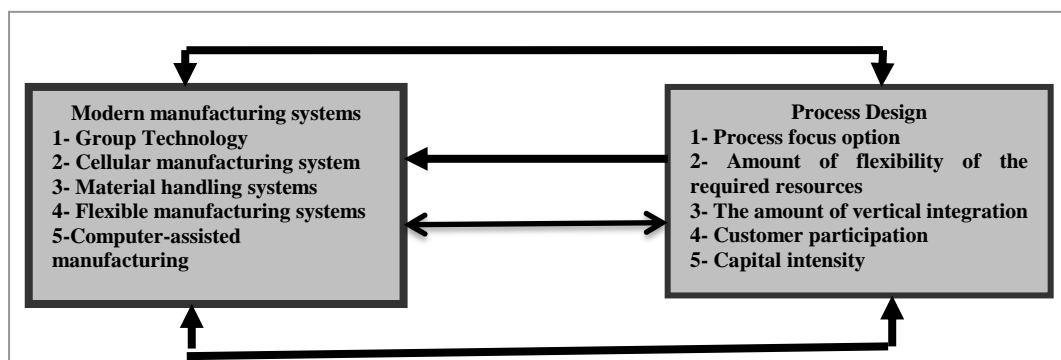


Figure (1) Research form

Source: Prepared by the researcher

2-5 Research hypotheses: The research seeks to test the following two main hypotheses:

1) There is a relationship correlation between modern manufacturing systems and the production process design.

2) There is an effect to modern manufacturing systems in the production process design.

2-6 previous studies

<p>Modern Manufacturing Systems An Information Technology perspective: The case study was also adopted in a group of industrial companies (Tzafestas, 2020: 1)</p>	<p>The aim of the research is to identify modern manufacturing systems as well as activities and processes that can be monitored and controlled at several levels. The research also addressed adaptation to rapid internal and external changes, as a variety of models and successful control methods have been developed that are based on the principles and tools of information technology, science Management is at an advanced technological level; the case study was also adopted in a group of industrial companies, and the study indicated that the current developments should be related to advanced manufacturing systems in terms of machines, robots and control devices, as direct numerical control (DCN) and computer numerical control (CNC) were used to improve mechanical processes as automatic systems provided solutions New for manufacturing tasks such as material handling, assembly, welding and spray painting.</p>
<p>The impact of production Technology in the design of process: A field Study at the General Company for the manufacture of tires in Babylon (Abbas et al., 2011: 1-56)</p>	<p>The study aimed to determine the relationship and impact of production technology and its dimensions with the design process by adopting the field study at the General Company for Tire Industry in Babil. Correlation and regression analysis. The research also reached a set of recommendations, the most important of which is the need to keep pace with contemporary developments in production and operations management, especially with regard to the use of modern technologies in production technology and process design.</p>

The third: the applied side**3-1: Description of the research population and sample**

It consisted of two paragraphs, the first related to the company in question, and the second paragraph related to the description of the research sample as follows:

3-1-1: About the General Company for Construction Industries

The company was established in (1998), and it is one of the companies affiliated with the Ministry of Industry and Minerals, as it is located in Baghdad Governorate and has other branches inside and outside the country.

The company aims to contribute to supporting the national economy in the field of production of building materials and various materials according to the approved specifications and according to the requirements of customers to achieve its own production plans.

As for the company's activities in the production lines, the company does the following:

- 1) Production of all materials necessary for construction works such as thermostats, ready-mixed concrete, structures, concrete columns, asbestos, and plastic pipes, in addition to building materials.
- 2) Developing and expanding existing factories and production lines and establishing projects in addition to their complementary lines.
- 3) Importing, buying, selling, and renting the various means of transport, machines, and tools required by the company's business in a way that improves and increases productivity in addition to its spare materials and tools.
- 4) Marketing the production locally and exporting it.

3-1-2: Personal characteristics of the sample members (the research sample)

This paragraph explains the personal characteristics of the research sample as shown in Table (1) after distributing (70) questionnaires from which (65) have been retrieved.

Table (1) Description of the research sample

sequence	variable	Categories and Designations	the number	percentage
1	Sex	Male	50	77%
		female	15	23%
		Total	65	100%
2	Social status	Married	45	69%
		Unmarried	20	31%
		Total	65	100%
3	Age	25-29	15	23%
		34-30	25	38%
		44-40	5	8%
		49-45	10	16%
		50 years or more	10	16%
		Total	65	100%
4	Academic achievement	Junior high	5	8%
		Technical Diploma	15	23%
		BA	35	53%
		Higher Diploma	2	3%
		M.A.	3	5%
		PhD	5	8%
		Total	65	100%
5	Current job location	Manager	3	5%
		Associate Manager	2	3%
		Engineer	15	23%
		Technical	25	38%
		Administrative	18	28%
		Factor	2	3%
		Total	65	100%
6	The number of years of service at the current position	5-1	6	9%
		10-6	4	6%
		11-15	5	8%
		16-20	5	8%
		25-21	15	23%
		26 years and over	30	46%
		Total	65	100%

Source: Prepared by the researcher based on the questionnaire form

It appears from the table above:

- 1) The percentage of males exceeded the females in the research sample, reaching (77%) compared to (23%). This indicates that the company relies mainly on males due to the nature of the company's research sample.
- 2) The percentage of the sample members who are married (69%) indicates the stability of workers in their work, which increases their commitment to employment.
- 3) The age group (30-34) years was the largest percentage, reaching (38%), followed by the age group (25-29) years, reaching (23%); this indicates that the sample members have mature age groups and are able to choose the appropriate answers to the questionnaire.
- 4) The percentage of holders of a Bachelor's degree was the largest, reaching (53%). This reflects the sufficient ability and knowledge of the research sample regarding the questionnaire form.
- 5) The percentage of technicians was (38%), and the largest percentage among the values was because they were the most familiar with the details of the work.
- 6) That (26 years and over) was the largest percentage, reaching (46%) among the percentages, which indicates the sufficient experience of the research sample in relation to the items of the questionnaire.

3-2: Description and analysis of the main research variables

This paragraph included a description of the paragraphs of the research variables, modern manufacturing systems, and the factors affecting the design of the production process as follows:

3-2-1 Description of modern manufacturing systems variants

Table (2) shows a description of the items of the variable of modern manufacturing systems: the arithmetic mean, standard deviation, and percentages. The paragraph (arranging the machines in the form of converging groups at each stage of production) got the highest arithmetic mean (4.49) with a standard deviation (0.640) and the highest percentage (92.3 %) in the technology of the groups, while the paragraph (the contribution in dividing the parts of the products into families and allocating the necessary equipment to treat them) reached the lowest arithmetic mean (2.56) with a standard deviation (1.249) and a percentage (23%).

With regard to the cellular manufacturing system, the paragraph (arrangement of equipment and machines with similar characteristics within families in the same manufacturing environment) reached the highest arithmetic mean (4.55) with a standard deviation (0.662) and a percentage (90.8%), Arithmetic mean (2.66) with a standard deviation (0.972) and a percentage (16.9%).

As for materials handling systems, the paragraph (the possibility of increasing the speed in transporting materials) got the highest arithmetic mean of (4.40) with a standard deviation of (0.580) and a percentage (95.4%), while the

Paragraph (reducing storage) was the same as the lowest arithmetic mean as it reached (2.09), a standard deviation (0.092), and a percentage (6.2%).

And flexible manufacturing systems were a paragraph (availability of a central computer to schedule operational operations) with the highest arithmetic mean of (4.67) with a standard deviation (0.562) and a percentage (95.5%), which is the highest percentage among the items of the variable of modern manufacturing systems, and the paragraph (relying on loading stations Machines through computer control) the lowest arithmetic mean (3.75) with a standard deviation (0.901) and a percentage (73.8%).

Finally, the computer-based manufacturing system, the section (Achieving good performance rates) got the highest arithmetic mean (4.58) with a standard deviation (0.609) and a percentage of (87.7%), and the paragraph (Using modern methods in manufacturing) got the lowest arithmetic mean (2.69) with a deviation Standard (1.249) and a percentage of (24.6%).

Table (2): the arithmetic mean, standard deviation, and percentages of the research sample answers

sequence	Variants of modern manufacturing systems	mean	standard deviation	Relative importance (Percentage of agreement)	Arrange the paragraphs and dimensions according to their degree of importance
-	The company's management applies group technology based on the following:				
1	Seeking to raise the spirit of cooperation and improve work performance.	4.20	0.689	84.6%	Sixth
2	Arranging machines in the form of close groups at each stage of production.	4.49	0.640	92.3%	The third
3	Contribute to the division of product parts into families and allocate the necessary equipment to process them.	2.56	1.249	23%	Thirteenth
First	Group technology	3.75	0.859	66.6%	
-	The company is adopting the cellular manufacturing system, through:				
4	Arranging equipment and machinery with similar characteristics with in families in a single manufacturing environment.	4.55	0.662	90.8%	The fourth
5	Allocate the group of dissimilar machines to be processed.	2.66	0.972	16.9%	Fourteenth
6	Organize workers into small groups to produce related products.	3.72	0.787	48%	tenth
Second	Cellular manufacturing system	3.64	0.747	51.9%	
-	The company relies on material handling systems to:				
7	We are reducing stock.	2.09	0.092	6.2%	Fifteenth
8	The possibility of increasing the speed in the transfer of materials.	4.40	0.580	95.4%	the second
9	We have increased production capacity.	3.72	0.818	78.5%	Seventh
Third	Material handling systems	3.40	0.496	60%	
-	The company has the ability to use flexible manufacturing systems by:				
10	Provides a central computer for scheduling operations.	4.67	0.562	95.5%	First
11	I am using a computer-controlled system to transfer materials between production machines.	3.90	0.722	69.2%	Ninth
12	Dependence on machine loading stations by computer control.	3.75	0.901	73.8%	Eighth
Fourthly	Flexible manufacturing systems	4.10	0.728	79.5%	

-	The company is interested in the computer-based manufacturing system for:				
13	We are developing visual and written communication mechanisms and replacing them with computer technologies.	3.27	1.125	47.7%	eleventh
14	The use of modern methods in manufacturing.	2.69	1.249	24.6%	Twelfth
15	Achieve good performance rates.	4.58	0.609	87.7%	Fifth
Fifth	Computer-aided manufacturing system	3.51	0.994	53.3%	

Source: Prepared by the researcher based on the questionnaire form

2-3-2: Describe the production process design variables

Table (3) shows a description of the arithmetic mean, standard deviations, and percentages of the variable paragraphs of the design of the production process, as the paragraph (changing the type of the process to suit the nature of the products provided to the customer), occurred with the highest arithmetic mean (4.47) with a standard deviation (0.709) and the highest percentage (87.7%) in The option to focus the process while the paragraph (facilitating the production of a typical product with a small variety that is produced in large quantities) was less in the arithmetic mean (2.81) with a standard deviation (1.379) and by a percentage (35.4%).

With regard to the flexibility of the required resources, the paragraph (Striving to produce a wide variety of products) reached the highest arithmetic mean (4.29) with a standard deviation (0.700) and a percentage (86.2%), and the paragraph (Owning flexible machines and equipment that helps them implement the change process successfully) At the very least, the mean is (2.66), with a standard deviation (1.243) and in a percentage (44.6%).

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As for the amount of vertical integration, the paragraph (managing its equipment from raw materials) got the highest arithmetic mean (4.44) with a standard deviation of (0.685) and a percentage (89.1%), while the paragraph (following the special distribution system) was the same as the lowest arithmetic mean. It reached (2.87), a standard deviation (1,352), and a percentage (35.3%).

As for the amount of vertical integration, the paragraph (managing its equipment from raw materials) got the highest arithmetic mean (4.44) with a standard deviation of (0.685) and a percentage (89.1%), while the paragraph (following the special distribution system) was the same as the lowest arithmetic mean. It reached (2.87), a standard deviation (1,352), and a percentage (35.3%).

Customer participation was the paragraph (considering it part of the production process) with the highest arithmetic mean of (4.63) with a standard deviation (0.486) and with a percentage (99.9%), which is the highest percentage among the paragraphs of factors affecting the design of the production process. (Its products) have the lowest arithmetic mean (2.83) with a standard deviation (1.244) and a percentage of (30.7%).

Finally, capital intensity, the paragraph (developing human capabilities to perform multiple and varied tasks) got the highest arithmetic mean (4.46) with a standard deviation (0.686) and a percentage of (89.2%), and the paragraph (Deciding to define a new process design) got the lowest arithmetic mean (2.75) with a standard deviation (1,250) and a percentage of (26.1%).

Table (3): the arithmetic mean, standard deviation, and percentages of the research sample answers

sequence	Variants of Process design	mean	standard deviation	Relative importance	Arrange the paragraphs and dimensions according to their degree of importance
-	Process focus option/company management approves process focus option for:				
1	Change the type of operation to suit the nature of the products provided to the customer.	4.47	0.709	87.7%	The fourth
2	We are facilitating the production of a typical product of little variety, produced in large quantities.	2.81	1.379	35.4%	Twelfth
3	A wide variety of products according to the customer's request in small quantities.	3.86	0.881	75.4%	Seventh
First	Process focus option	3.71	0.989	66.1%	
-	The firm applies the amount of material flexibility required by:				
4	I own flexible machinery and equipment to help them implement the change process successfully.	3.27	1.243	44.6%	tenth
5	Personnel achieves a wide range of diversity in tasks and duties.	3.60	0.996	66.1%	Ninth
6	We are striving to produce a wide variety of products.	4.29	0.700	86.2%	Fifth
Second	The amount of material elasticity required	3.72	0.979	65.5	
-	The company's management applies vertical integration to:				
7	It manages its supplies from raw materials.	4.44	0.685	89.1%	The third
8	Follow a private distribution system.	2.87	1.352	35.3%	Thirteenth
9	I own distribution channels such as distribution centers and wholesale stores.	3.38	0.913	39.9%	eleventh
Third	The amount of vertical integration	3.56	0.983	54.7%	
-	The company's management uses the following aspects to involve the customer in designing the production process:				
10	Considering it as part of the production process.	4.63	0.486	99.9%	First
11	Adopting customers' ideas to introduce new products.	3.69	0.882	73.8%	Eighth
12	They are utilizing the feedback to improve their products.	2.83	1.244	30.7%	Fourteenth
Fourthly	Customer participation	3.71	0.870	68.1%	
-	The company is developing a capital intensity plan based on the following:				
13	Decide to define a new process design.	2.75	1.250	26.1%	Fifteenth
14	Taking into consideration owning a lot of equipment with technological capabilities.	4.00	1.015	76.9%	Sixth

15	Developing human capabilities to perform multiple and varied tasks.	4.46	0.686	89.2%	the second
Fifth	Capital intensity	3.73	0.983	64%	

Source: Prepared by the researcher based on the questionnaire form

3-3: Test the correlations between the two research variables

This paragraph aims to verify the validity of the hypothesis of the correlation between modern manufacturing systems (as independent variables) and the design of the process (as a dependent variable). The test was carried out at the level of each of the independent variables to arrive at results that decide whether to accept or reject the hypothesis according to the hypothesis of the link between the independent variable and the dependent variable. For the purpose of reaching this goal, the ranks correlation coefficient was used (Spearman). Table (4) indicates that there is a weak correlation between modern manufacturing systems and the process design, as the value of the correlation coefficient at the sample level was (0.085*), which indicates a weak relationship at Level (0.05) with a degree of confidence of (0.95), which confirms the rejection of the first hypothesis (There is relationship correlation between modern manufacturing systems and the production process design).

Table (4) the correlation relationship between the two main research variables

The first hypothesis	The content of the hypothesis	Correlation coefficient	Moral Sig
	There is a relationship correlation between modern manufacturing systems and the production process design.	0.085*	0.05

Level of spirits 0.01 , * Level of spirits 0.05 N= 65 **

Source: Prepared by the researcher based on the outputs of (SPSS)

3-4: Measure the impact of the research variables

Table (5) shows the results of regression analysis between the two research variables and the existence of an effect of modern manufacturing systems in the design of the process, as the coefficient of determination (R^2) reached (0.31), a percentage indicating that (31%) of the total differences in the design of the process is determined by the company's interest in manufacturing systems. And the exploitation of these systems in the factors affecting the design of the process and that the remaining percentage (69%) represents the percentage of the contribution of the variables not included in the research model and which cannot be controlled.

The calculated value of (F) was (1.990), which is less than its tabular value of (2.000) at the degree of freedom (1 and 63) at a significant level (0.05), as the regression curve indicates that there is no effect of modern manufacturing systems in the design of the process, This indicates the rejection of the second main hypothesis, which states that (there is an effect of modern manufacturing systems on the design of the production process).

Where it appears that in modern manufacturing systems, the independent variable (Y) and the dependent variable, process design (X), will be according to the estimated regression function.

$$= \beta_0 + \beta_1 X \hat{Y}$$

$$Y = 25.925 + 0.172 X$$

Table (5) Measuring the impact of modern manufacturing systems on process Design

variable The Independent	Dependent variable Design the	The calculated (f) value	(F) Tabular value	R ²	P. value	Degree of freedom	R	R ² Ad	α value	β value
Modern manufacturing systems	Process design	1.990	2.000	0.31	0.05	1 and 63	0.175 ^a	0.015	0.172	25.925

Source: Prepared by the researcher based on the outputs of (SPSS)

The fourth: conclusions and recommendations

4-1 results

- 1) The presence of clarity and clear perception in the research sample of the variable of modern manufacturing systems and is confirmed by the high percentage of the arithmetic mean.
- 2) The existence of a clear perception among the individuals of the research sample for the design variable of the production process, and this is confirmed by the high percentage of the arithmetic mean.
- 3) The results showed a weak correlation between modern manufacturing systems and process design, and this explains the company's lack of interest in modern manufacturing systems when designing the process, which confirms the rejection of the first main hypothesis that states (there is a correlation relationship between modern manufacturing systems and the design of the production process).
- 4) The research found that there is no effect of modern manufacturing systems in the design of the process, and this confirms the rejection of the second main hypothesis that stated (there is an effect of modern manufacturing systems in the design of the process).

4-2: Recommendations

- 1) The contribution of the company must be divided into parts of the products into families and the allocation of the necessary equipment to deal with them in group technology in relation to the changing modern manufacturing systems
- 2) It is necessary to put a group of dissimilar machines to be treated when applying cellular manufacturing.

- 3) The company needs to reduce warehousing by adopting material handling systems.
- 4) Providing a computerized system for flexible manufacturing systems, as it is relied upon at the machine and equipment loading stations.
- 5) Following training curricula on how to use modern methods in the computer-based manufacturing system.
- 6) Interest in changing the type of process to suit the nature of products provided to the customer for the option of focusing the process in the process design variable.
- 7) The necessity to have flexible machinery and equipment to assist the company in successfully implementing the change process with regard to the flexibility of the required resources.
- 8) The company needs to follow a special distribution system to implement vertical integration.
- 9) The feedback should be used to improve its products regarding the customer engagement clause
- 10) It is necessary to make a decision to define a new process design in relation to the capital intensity of the process design variable.

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Appendices

Appendix (1): Questionnaire form Peace, mercy and blessings of God.

We put in your hands the questionnaire form for the research The research tagged "The role of modern manufacturing systems in designing the production process: a field study in the General Company for Construction Materials Industry". Please kindly answer the paragraphs of the questionnaire. There is no need to mention the name as it is used for scientific research purposes only.

Thankful for your cooperation with us...**First: General data**

- 1- Gender: Male () Female ()
- 2- Academic achievement: () doctorate () master () higher diploma
() bachelor's () technical diploma () junior high () and below
- 3- Scientific specialization: ()
- 4- The number of years of service: () a year

Second: procedural terminology

1- Modern manufacturing systems: The developments that occurred in the technical and scientific fields have resulted in the emergence of modern manufacturing systems, most notably:

A- Group technology: a manufacturing philosophy that calls for investing in the similarity between things (products, businesses, equipment, routes or transportation) to reduce manufacturing costs and increase productivity.

B- Cellular Manufacturing System: It is a manufacturing philosophy that relies on group technology foundations to improve quality and increase productivity.

C- Material Handling Systems: It is a self-propelled technology that specializes in transporting and handling materials, through which it can increase the efficiency of storage and retrieval and the movement of materials within the factory such as programmed conveyor belts and self-directed vehicles.

D- Flexible manufacturing systems: Self-automated systems that respond quickly to any changes in the type or design of the product through the central computer that provides the manufacturing systems with information that balances the machines and the proper scheduling of production.

E- Computer Integrated Manufacturing: It is an integrated computer-based manufacturing system in which the main functions of manufacturing are replaced by automatic technology, as the functions of design, testing, manufacturing, assembly and inspection are integrated with each other on the one hand, and with the scheduling and factory planning function on the other hand.

2- Factors influencing process design:

A- Process focus option: This option depends on the quantity of production and the degree of recommendation.

B- The amount of flexibility of the required resources: It is the ability to change in the volume of production and change in the type of product.

C- The amount of vertical integration: it means the amount by which the production system in the company handles through a whole series of processes starting from raw materials to sales and consists of backward vertical integration and forward vertical integration.

D- Customer participation: is considering the customer as part of the production process.

E - Capital intensity: The combination of equipment and human skills in production processes.

The first Variable: modern manufacturing systems: The following is a group of expressions related to modern manufacturing systems. Please choose the appropriate answer and put an (X) in front of it.

sequence	The paragraphs	I do not strongly agree (5)	I don't agree (4)	neutral (3)	Agreed (2)	I strongly agree (1)
first	Group Technology / The company's management applies group technology based on the following:					
1	Seeking to raise the spirit of cooperation and improve work performance.					
2	Arranging machines in the form of close groups at each stage of production.					
3	Contribute to the division of product parts into families and allocate the necessary equipment to process them.					
second	Cellular Manufacturing System / The company adopts the cellular manufacturing system, through:					
4	Arranging equipment and machinery with similar characteristics within families in a single manufacturing environment.					
5	Allocate the group of dissimilar machines to be processed.					
6	Organize workers into small groups to produce related products.					
third	Material Handling Systems / The company relies on material handling systems for:					
7	Reducing stock.					
8	The possibility of increasing the speed in the transfer of materials.					
9	Increased production capacity.					
fourthly	Flexible manufacturing systems / for the company the ability to use flexible manufacturing systems by the following:					
10	Provides a central computer for scheduling operations.					
11	Using a computer controlled system to transfer materials between production machines.					
12	Dependence on machine loading stations by computer control.					
fifth	Computer-based manufacturing system / the company is interested in computer-based manufacturing system for:					
13	Developing visual and written communication mechanisms and replacing them with computer technologies.					
14	The use of modern methods in manufacturing.					
15	Achieve good performance rates.					

The second Variable: process Design Please put a mark (X) in front of the answer that you think appropriate:

sequence	The paragraphs process Design	I do not strongly agree (5)	I don't agree (4)	neutral (3)	Agreed (2)	I strongly agree (1)
first	Process focus option / company management approves process focus option for:					
1	Change the type of operation to suit the nature of the production provided to the customer.					
2	Facilitating the production of a typical product of little variety, produced in large quantities.					
3	A wide variety of products according to the customer's request in small quantities.					
second	Amount of Material Flexibility Required / The company applies the amount of material elasticity required through:					
4	Owning flexible machinery and equipment to help them implement the change process successfully.					
5	Personnel achieve a wide range of diversity in tasks and duties.					
6	Striving to produce a wide variety of products.					
third	The amount of vertical integration / company management applies vertical integration to:					
7	It manages its supplies from raw materials.					
8	Follow a private distribution system.					
9	Owning distribution channels such as distribution centers and wholesale stores.					
fourthly	Customer participation / the company management uses the following aspects to involve the customer in designing the production process:					
10	Considering it as part of the production process.					
11	Adopting customers' ideas to introduce new products.					
12	Utilizing the feedback to improve their products.					
fifth	Capital Intensity / The company develops a capital intensity plan based on the following:					
13	Decide to define a new process design.					
14	Taking into consideration owning a lot of equipment with technological capabilities.					
15	Developing human capabilities to perform multiple and varied tasks.					

دور نظم التصنيع الحديثة في تصميم العملية

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المستخلص:

هدف البحث لقياس علاقة الارتباط بين نظم التصنيع الحديثة وتصميم العملية وقياس التأثير باعتماد الانحدار، اذا تكون البحث من متغيرين رئيسين هما نظم التصنيع الحديثة وتصميم العملية، وتم تطبيقه في الخطوط الانتاجية للشركة العامة لصناعة الانشائية، حيث جرى اختيار عينة من المديرين والمهندسين والفنيين والاداريين وبعض العاملين لتعبئة الاستبانة الخاصة به حيث تم توزيع (70) استمارة واعتمدت (65) منها صالحة للاستخدام، وتحليل البيانات تم اعتماد معامل الارتباط لقياس العلاقة وتحليل الانحدار لمعرفة التأثير باستعمال (SPSS)، وتوصل البحث الى رفض الفرضية الاولى التي نصت على (يوجد علاقة ارتباط بين نظم التصنيع الحديثة وتصميم العملية).

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