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The Role of the Smart Design System in Supporting Lean Manufacturing Requirements: At Alexandria Automotive Manufacturing Company in Iraq

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Abstract: The study aimed to show the central role of Intelligent Design Systems in supporting the requirements of Agile Manufacturing in the Alexandria Automobile Manufacturing Company in Iraq. To achieve this goal, it was necessary to solve the problem in the study. The solution to this problem depended on visiting the sample of companies studied and seeing the reality of applying the research topic. A data collection questionnaire was then prepared and distributed to a sample of 350 company employees. The data was then analyzed using statistical programs (SPSS, AMOS). Based on the analysis results, the study found a statistically significant influence relationship between Intelligent Design Systems in Agile Manufacturing (General) and all the dimensions of Intelligent Design Systems in Agile Manufacturing (General). It was a statistically significant influence relationship. Given this, some recommendations were proposed that would be beneficial to the company and this study.

Keywords:
Smart Design, Agile Manufacturing, Alexandria Company.

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دور نظام التصميم الذكي في دعم متطلبات التصنيع الرشيق: في شركة الإسكندرية لصناعة السيارات في العراق

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المستخلص

تهدف الدراسة الى كشف الدور الرئيسي نظام التصميم الذكي في دعم متطلبات التصنيع الرشيق: في شركة الإسكندرية لصناعة السيارات في العراق، ولتحقيق تلك الهدف لابد من معالجة مشكلة الدراسة، ان معالجة تلك المشكلة يعتمد على زيارة الشركة عينة الدراسة والاطلاع على واقع تطبيق موضوع الدراسة، وبعد ذلك تم تصميم استمارة الاستبيان لجمع البيانات، وتم توزيعها على عينة عددها 350 من العاملين في الشركة، وبعد ذلك تم تحليل البيانات باستخدام البرنامج الاحصائي (SPSS, AMOS) وفي ضوء نتائج التحليل كشفت الدراسة ان هناك علاقة تأثير معنوية ذات دلالة إحصائية لنظام التصميم الذكي في التصنيع الرشيق (اجمالا)، وكذلك هناك علاقة تأثير معنوية ذات دلالة إحصائية لكافة ابعاد نظام التصميم الذكي في التصنيع الرشيق (اجمالا)، وفي ضوء تم تقديم مجموعة من المقترحات التي تخدم الشركة والدراسة الحالية.

الكلمات المفتاحية: التصميم الذكي، التصنيع الرشيق، شركة الإسكندرية.

Introduction:

Currently, global manufacturing processes are transforming towards intelligent manufacturing, and the changes brought about by the upcoming fourth industrial revolution have given rise to more complex, more innovative products with new capabilities. This trend affects the entire product life cycle and leads to profound changes in the classic product development process (Nunes et al., 2017). This urgently requires the development of new knowledge-based, real-time intelligent products to meet the requirements of the fourth industrial revolution. In each sub-process, namely, product design, production system design, product delivery process and production improvement, computer-aided support tools are used to reduce errors in the early stages of technical design, thereby making product design more effective. (Bilal, et al., 2019)

Identifying processes that because waste is key to implementing lean manufacturing. Based on the idea that waste is any activity that incurs costs but does not add value to the customer, Toyota's production system identifies seven categories of waste: overproduction, inventory, movement, defects, transportation, overprocessing, and waiting. Overprocessing is unnecessary or incorrect and is usually caused by poor tooling or product design. This waste is also related to labor performance; as poor design leads to additional physical labor. As one of the most well-known waste control methods in manufacturing, VSM is a simple tool based on visual processes that identify all basic wastes and facilitate their disposal (Huang et al., 2022).

This study attempts to integrate intelligent design and agile manufacturing, as integrating these two variables is essential to maximizing the efficient use of all resources within an organization and eliminating all types of waste in the production process. In addition, the value provided to the customer is maximized. Achieving integration is based on four axes: previous research and development of hypotheses, research methods, theoretical framework, and field framework, until discussion of results and proposal submission.

Previous studies and hypothesis development: Study (Bilal et al., 2019) “Towards Intelligent, Experience-Based Product Design for Industry 4.0” The study introduces the concept of a Smart Virtual Product Development System (SVPD) that can support industrial product development processes and decision-making processes in product design, improving manufacturing, planning and inspection. A prototype version of the system is then developed and tested. A case study illustrates how the system design knowledge management unit works. The system successfully submitted this time supports intelligent product design and can play an important role in developing Industry 4.0.

The study (Huang et al., 2022) “Smart Manufacturing from Lean Manufacturing to Product Design 0.4” involved the process of integrating legacy machines with switch sensors that provide detailed data on the condition of the machines and provide in-depth insights into the analysis of production activities and after the implementation of agile manufacturing methods. In addition, it was shown that the collected data can be used to perform Dynamic Value Stream Mapping (DVSM) in near real-time to provide a deeper understanding of the manufacturing process level. More detailed mapping can identify waste related to labor and design, so the first key hypothesis is:

H1: There is a statistically significant effect relationship between intelligent design in agile manufacturing.

Research (Forghani & Tavasoli, 2017) “A Study on the Relationship between Knowledge Management Dimensions and Organizational Performance in Lean Manufacturing” The objective of this study was to examine the relationship between knowledge management dimensions and organizational performance in lean manufacturing. The statistical research community included Miss Sargeshma's staff. A sample of 194 people was selected from the study using simple random sampling. The research data was collected using a standard knowledge management questionnaire and an organizational performance questionnaire designed by the researcher. The data was analyzed using SPSS19 software. The Kolomogorov-Smirnov test and Pearson correlation test were used. The results of the study indicated that there is a significant relationship between knowledge management dimensions and organizational performance in agile manufacturing. Considering this, the first sub-hypothesis is:

H1.1: Lean manufacturing knowledge stock has a statistically significant effect relationship.

The study (Sartal et al., 2017) asked, "How much environment and IT are needed for lean manufacturing?" This study analyzes the role of information technology and the environment in the ability of lean manufacturing to achieve better industrial performance. It proposes hypotheses that were tested on a cross-industry sample of 763 manufacturing plants from five different European countries. The results confirm the adequate mediation of the two technologies between striped manufacturing processes and industrial performance. This requires agile manufacturing to create adequate conditions on the factory floor to develop technology-enabled capabilities to improve industrial performance by incorporating factory technologies into projects. The transition to agile manufacturing, from this perspective, is the second sub-hypothesis:

H1.2: There is a statistically significant influence relationship between information systems in agile manufacturing.

Study (Han et al., 2007) "Flexible process planning system considering designer intention and manufacturing conditions" This study proposed a manufacturing process planning system that can flexibly implement process planning, consider designer intention and eliminate interference in the manufacturing process can be solved by improving the planning of the manufacturing process to reduce manufacturing time and cost and recognize the designer's intention. Therefore, the third sub-hypothesis:

H1.3: There is a statistically significant causal relationship between the designer's intent to simplify manufacturing.

The study (Anand & Kodali, 2009), “Simulation of Design Models in Lean Manufacturing Systems – A Case Study”, This study attempted to bridge the gap between it and the literature on lean manufacturing and design model simulation in automobile workshops. The findings showed that the implementation of design model simulation in lean manufacturing systems has a significant impact on improving the performance indicators of the organization, and based on this, the fourth sub-hypothesis was proposed:

H1.4: There is a statistically significant influence relationship between design models in agile manufacturing.

Study (Gavareshki et al., 2017) “Application of Quality Function Deployment, Value Engineering and Agile Methods in Product Design Control Testing” The study discussed the identification and prioritization of product design control testing through the integration of quality function deployment techniques and value engineering According to the adoption of agile methods to improve product design productivity, the results of the study showed that the three matrices of quality function deployment, value engineering, and agile methods have a significant impact on product design testing. This study helped us to formulate the fifth sub-hypothesis:

H1.5: There is a statistically significant relationship between design testing and agile manufacturing.

Study Methodology

The problem of the study: Car manufacturers and assembly companies face the problem of wasted resources and expensive expenditures when carrying out their activities in the automotive industry. A solution to this problem must be found. At the forefront of the solution is the intelligent design system, as it plays an important role in understanding customer needs and translating them into the final product, taking into account the elimination of activities that add value to the product. In addition, intelligent design is characterized by a high degree of flexibility, which means that the design is easy to modify before implementation and determines the resources required for production to prevent manipulation. Alexander Motors is not far from this problem. To solve this problem, the following question must be asked: How can intelligent design contribute to agile manufacturing?

Objective of the study: The main objective of the study is to demonstrate the role of intelligent design in supporting the agile manufacturing needs of the Alexander Automotive Manufacturing Company. Based on this objective, we derived the following sub-objectives: 1- Diagnose the challenges of applying intelligent design and agile manufacturing in the sample companies. 2- Address these challenges based on the theoretical and practical aspects of the study.

Research Procedures: To support the practical aspects, several measures have been implemented, namely:

1. Review of previous literature, covering previous studies, developing hypotheses and covering the theoretical aspects of the study.
2. Questionnaire design, the components of which are shown in Table (1), where the questionnaire was designed based on a five-point Likert scale and assuming a mean (3).
3. The questionnaire was submitted to reviewers to determine its ability to measure the study dimensions and paragraphs.
4. The study used a descriptive analysis approach to analyze the relationship between intelligent design and agile manufacturing needs.
5. The study area was selected and represented by (Alexandria Automobile Manufacturing Company, Babylon City, Iraq) and 350 questionnaires were distributed to various employees of the company.
6. SPSS and AMOS were used in this study to analyze the data and test the hypotheses.
7. Discussion of the results and submission of recommendations.

Table (1): Questionnaire components and Cronbach alpha measurements

Study variables	Sub-dimensions	Number of paragraphs	Cronbach Alpha
Intelligent Design System	Knowledge Base	5	0.81
	Information Control	5	0.79
	Designer's intentions	5	0.85
	Design Model	5	0.80
	Design Test	5	0.88
Lean Manufacturing	Manufacturing flexibility	5	0.80
	Kanban System	5	0.86

Study variables	Sub-dimensions	Number of paragraphs	Cronbach Alpha
	Comprehensive productive maintenance	5	0.77
	Reduced initialization time	5	0.89
	Waste Management	5	0.82
	Statistical Control	5	0.90
	Continuous Improvement	5	0.89

Theoretical framework

Intelligent Design System:

Concept and dimensions of intelligent design system: User experience plays an indispensable role in designing intelligent products because building a user research system, obtaining direct information from users, and translating visions into feasible design solutions are the keys to innovation. With this in mind, the design team applied positive creativity theory to design the product through intelligent design methods intelligently, translating customer needs collected from user research into achievable functional requirements to improve user experience. Intelligent design is characterized by high flexibility, easy change, reduced time, effort and cost (Hussein, 2024), and is well known (Tsang et al., 2021, 2). Intelligent design is the use of technology to design products with a high level of quality and safety, which are easy to manufacture, use, and maintain so as to achieve customer satisfaction and superiority over competitors. Intelligent design systems exist in multiple aspects:

1. **Expert system or knowledge base:** It is one of the most valuable elements in intelligent design systems because it embodies the expert information available in virtual design and reflects it in the design of actual products or services, playing this role by designers, engineers, technical experts or external consultants using many advanced intelligent functions such as intuition, creativity, association, induction, recognition and reasoning, and carefully analyzing these functions to reach algorithms that implement these functions. Acquired. Knowledge helps solve design installation problems and perform functional tasks fully. When many sources of knowledge are

available and design solutions conflict, it is necessary to use the expert system shell together with the knowledge base. (Zhang, et. al, 2017: 635).

2. **Information control:** The effectiveness of the intelligent design system depends on the quality of the information used in the design because the design cases are published in the database of the Blackboard system, and the designers use all the functions provided by the system to develop the design and use it in the design. In this case, the intelligent design system interacts with the human designer as the final judge of the design case. The design check is then automatically performed, and the user is notified of the results. Based on these results, the system allows the system to change the design state to achieve the desired performance level (LI et al., 2020: 106).
3. **Designer's intentions:** Recognizing the intention of the designer expert during the design process is a complicated process. The difficulty lies in the fact that design intention is not a well-defined quantity and is challenging to measure. The intention of the designer can be determined by recording the reasons and circumstances that led the designer to change the original design. The intention of the designer can be determined by using an intelligent design system that facilitates this process, through which deviations from the proposed design are recorded, along with some information or explanations. This information is helpful for developing new alternatives if a similar situation arises in the future (Jamshidi et al., 2020: 5).
4. **Design model: To achieve the required integration between design functions, a reference model on which the design support tool is based must be selected.** This model must be tested on a computer to automatically evaluate the design, as the CAD system is an important factor for intelligent design. These components were developed for this work using Microsoft NET technology as a relational database management system (RDBMS) to achieve a suitable design (Zhang et al., 2017: 636).
5. **Design testing:** Design testing calls upon the model designed by the product design system to analyze the current state of the design, highlight problem areas, and indicate possible improvements. This section is made before important decisions about product features and processes (Jamshidi et al., 2020: 6).

Lean Manufacturing

The concept and dimensions of agile manufacturing (Aref and Alwan, 2024) Mean that lean manufacturing is committed to achieving high performance in exchange for reducing energy, money, time, inventory, etc., in order to achieve an increase in output and productivity, thereby better meeting customer needs. Competitive position, he believes (Bedaweed, 2023), is a flexible production system that produces and provides a variety of products at low cost and high feasibility while reducing customer waiting time because it focuses on eliminating all forms of waste, activities and practices by improving the quality and efficiency of the production process, as well as making sound and effective use of available resources, successfully applying the requirements of agile manufacturing to multiple dimensions of availability, eliminating those factors that do not add value to the product:

1. Manufacturing Flexibility: Manufacturing flexibility is an important competitive weapon for any company as it gives the company the ability to respond and adapt to various internal and external environmental conditions. This helps the company to meet different customer needs quickly, efficiently and without waste, as manufacturing flexibility requires (design flexibility, machine flexibility, worker flexibility, product flexibility). Therefore, flexibility can bring multiple competitive advantages such as B. Reduced costs, improved quality, increased customer loyalty, reduced waste and product innovation in a way that competitors cannot imitate (Al-Mousawi and Abu Loaf, 2023).
2. Kanban System: It is an effective tool for planning production processes, helps reduce the cost of processing information and its transmission to the environment, and helps determine resource requirements. The card is widely used to control the movement of production and storage and to maintain the confidentiality of product information at every stage of production and in the subsequent stages of the development process to improve product quality. Kanban cards work using two cards: a debit card and a production card. These cards indicate the part number, name, involved service station, storage location and machine capacity (Bedawid, 2023).
3. Total Productive Maintenance: It is a technical system managed by the maintenance team, which aims to reduce machine interruptions by reducing machine idle time and keeping the machines in stable and good working condition because Total Productive Maintenance is based on several requirements, the most important of which are (Planned Maintenance,

Professional Safety Work, 6S Technology, Self-Maintenance, Quality of Maintenance Operations, Continuous Improvement) (Mohammed, 2019).

4. Reduce initialization and preparation time: Agile manufacturing aims to reduce unnecessary machine downtime caused by arranging machines or changing production patterns. However,t companies are striving to adopt modern methods or specific design findings to reduce preparation time, so the initialization and preparation process is an important factor in shortening initialization time and reducing inventory in operations (Fahad et al., 2024).
5. Waste Management: Industrial companies strive to reduce solid, liquid and gaseous wastes to protect the health of workers and society at large. Waste treatment depends on the design of administrative and technical systems to prevent the release of pollutants into the environment and reduce the consumption of natural resources, thus supporting sustainable development efforts (Al-Mousawi and Abu Ragheef, 2023).
6. Statistical Control: Lean Manufacturing aims to develop a program to collect and analyze the results of the production process to find out which products are different from others. This program ensures high-quality products and firm control over all activities of the organization (Fahad et al., 2024)
7. Continuous Improvement: This is a process that aims to improve information, material flows and products to control production costs, quality and waste disposal in all systems and processes of the organization. Kaizen can use many tools and methods that help achieve success and excellence, including (Total Quality Management TQM, Sigma Six, JIT, Value Stream Planning, Dashboards, and Business Reengineering Processes) (Bedaweed, 2023).

Field Framework

Analysis of the results of the intelligent design system: The results in Table (2) show that the approval of the tested population on the dimensions of the intelligent design system reached 75.7%. From the value of the arithmetic mean (3.642) (higher than the hypothesized mean of 3) and the response rate of 72.8%, the percentage is high and statistically significant, as the dimension with the highest agreement rate (80.9 %), the response rate reached 77.9% (design test), which means that the workers are very aware of the importance of applying intelligent design. The design model was electronically tested before implementation into the final product, and the negative trends in terms of standard deviation ratio (1.000) and gap ratio (27.2) were minimal.

Table (2): Response Scale for Smart Design System in the Surveyed Company

Dimensions	Agreement Ratio	Arithmetic mean	Standard deviation	Response Rate	Gap ratio	Order
Knowledge Base	0.738	3.554	1.067	0.7108	0.2892	4
Information Control	0.716	3.433	1.012	0.6866	0.3134	5
Designer's intentions	0.782	3.761	0.968	0.7522	0.2478	2
Design Model	0.742	3.564	1.065	0.7128	0.2872	3
Design Test	0.809	3.899	0.891	0.7798	0.2202	1
Rate	0.757	3.642	1.000	0.728	0.271	

Analysis of Lean Manufacturing Results: The results of Table (3) show that most of the people in the study sample agree with all the dimensions of Lean Manufacturing (75.7%), and this percentage is high and statistically significant with respect to the value of Lean Manufacturing. The arithmetic mean (3.680), which is higher than the value of the hypothesized mean of 3, and the relationship with the response rate (73.6%). At the same time, the dimensions represent the percentage of agreement and the response rate increase (statistical control) is, because it forms the agreement rate and response rate (82.8%) and (80%) respectively, indicating that the employees have enough awareness of the application of Agile Manufacturing techniques in all the activities of the company, in good form of negative trends (mismatch), the percentage of standard deviation ratio (1.011) and gap ratio (26.3) is minimal.

Table (3): Response Scale Lean Manufacturing in the Surveyed Company

Dimensions	Agreement Ratio	Arithmetic mean	Standard deviation	Response Rate	Gap ratio	Order
Manufacturing flexibility	0.708	3.443	1.055	0.6886	0.3114	6
Kanban System	0.766	3.653	1.034	0.7306	0.2694	4

Dimensions	Agreement Ratio	Arithmetic mean	Standard deviation	Response Rate	Gap ratio	Order
Comprehensive productive maintenance	0.667	3.231	1.076	0.6462	0.3538	7
Reduced initialization time	0.803	3.887	1.011	0.7774	0.2226	3
Waste Management	0.719	3.549	1.045	0.7098	0.2902	5
Statistical Control	0.828	4.002	0.879	0.8004	0.1996	1
Continuous Improvement	0.812	3.998	0.978	0.7996	0.2004	2
Rate	0.757	3.680	1.0111	0.7360	0.263	

Hypothesis testing: Testing the first central hypothesis: Figure (1) shows that there is a significant effect relationship between intelligent design systems in lean manufacturing (overall), measured by an estimated value of 0.64. On this basis, we accept the hypothesis, and the details are shown in Table 4.

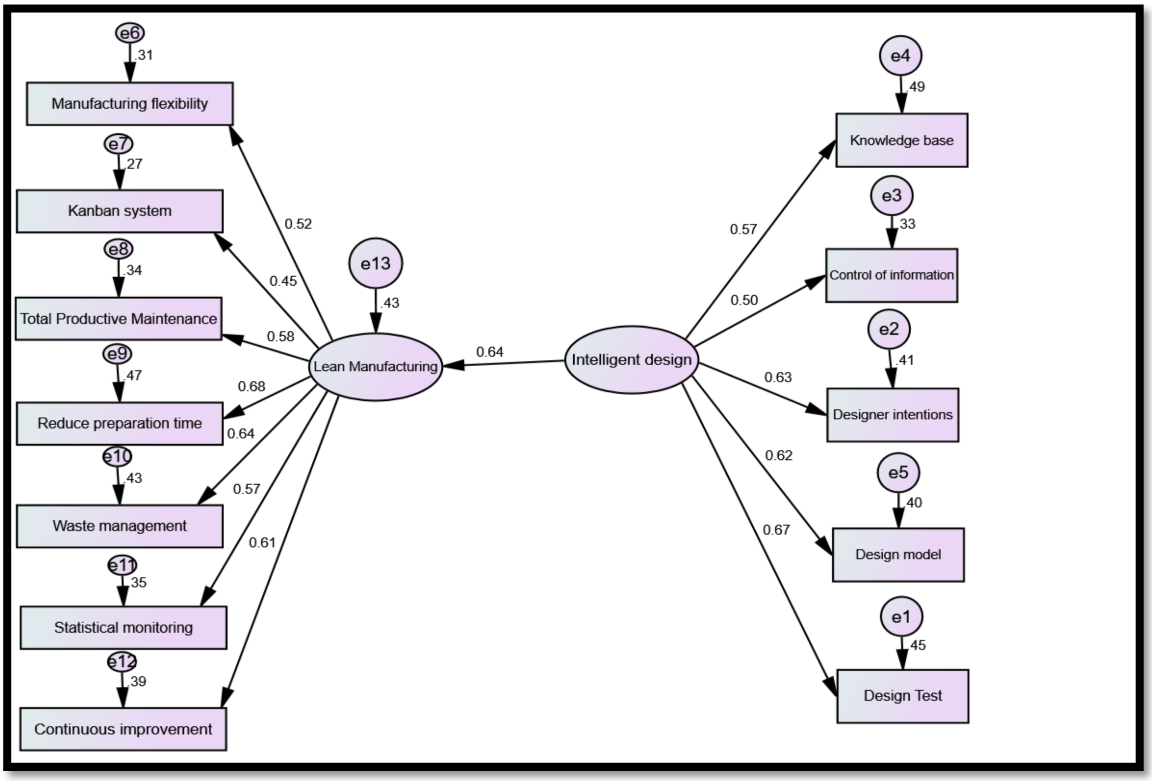

Figure (1): Structural equation model of the impact of intelligent design systems on agile manufacturing (overall)

The results of the chart in Table (4) indicate that there is a significant relationship between intelligent design systems and agile manufacturing (overall). Regarding the estimated value of regression (estimate) of 64%, each unit increase in intelligent design leads to an increase of 64% in agile manufacturing, while the standard error (standard error) measuring the variance of the estimate here is 0.033, which is low, indicating that the estimate is accurate and the critical error rate is 22.791. The estimate is more significant than ±1.96 at the 0.05 significance level, which means that the value is less than 0.001 relative to the (P) value of (000), which means that the value is less than 0.001, which indicates that the effect is highly statistically significant. This effect is unlikely to be due to chance. The value of the standardized regression coefficient SRW is 0.465, which means that intelligent design in agile manufacturing explains the manufacturing. In view of the above, we accept the first central hypothesis, which states that there is a significant positive effect relationship of intelligent design systems in agile manufacturing (overall):

Table (4): Regression analysis of lean manufacturing intelligent design system (total)

Standard regression coefficient SRW	**P**	**C.R.**	**S.E.**	**Estimate**	**Relations**		
0.465	***	22.791	.033	0.63.9	Lean Manufacturing	<---	Smart Design

Sub-hypothesis testing: Figure (2) deals with the influence relationship of the sub-variables of an intelligent design system (knowledge base, information control, design intention, design model, design test) on the dependent variable of agile manufacturing and finds that the strong relationship has a significant effect.

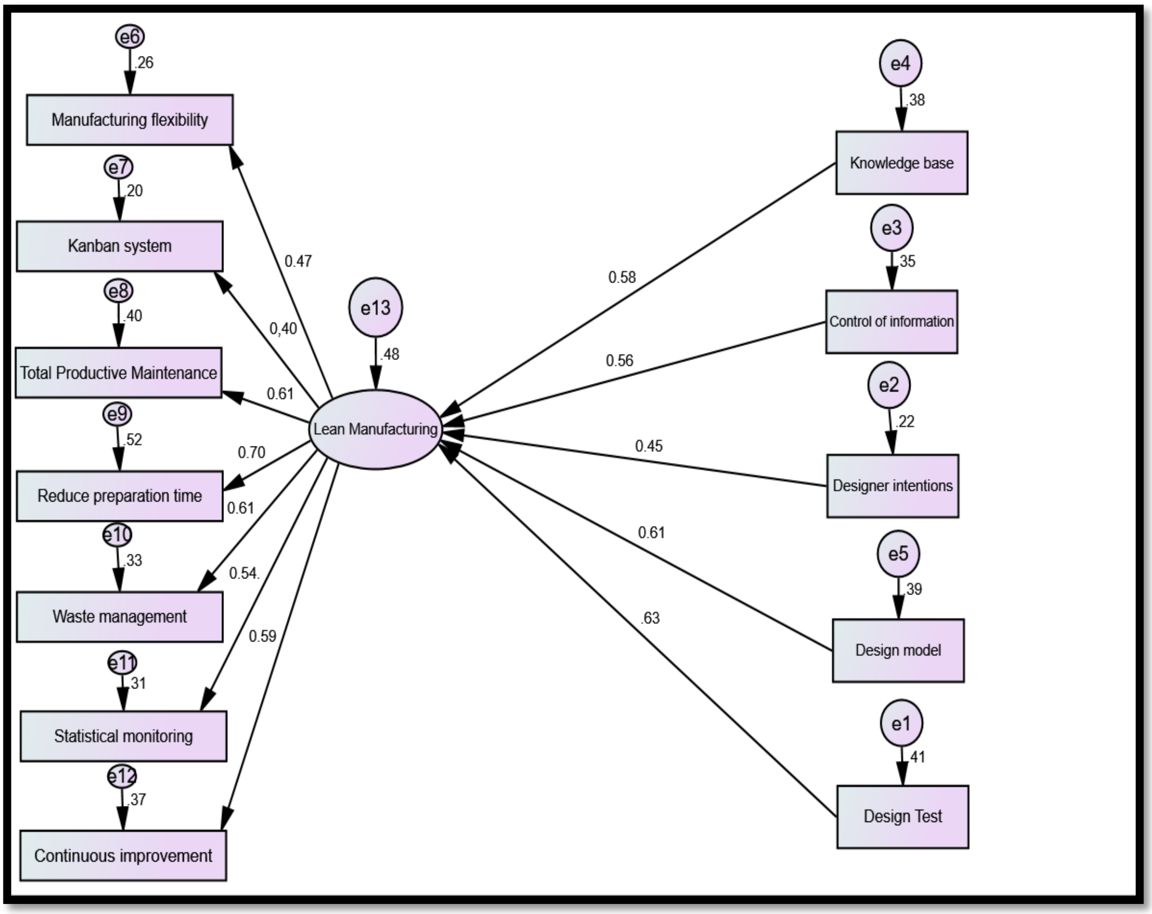

Figure (2): Structural equation modelling of the impact of smart design dimensions (individually) on lean manufacturing (overall)

The results of Figure (2) in Table (5) show that there is an effect relationship between the intelligent design (personality) dimension in lean manufacturing (overall) through the estimated values of the provided regression (estimates). Our sub-hypotheses to help test the first central hypothesis are as follows:

1. **Sub-hypothesis 1:** The results of Table (5) indicate that there is an influence relationship between the knowledge base of lean manufacturing, as long as the estimated value of the regression (estimate) is (0.58), which means that the increase in the knowledge base of lean manufacturing leads to an increase of (0.58) by one unit of the knowledge base dimension. In agile manufacturing, the standard error (S.E) is (0.061), which is very low, while the ratio to the critical ratio (C.R) is (23.977), indicating that the effect is highly statistically significant, that is, the standardized regression coefficient (SRW), whose value is (0.376), indicating that the dimensions of the defined base explain a large part of the variation in lean manufacturing. Based on

these results, we will accept the first sub-hypothesis that appears in the first central hypothesis, which states that there is no significant evidence of an influence relationship between the knowledge base of lean manufacturing.

2. **Second sub-hypothesis:** The results of Table (5) indicate the effect relationship of information control in lean manufacturing, as long as the estimated value of regression (estimate) is (0.56), which means that increasing one unit of information control dimension leads to an increase of (0.56). In agile manufacturing, the standard error (S.E) is (0.070), which is very low, while the critical ratio (C.R) is (18.542), indicating that the effect is highly statistically significant, which is related to the standardized regression coefficient (SRW), which has a value of (0.335), indicating that the information control dimension explains a large proportion of the variation in lean manufacturing, based on these results we will secondly accept the sub-hypothesis generated by the first central hypothesis, which states that (there is a significant effect relationship of information control in agile manufacturing, but there is no evidence of morality).
3. **Third Sub-hypothesis:** The results of Table (5) indicate that there is a causal relationship between designer intention in agile manufacturing and the estimated value of gradient (estimated) (0.45), which means that an increase of one unit in designer intention dimension leads to an increase of (0.45). In agile manufacturing, the standard error (S.E) is (0.081), which is very low, while the critical ratio (C.R) is (12.431), indicating that the effect is highly statistically significant. The standardized regression coefficient (SRW) is (0.234), indicating that the designer intention dimension explains an acceptable relationship. Due to the changes in agile manufacturing, from the perspective of these results, we accept the third sub-hypothesis generated by the first central hypothesis and state that: (There is an effect relationship, but there is no significant evidence of designer intention in agile manufacturing).
4. **Fourth sub-hypothesis:** The results of Table (5) show that there is an effect relationship of design model in agile manufacturing in terms of the estimated value of gradient (estimate) is (0.61), i.e., increasing the dimension of the design model by one unit leads to an increase of (0.61). In agile manufacturing, the standard error (S.E) is (0.059) which is very low, while the critical ratio (C.R) is (27.155), indicating that the effect is highly statistically significant, which is related to the standardized regression

coefficient (SRW) whose value is (0.391), indicating that the dimension of the design model explains an acceptable relationship. Due to the changes in agile manufacturing, based on these results, we will accept the fourth sub-hypothesis, which is derived from the first central hypothesis, that is, (there is an effect relationship of design model in agile manufacturing, but there is no significant evidence).

5. Fifth Sub-Hypothesis: The results of Table (5) show that there is an effect relationship of design testing in agile manufacturing in terms of the estimated value of gradient (estimated) (0.63), which means that the result increases by (0.63) after adding one Unit design test. In agile manufacturing, the standard error (S.E) is (0.057) which is very low, while the ratio to critical ratio (C.R) is (28.005), indicating that the effect is highly statistically significant, which is related to the standardized regression coefficient (SRW) whose value is (0.411), indicating that it nicely explains the change ratio of agile manufacturing after design testing. Based on these results, we accept the fifth sub-hypothesis generated by the first central hypothesis, which states that (there is no significant evidence of an effect relationship of design testing in agile manufacturing).

Table (5): Regression analysis of lean manufacturing intelligent design dimensions (individual) (total)

Relations			Estimate	S.E.	C.R.	P	Standard regression coefficient SRW
Knowledge Base	<--	Lean Manufacturing	.58	.061	23.977	***	.376
Control of information	<--	Lean Manufacturing	.56	.070	18.542	***	.335
Designer's intentions	<--	Lean Manufacturing	.45	.081	12.431	***	.234
Design Form	<--	Lean Manufacturing	.61	.059	27.155	***	.391
Design Test	<--	Lean Manufacturing	.63	.057	28.005	***	.411

Future Administrative Impact: Smart design helps reduce waste by designing more efficient and reliable cars. The integration of the two systems leads to an overall improvement in the efficiency of administrative and production processes. In addition, innovative design and agile manufacturing help product innovation, allowing companies to respond better to market demands and outperform competitors. These two variables prompt companies to establish training programs because innovative design and agile manufacturing require high skills. In addition, the integration of innovative design and agile manufacturing reduces production risks through planning, virtual testing etc., achieving operational sustainability, reducing risks, etc.

Discussion of results

The study addressed an important central question related to production and operations specialization, namely, showing the relationship between two fundamental variables for company success. For example, the relationship between intelligent design systems and agile manufacturing was discussed at the Alexander Motors Company in Babylon, Iraq. In order to develop the hypothesis of the study, previous literature was reviewed. Based on the review of this literature, it was determined that the study could not find any similar studies. The research question was: How does intelligent design promote agile manufacturing؟

The answer to this question was limited to the domain framework, where the results of intelligent design and analysis showed that the people of the study sample agreed on all dimensions of the intelligent design system (75.7%). This percentage was high and statistically significant in terms of the arithmetic mean (3.642) as well as the response rate (72.8%), as this dimension achieved the highest percentage of agreement (80.9%), while the control information dimension achieved the lowest results. In addition, the results of lean manufacturing showed that (75.7%) agreed on all dimensions, which was high and statistically significant in terms of the arithmetic mean (3.680) as well as the response rate (73)., 6%), any dimension strengthened the consistency percentage (statistical control), formed a consistency rate (82.8%), and the smallest dimension was comprehensive production maintenance.

Regarding the hypothesis testing, the Bstructural equation and its form and table show that there is a significant influence relationship between the intelligent design system for agile manufacturing in the research sample companies in general and expressly; therefore, all the hypotheses of the study were accepted because they achieved the research objective of proving the relationship between the two variables.

Based on these results, a series of recommendations must be submitted: 1. Work on developing a comprehensive strategy that takes into account the goals and importance of applying innovative design and agile manufacturing in the company. 2. The company's management needs to prepare training programs to develop employees' skills so that they have more experience in performing tasks related to innovative design and agile manufacturing. 3. Provide adequate financial resources to invest in modern technologies to achieve the integration of innovative design and agile manufacturing in the company. 4. Teamwork within the company to promote collaboration between design and production.

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