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# The role of digital lean manufacturing in enhancing a flexibility supply chain: A field study-Misan Oil Company

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**Abstract**
Today, businesses are struggling in the era of pandemic. Faced with the harsh market conditions this year and how digital technology has been changing more and more innovation mode of operations for businesses, flexibility is even more important now. Equally important is the fact that today's process of deep change will also change totally not only the physical but less competitive image of industries. Thus, in such contexts, we see the need for using companies 'ovation operation as a durable competitive edge. It is time to study factory system flexibility anew. Over the years previous research projects have examined machines and equipment, processes, pathways and personnel control systems; all looked at manufacturing plants. All this journey comes into being with the Digital Lean Manufacturing System (DLM). Businesses now realize that machine flexibility is no longer enough. If they are to survive, they must extend right down through the production line outsourced parts plus product procurement support management chain. Only the report uses national this year in digital lean manufacturing practices and their efficiency implications the questionnaire form for research sample. Moderated by a well-structured questionnaire administered to (199) academic faculty members: with examples of statistical software (AMOS V.25), survey data showed that: in the use of DLM supply chain flexibility had a positive correlation. Companies within a variety of industries are beginning to see the importance of and have shown the worth of such systems in driving up organizational performance efficiency; indeed, a theory based on lean manufacturing is all but certain to have deep roots in China society. Therefore, it is recommended that leaders of Misan Oil Company put more effort into developing its digital infrastructure in 2019.So as result they can use such technologies as artificial intelligence (AI) and Internet of Things (IoT) in a strategic way. By using AI embedded IoT equipment, processes can be constantly monitored and progress also improved on other as yet untouched areas - so that overall efficiency is enhanced. Now it is also possible to exploit Big Data systems that are planned around artificial intelligence (AI) for supply chain optimization applications in this way. Engaged in these technologies, a company can apply DLM theory to all its operations and thereby improve supply chain's robustness. The result is once again what counts.

**Keywords:** Digital lean manufacturing (DLM), resilience in the supply chain

## Introduction
For instance, when the new crown pneumonia pandemic struck, the digital economy came into being almost overnight. In such activities as online shopping, telework, online education and telemedicine, we had a large amount of virtual purchasing power. Using strategic digital manufacturing technologies can turn networks of partners that are either built from scratch or evolved proactively into helpmates 2. In this regard, research into how adaptable digital manufacturing can help make supply chains more resilient is essential, and should, first and foremost, directly benefit the practitioners out in industry. Among them include the following four elements: the core concepts that form digital manufacturing resilience, key techniques as well as case histories from those pioneering adopters. This paper will cover these main areas. Chapter One: Research General Settings-This chapter discusses what research is about. Focusing on the problem area, it lays down its scope and looks at the targets to be achieved. An also included are research hypothesis in addition, the methodology includes data collection methods, analysis tools and the research community and sample. The second section, Theoretical Framework, delves into the academic literature on digital Lean Manufacturing (DLM). The section covers the four major techniques of DLM, the problems

encountered in implementation and the advantages it obtains. In addition, this section discusses the concept of supply chain resilience-Its main components are expounded upon (See the Tramp based framework in Chapter Three). T includes a break do win of both static as well as dam (Section Two) Section Three: Practical framework - In this section, data is analyzed and a survey utilizing the right research tools represented. Research hypotheses are tested by the right statistical methods and results are sifted to find out the function of flexible digital manufacturing in enhancing supply chain resiliency. Section Four: Results and Recommendations -Shows the results carried out by researcher and most important recommendations are given.

**The First Topic**

**Methods:** While scientific research design it is usually necessary to specify the problem, its significance and goals, research hypothesis, hypothetical plan of work that this community and sample ought to be surveyed which technique will be used. The kind of information how various data should be collected are then outlined below.

**First: The Research Problem**

As regards test, the question is how to determine how an oil company Misan is being researched leanly. Oil Corroboration Misan under Digital Length Manufacturing Project (DLM) Lean manufacturing, weaving digital technologies together with lean production principles improves manufacturing even more slightly. Flexibility But, critical contribution to overall supply lace can: reduce process, add transparency to one Sower downstream quality refers, as waste per its final act of refining another way to put this is that companies which adopt flexible manufacturing methods like this are easier than those with conventional technology to meet changes in market demand. Moreover, they react much earlier and more flexibly.

In addition, they benefit from material versatility and optimal resource allocation. The main question to be investigated in this research is: when Digital lean manufacturing is used as a tool for improving supply chain flexibility, does it actually yield any substantial results?

**Second: The Importance of Research**

The importance of scientific research comes from the researcher's attempt to provide a theoretical framework that clarifies the role of flexible digital manufacturing in enhancing the flexibility of the supply chain, as most Iraqi companies need to keep pace with global companies. By production new products, using a contemporary concept that combines digital lean manufacturing (DLM) and Supply Chain Resilience

**Third: Research objective**

After identifying the research problem and its importance, the research objective can be determined, which focuses primarily on identifying the level of availability of flexible digital manufacturing that enhances the flexibility of the supply chain in a company. Misan oil is under investigation.

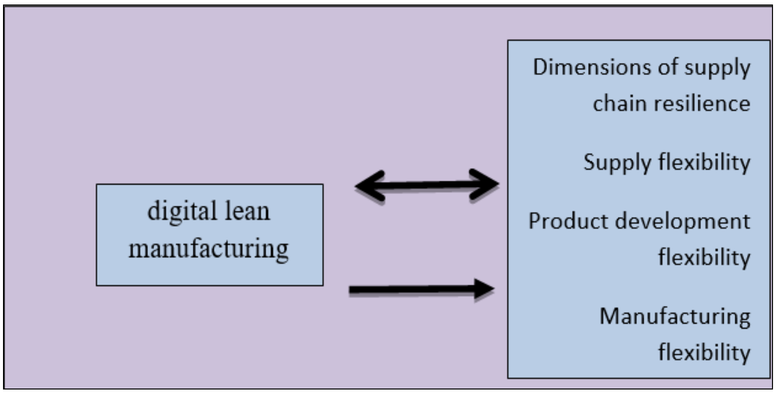
**Fourth: Research hypotheses**

In light of the problem, importance and objective of the research, the following main hypotheses were formulated:

1. The primary hypothesis suggests a statistically significant relationship between digital lean manufacturing (DLM) and supply chain resilience.
2. The second main hypothesis There is a relationship of influence Statistics morally significant to for digital lean manufacturing (DLM) in Supply chain resilience

**Fifth: The Hypothetical Plan of the Research**

In order to complete the research requirements within its theoretical and practical framework and based on the research hypotheses, the researcher developed a hypothetical diagram that clarifies the limits of the research variables and the nature of their interconnections are depicted in Figure (1).




**Source:** Prepared by the researcher

**Fig 1:** Hypothetical diagram of variable relationships

**Sixth: Research Limits**

1. Human limits of research it was represented by employees working in the Production Authority, the Halfaya Fields, and the Misan Fields Operating Authority.
2. Spatial boundaries of the research the spatial boundaries of the research were represented by Misan Oil Company.

**Seventh**

**Research Community and Sample**

This research was applied in Misan Oil Company, specifically in the Production Authority, Halfaya Fields and Misan Fields Operating Authority, where a deliberate sample was chosen consisting of (199) An individual working in the company.

**Eighth: Data Collection Methods**

- **Theoretical Framework:** To collect data for the theoretical framework, this is done by reviewing previous literature and academic studies related to digital lean manufacturing and supply chain flexibility.
- **Practical framework:** This is done by distributing a questionnaire to employees in the target organization to measure the extent to which digital lean manufacturing is implemented in enhancing supply chain resilience, using a statistical analysis program.

**The Second Topic: The Theoretical Aspect**
**First: digital Lean Manufacturing**
**1. The Concept of Digital Lean Manufacturing**

Lean manufacturing has emerged as an innovative approach to structuring and overseeing manufacturing organizations, gaining prominence since its adoption in the industry. (Womack & Roos, 2007) [26] where flexible manufacturing was applied in many organizations, and lean manufacturing was defined as doing more with less cost (Womack & Roos, 1999) and flexible manufacturing can be explained as eliminating waste (Liker, *et al.*, 2004) where flexible manufacturing was summarized in five principles which are:

- Determine the value accurately.
- Define the value stream for each product.
- Striving for perfection.

The evolution of industry and advanced digital technologies has recently introduced manufacturers to innovative approaches for enhancing production processes. (Lasi *et al.*, 2014: pp. 239-242) [13]. This development has paved the way for the integration of lean manufacturing into industry practices. Therefore, digital lean manufacturing (DLM) systems were put forward in 2007 (Raff, 2011). The manufacturing sector, and in particular small and medium-sized enterprises (SMEs), has been quick to adopt digital technologies coupled with agile behaviors to show considerable progress in recent years. This trend has inspired a new lean manufacturing concept, Digital Lean Manufacturing (DLM). In this study, we examine the conception of digital lean manufacturing (DLM) which deploys digital technology to drive the transformation from lean manufacturing practices still in infancy within manufacturing enterprises. (Ashrafian *et al.*, 2019) [3] Digital Lean Manufacturing (DLM) is believed to have come into being as early as 2007, focusing on computer-aided design (CAD) and computer-aided manufacturing (CAM) integrated products and processes develop mint (IPPD). Later manufacturing entered a phase of industrial integration and smart operation. (SMP) (Cattaneo *et al.*, 2017; Mora *et al.*, 2017) [5] The scientific community, is widely recognized as being among the first to establish and classify the concept of digital lean manufacturing (DLM). DLM is the process of acquiring, integrating, processing, and visualizing data with descriptive, predictive, prescriptive analytical tools. These instrumentations are intended to recognize, correct, predict, and MRI process parameters. Digital lean manufacturing (a) thus resembles traditional low-cost manufacturing at its core, yet it adds on advanced digital capabilities. (Romero *et al.*, 2018) [19].

**The Most Prominent Digital Lean Manufacturing Techniques (DLM):** In this research, we refer to the latest technologies related to digital lean manufacturing (DLM) has emerged as a renewed model in production management. (Powell *et al.*, 2022) [17] The movement of transformation from lean manufacturing to digital lean manufacturing depends on four techniques explained as follows:

**Big Data:** Big data not only gives managers real-time visibility into the lifecycle of manufacturing (production, operations, and equipment), but it also opens up new opportunities in asset management, end-to-end supply chain visibility, and many other aspects of manufacturing. Data is the groundwork on which the factory operates, thanks to the efficiency of advanced data.

**Collaborative robots:** Robots have expanded both in capability and presence over the years of digital lean manufacturing **(**DLM) All over the world, collaborative robots are specifically designed to interact and work alongside humans in a safer and smarter way than traditional forms of automation. It is difficult to ignore the economics, as labor costs are constantly rising.

**Analytics:** It's a common refrain among operations managers today as they struggle to anticipate market needs, quickly adjust production, and produce multiple products on a single production line. This technology requires real-time production monitoring and planning, with analytics software playing a critical role in manufacturing operations. These analytics facilitate rapid on-demand manufacturing and all other components of the product lifecycle, and therefore must be integrated with other digital capabilities, particularly manufacturing execution systems.

**Internet of Things (IOT):** The sensors and actuators that form the core of the Internet of Things are now a component of predictive maintenance and digital warehouse management. In fact, IoT-enabled equipment is capable of performing autonomous maintenance and automatically alerting managers to problems, making maintenance activities faster, cheaper, and more efficient.

**2. Benefits of Digital Lean Manufacturing (DLM)**

There are many benefits mentioned in previous studies regarding digital lean manufacturing (DLM), where we notice through the analysis of these benefits that most of them focus on operational and financial performance indicators, with a small number related to social and environmental benefits, and the most important of these benefits are:

a) Increased productivity stands out as a key advantage of digital lean manufacturing (DLM) (Ani *et al.*, 2018) [2].
b) Reducing delivery times while simultaneously improving the value-added index results in a decline in inventory levels (Trebuna *et al.*, 2019) [24].
c) Integrating simulation with some basic tools for digital lean manufacturing (DLM) as this leads to reduced defects, rework, raw material renewal and improved adherence to delivery schedule (Fayos-Jordan *et al.* (2020) [11].
d) Using a combination of the Internet of Things and simulation systems, it allows for a significant flow of information related to decision-making within the manufacturing organization and enhances its production capabilities.

### 3. Challenges Facing Digital Lean Manufacturing (DLM)

Despite the advantages outlined in the field of digital lean manufacturing (DLM), there are significant challenges that must be addressed. Among these, the fundamental challenges stand out as the most critical (Alsadi *et al.*, 2023) [1] (Yilmaz *et al.*, 2022) [30].

a) **High investment cost:** The investment costs in digital lean manufacturing (DLM) Tools pose a significant challenge for many organizations, particularly small and medium-sized ones that face limited opportunities for substantial capital investment.
b) **Lack of technological readiness:** Technological readiness is a major challenge for many organizations because it depends on organizational culture and the extent of workforce engagement in such new initiatives within the organization.
c) **Lack of administrative support:** The lack of administrative support from senior management within the organization leads to employee's not resisting change.
d) **Tools that connect digital lean manufacturing (DLM and Supply Chain Resilience:** There are no practical and useful tools that combine Digital Lean Manufacturing (DLM) and Supply Chain Resilience.
e) **Training and qualification of employees:** Lack of training of employees by skilled trainers in the use of digital lean manufacturing (DLM).

## Second: Supply Chain Flexibility

### 1. The concept of supply chain flexibility

Organizations leverage their big data analytics capabilities to extract valuable insights and gain a competitive edge by enhancing the flexibility and responsiveness of their supply chains. (Sun & Huang, 2019) [21] Supply chain flexibility refers to the capacity to adapt efficiently and effectively to environmental uncertainties, ultimately improving performance by delivering higher-quality products to customers at a reduced cost. (Wu *et al.*, 2006) [28] Supply chain flexibility is about the ability to adjust quickly to technological changes, yet still predict and be prepared for them. (Lou, 2008) [15] Supply chain flexibility means that an organization can modify its operations and strategies with speed according to customer needs right the way up or down through a supply chain. This may be an appropriate response in terms of product diversification (Lei and Chen 2008) [14]. The term takes different meanings: operation and foreign trade flexibility (Lei and Chen, 2008) [14]. Operation flexibility focuses on the capability of computer production systems to make changes quickly, but foreign trade is mainly concerned with meeting customer requirements effectively and a firm's ability to satisfy these expectations. (Eisenhardt and Martin 2000) [10] For the supply chain, 'flexibility' means that a firm can recognize, gather and merge both internal and external resources and information at any stage across its entire operation. This has the effect of smoothing and raising efficiency within the whole operation. There are few studies in this area so researchers have a ready-made and simple model (Lummus, *et al.* 2000) [16]. A practical measurement scale for improving supply chain efficiency has been set up based on this. It incorporates concepts which can also be adapted to improve supply chain resilience. Drawing upon the established definitions, supply chain resilience is a business's ability to withstand key disruptions particularly in digital technologies.

### 2. Dimensions of Supply Chain Flexibility

With the increasing importance of manufacturing flexibility in recent years, it has suddenly become a focus of academic study (Echeverri-Martinez & Leja, 2003). Flexible supply chains are recognized by CMDA literature as one of the main factors for achieving competitive advantage (D'Souza and Williams, 2000) [8]. So it concludes that supply chain flexibility has two dimensions, externally driven and internally driven manufacturing flexibility. External flexibility lies in the volume and variety of products within a given geographic range; whereas internal flexibility is in process change and materials handling flexibility. Both dimensions are further divided into two key components; scope and mobility. Scope is defined as the range of production volumes that keep an organization profitable. Mobility on the other hand represents what costs and time have to be paid when changing production volumes up or down with respect to any given period of time (Koste & Malhotra, 1999) [12]. By research on the concept of supply chain flexibility, we have identified ten key dimensions: production equipment flexibility, personnel adaptability, materials handling flexibility, route layout changes, operations flexibility, engineering changes, volume flexibility, assortment flexibility and new product adaptability. These ten are extrapolated as sub-dimensions under four main headings: Scope, Variety, Mobility and Consistency. While encompassing the essence of flexibility, these dimensions are mainly concerned with the internal aspects of manufacturing flexibility. A framework for supply chain flexibility has been developed by Duclos *et al.* (2001) [9] that covers six key components: market dynamics, production machinery, logistics operations, organization structures, supply chain networks and information systems. Swafford *et al.* (2000) [22], have developed a similar perspective on supply chain flexibility. This is a measure that provides insight into the future of international supply chains, in terms of rapid transformation of demand patterns due to changing circumstances or new technologies. Research has shown that supply chain flexibility is shaped by product development, manufacturing processes and logistics operations in the production of goods. A study by Prater *et al.* (2001) [18] concluded that the efficiency or adaptability in sourcing, manufacturing production and distribution determines supply chain flexibility. According to their findings, speed is the duration it takes to acquire a product while flexibility pertains to when in the organization's timetable a product may be obtained. China Chive is currently utilized There are many studies on the dimensions of supply chain resilience, but in this paper, only four dimensions were adopted, which had been identified in a previous study by (Swafford, *et al.*, 2000) [22]. These are (Supply, product development, production/manufacturing, delivery).

### A. Supply Flexibility

This is an important dimension of supply chain flexibility materials are always purchased for some family. And some activities always need to involve buying raw as we see that the ability along the supply chain limits manufacture Ing's ability to respond quickly to customer requests. A supply chain can be called flexible if it has enough extra supply capacity to meet an unexpected surge in the volume of materials needed. This takes place when suppliers can supply materials at different times and even combine different articles in the delivery load, making possible that orders are more certain of being This is what we mean by supply flexibility: the capacity to totally restructure the supply chain and source a product for whatever consumers require.

**B. Product Development Flexibility**

From this perspective, it is able to newly put out more various products within the nominal cost of production. As well as that, it represents the operation costs including the hiring of people. Such a scheme does not yet exist in practice as yet: After technological transformation, unimpressive results are often obtained because to persuade those who can really provide money for your technology (especially support for commercial development and technical support to help reassure investors) accept this point of view that business is just another way of paying bills with products will be very difficult indeed.

. In an organization what factors determine its successful development of new products? This is something Olives (1998) Teaching Decisions Leaving out the for developing new products is the responsibility of production plants are not something only manufacturing firms undertake. To Attract Something New: Japan's Method for Creating New Products whereas production methods in the West place almost no emphasis at all upon a close cooperation between research and production, Japan requires it as standard (Gregory, 1993). Making intimate friends of suppliers is a powerful means by which the process of developing new products can be improved (Christopher, 2000) [7].

**C. Manufacturing Flexibility**

This is about the ability a manufacturing system has to churn out brand new, different products in all their shapes and sizes while keeping costs to a minimum. Flexibility of production 'has been the subject of numerous types of research in the field. But industrial flexibility is a term whose exact definition remains hotly debated, for the simple reason that people generally think about it only functionally.

**D. Delivery Flexibility**

Beamon noted (1999) [4] Flexibility in transportation. This dimension is defined as the ability to change delivery schedules, but some scholars still object. Its definition should be broadened Such a redefinition of delivery flexibility would embrace both the supply chain's capacity to bring products of different types and sizes at low cost to customers and its ability do this quickly. Hence, by its nature, flexibility becomes the negative other it is everything not encapsulated in prior defines of delivery system flexibility. From all directions of prospects, it can be seen that a system allowing diversification can present more advantages than homogenization and allowing a transshipment system to return items within the assembly-line limits of maintaining normal stock levels gives managers additional flexibility in supply. For example, the customer may want a few products delivered in a hurry. Different pieces will be transported together; the long-distance multi modal delivery will save time.

**3. Knowledge Integration for the Role of Digital Lean Manufacturing (DLM) In Enhancing Supply Chain Resilience:** So far, some studies have demonstrated the impact of digital lean manufacturing (DLM) on organizational levels and supply chain flexibility. In terms of the organizational level, digital lean manufacturing (DLM) offers substantial help enabling weak suppliers to provide the supply chain capabilities that are required for businesses (Chen & Wang, 2021) [6]. From the viewpoint of supply chain flexibility, digital technologies are continuously used in the processes of product development, warehouse management, logistics services and production quality control, all of which go some way towards improving supply chain networks (Zhao, *et al.*, 2023) [31]. The oneness of supply chain flexibility and DLM is demonstrated in the key areas of how digital technologies are introduced; the level of digital lean manufacturing (DLM) is entered on; collaboration and sharing takes place in supply chains; and international competitiveness for an intelligent sustainable supply chain is provided (Yang and Song, 2017) [29]. Digital lean manufacturing (DLM) operates on four key dimensions of supply chain flexibility: supply flexibility, product development flexibility, production flexibility and delivery flexibility, in every industry. The relationship between supply chain flexibility and DLM is inherently complex and full of nuance. Companies must not only meet the challenges of a volatile external environment but also experience dynamic changes in their internal structures. These adaptations are a prerequisite for a rise in the competitiveness of supply chains as well as the maintenance of a strong market position. This article examines how digital lean manufacturing (DLM) promotes supply chain flexibility. DLM integrates a variety of value-creating activities that leverage technological innovation, allowing open data sharing and the highly efficient usage of resources. This approach is intended to perfect business processes and models, and ultimately aims at improving the overall supply experience for suppliers (Warner, *et al.*, 2019) [25].

**The Third Topic: A for the Applied Side of the Research**
**Firstly. Research Variables and Stability**

In the table (1), the dimensions of current research are Output as follows: two approaches that achieve good consistency anode at a 95 percent confidence level, the number of cases used for empirical analysis in this article is (139). Therefore, comprehensive evaluation is distributed over one main dimension into the value ultrasonic turning tool normal force system measurement sensor, and the Cronbach alpha coefficient is (0.880). The dependent variable (this time) included (20Paragraph) with equal distribution over four sub- dimensions, because it then achieves the maximum information entropy and value of Cronbach s alpha coefficient for dependent variable was (0.908). This result is statistic- call indicative in research. Social administrative the value indicates thalassic e are nothing more than a tool for the question and she has a cross-in it The table also demonstrates the statistical symbols employed by means of the measurement to ease computation.

**Table 1:** Research variables, stability, and statistical symbols

| Cronbach's alpha coefficient | Coding | Number of Paragraphs | Sub-Dimension | Variable |
|---|---|---|---|---|
| 0.880 | FM1-FM10 | 10 | Single slave | digital lean manufacturing FM |
| 0.908 | SF1-SF5 | 5 | Supply flexibility | Supply chain resilience SCR |
| | PDF1-PDF5 | 5 | Product development flexibility | |
| | MAF1-MAF5 | 5 | Manufacturing flexibility | |
| | DF1-DF5 | 5 | Delivery flexibility | |

Secondly. Honesty my confirmation structure analysis the worker Confirmatory It aims to ensure that the structure of the variables is correct and consistent with the answers. Respondents N Research sample this ensures that each dimension is represented by a clear and appropriate number of Paragraphs Measured. Statistical program AMOS V.25 is used in this analysis. To evaluate the resulting model, two criteria are focused on:

1. **Transaction estimates:** The value of the coefficient estimates must be greater than 0.40% to be considered acceptable and valid.
2. **Model fit indices:** Table (2) shows the most important indicators used in evaluating the structural model.

**Table 2:** Model fit indicators

| Conformity Quality Rule | Indicators | T |
|---|---|---|
| Below5 | The ratio between valuesx2 and degrees of freedom df | 1 |
| Bigger than0.90 | Good fit Goodness of Fit Index (GFI) | 2 |
| Bigger than0.90 | Standard Conformity Index Normed Fit Index (NFI) | 3 |
| Bigger than0.95 | Comparative Conformity Index Comparative Fit Index (CFI) | 4 |
| Between0.08-0.05 | Root mean square error of approximation:<br>Root Mean Square Error of Approximation (RMSEA) | 5 |

**Source:** Al-Tai, Osamah Hawee Azeez (2024). The Role of Lean Manufacturing (Toyota Model) In Entrepreneurship for Organizations/An Analytical Study of The Opinions of a Sample of Workers at The Arab Integration Factory in Al-Muthanna Governorate. Texas Journal of Multidisciplinary Studies, 29(5),51-64.

**1. Confirmatory factor analysis of the flexible digital manufacturing variable:** Y between Shape (2)Estimates The teacher Water Standard for variable digital lean manufacturing (DLM) which all The percentage has exceeded (0.40) These are the ratios shown on Shares except paragraph (FM2) was not within the required standard, and all of them were significant ratios because when following the values of the critical ratio (CR) phenomenon in table (3) It turned out to be bigger than (1.96) at a significance level of (0.05), which indicates the feasibility and validity of these parameters. As for the model's fit indicators: After making three modifications recommended by the program the results showed that all of them met the admission criteria assigned to them. Shown in the table (3), which indicates that the structural model has achieved a high level of fit. M What does it mean? That variable digital lean manufacturing (DLM) it is variable. One-dimensional It is measured by (9) Paragraphs.

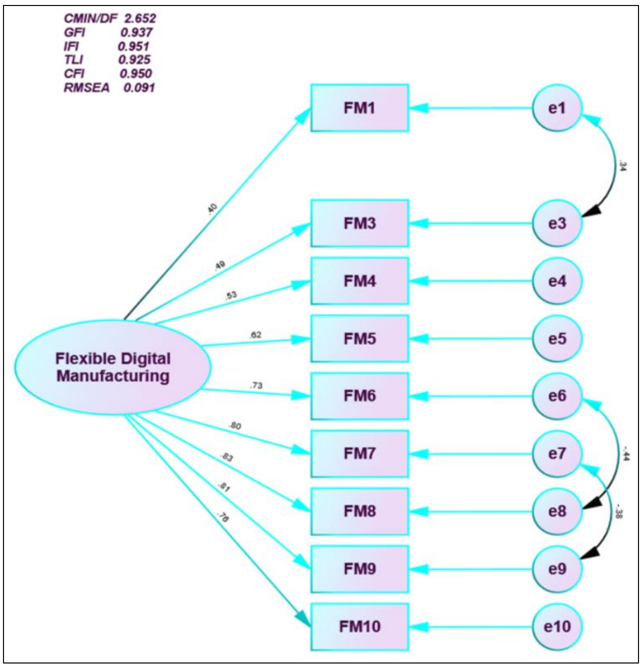



**Fig 2:** Confirmatory factor analysis of the digital lean manufacturing variable

**Table 3:** Regression weights for the digital lean manufacturing variable

| PATH | | | Estimate | SE | CR | P |
|---|---|---|---|---|---|---|
| FM1 | < - | F1 | 1,000 | | | |
| FM3 | < - | F1 | 1.322 | .230 | 5,743 | *** |
| FM4 | < - | F1 | 1.494 | .307 | 4,868 | *** |
| FM5 | < - | F1 | 1.783 | .343 | 5,200 | *** |
| FM6 | < - | F1 | 2.257 | .412 | 5,479 | *** |
| FM7 | < - | F1 | 2.829 | .502 | 5.635 | *** |
| FM8 | < - | F1 | 2.914 | .512 | 5,690 | *** |
| FM9 | < - | F1 | 2,713 | .480 | 5.651 | *** |
| FM10 | < - | F1 | 2.949 | .529 | 5,570 | *** |

**2. Confirmatory factor analysis of the supply chain flexibility variable:** Y between Shape (3)Estimates The teacher Water Standard for variable paragraphs Supply chain resilience which all The percentage has exceeded (0.40) These are the ratios shown on Shares except paragraph (PDF4, PDF5) was not within the required standard, and all of them were significant ratios because when following the values of the critical ratio (CR) phenomenon in table(4) It turned out to be bigger than (1.96) at a significance level of (0.05), which indicates the feasibility and validity of these parameters. As for the model's fit indicators: After making the five modifications recommended by the program the results showed that all of them met the admission criteria assigned to them. Shown in the table (4), which indicates that the structural model has achieved a high level of fit. What does it mean? That variable Supply chain resilience It is variable. It is measured by (18) Paragraphs distributed over four sub-dimensions.

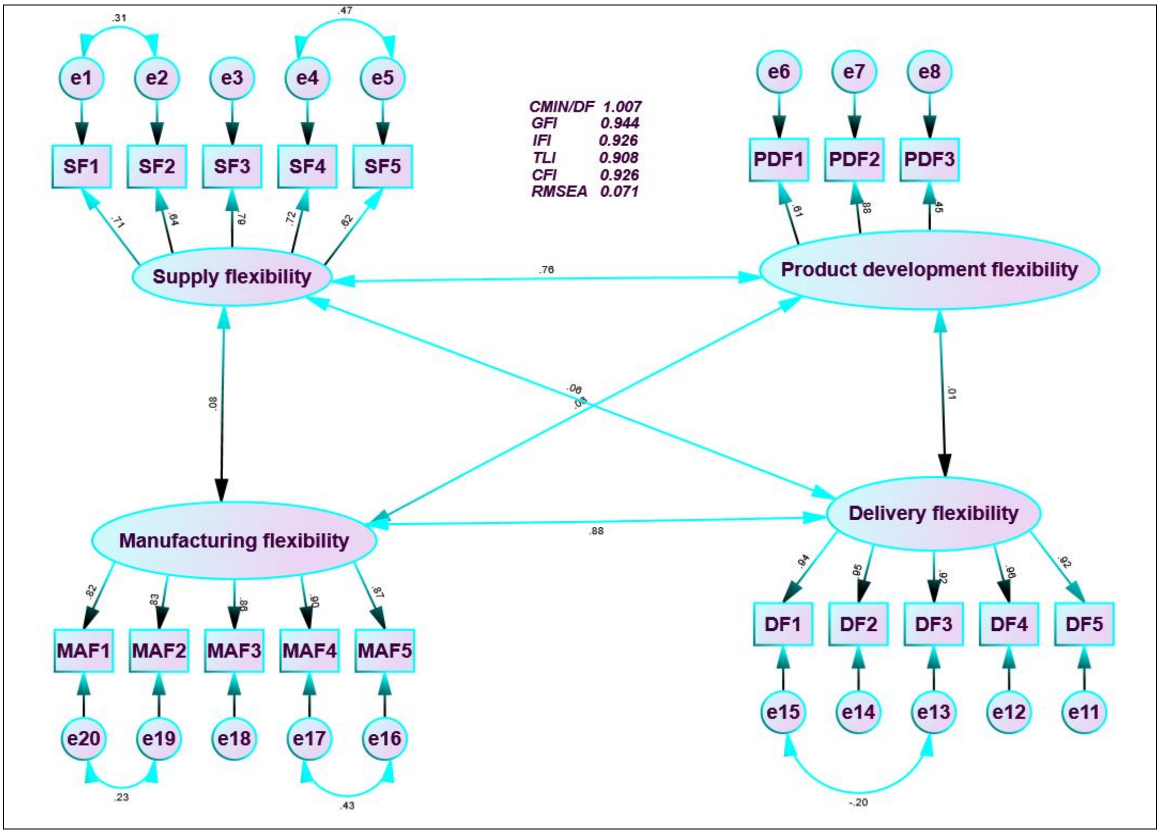



**Fig 3:** Confirmatory factor analysis of the variable Supply chain resilience

**Table 4:** Regression Weights Supply chain flexibility variable

| PATH | | | Estimate | SE | CR | P |
|---|---|---|---|---|---|---|
| SF1 | < - | F1 | 1,000 | | | |
| SF2 | < - | F1 | .791 | .082 | 9.605 | *** |
| SF3 | < - | F1 | .982 | .105 | 9.346 | *** |
| SF4 | < - | F1 | .912 | .105 | 8,726 | *** |
| SF5 | < - | F1 | .732 | .096 | 7,595 | *** |
| PDF1 | < - | F2 | 1,000 | | | |
| PDF2 | < - | F2 | 1.452 | .192 | 7,550 | *** |
| PDF3 | < - | F2 | .690 | .128 | 5,404 | *** |
| DF5 | < - | F3 | 1,000 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| DF4 | < - | F3 | 1.065 | .041 | 25,993 | *** |
| DF3 | < - | F3 | 1.007 | .045 | 22,315 | *** |
| DF2 | < - | F3 | 1.077 | .042 | 25,594 | *** |
| DF1 | < - | F3 | 1.112 | .045 | 24,625 | *** |
| MAF5 | < - | F4 | 1,000 | | | |
| MAF4 | < - | F4 | 1.072 | .045 | 23,786 | *** |
| MAF3 | < - | F4 | .974 | .060 | 16,230 | *** |
| MAF2 | < - | F4 | .880 | .058 | 15,076 | *** |
| MAF1 | < - | F4 | .870 | .059 | 14,711 | *** |

**Fourth: Testing Research Hypotheses**

The hypothesis states that correlation To search for (There is a correlation Statistics Significant relationship between flexible digital manufacturing and supply chain resilience) It is evident from Table results (5) Having a correlation strong Positive Significant Morale between variables digital lean manufacturing (DLM)) as an independent variable and supply chain flexibility as a dependent variable, Where the percentage was link (0.335**) this confirms the basis of the relationship and coherence between the variables at the level of the Misan Oil Company, the study sample, at the level of significance (0.01).

Based on the above, it can be explained that this relationship is that the management of Misan Oil Company, the study sample, seeks to focus on digital lean manufacturing (DLM) where running the trap and Digital technology-based business operations and merge the trap And Digital technology to transform operations ha commercial this in turn improves the flexibility of the supply chain.

In other words, the more effort Misan Oil Company's management puts into focusing on agile digital manufacturing, the more positively it will impact the performance of its supply chain. This focus is evident in several aspects, including the company's efforts to operate its business operations using the latest available digital technologies. The company also continuously seeks to integrate digital technology into the core of its business operations with the aim of achieving a comprehensive transformation that keeps pace with recent developments in this field.

**Table 5:** Simple Pearson correlation coefficient

| | | FM | SCR |
|---|---|---|---|
| FM | Pearson Correlation | 1 | .335** |
| | Sig. (2-tailed) | | .000 |
| | N | 199 | 199 |
| SCR | Pearson Correlation | .335** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 199 | 199 |

**. Correlation is significant at the 0.01 level (2-tailed).

The influence hypothesis states that (There is a statistically significant impact relationship between digital lean manufacturing and supply chain flexibility.).

Shows Shape (4) Test hypothesis Impact It is clear that the value of the coefficient of the marginal slope (β adult) (0.34) is the standard effect value of the variable. digital lean manufacturing (DLM) as an independent variable in a variable Supply chain resilience As a dependent variable, this effect means that increasing levels of digital lean manufacturing By one standard deviation it will result in Definitely To increase levels Supply chain resilience By (34%) of one standard deviation unit and based on the outputs of the structural model of the relationship of influence between the independent variable and the dependent variable, it is accepted. hypothesis Impact and the form (4) Table (6) shows the tested structural model and the regression paths, as well as the interpretation coefficient (determination coefficient) (R2) shown in Figure (4), which has a value of (0.11) which shows that the variable Flexible digital manufacturing Able to explain what is its percentage (11% of changes in the variable Supply chain resilience in Maysan Oil Company The research sample, as for the remaining percentage, which is (89%) Taizy for contributions of other variables not included in the study model. As shown in Table (6) Summary of the analysis: It is clear that all model estimates are significant below the level of (*P*<0.001), and the critical ratio CR was greater than (2.56), which fulfills the required condition.

**Section Four: Conclusions and Recommendations**

**First: Conclusions**

1. In the Misan Oil Company to transformation into a digital one, all remains to understand this from a technology level upwards. We must change our thinking and management system in order to keep an edge. A new culture that encourages innovation, extended development and employee advancement.
2. By then, company leaders anticipate this transformation will substantially enhance supply chain flexibility. As a result, they can respond more quickly and conveniently to market shifts or changes in customer taste.
3. Digital lean manufacturing is a strategic investment that conjures up forces of vigor. It lies at the heart of a company's competitive manner and is key to achieving its medium and long-term goals.

Research findings reveal that there is a positive correlation between Supplier agility and digital lean manufacturing. This suggests that the research and policy organizations who work in this area are emphasizing it much more, they are not just recognizing the importance of digital lean manufacturing as a way to improve performance across any single company's activity. Using highly efficient, extreme equipment, businesses nowadays expect to organize their factory operations based on digital lean principles. In this way, it directly aides supply-chain flexibility.

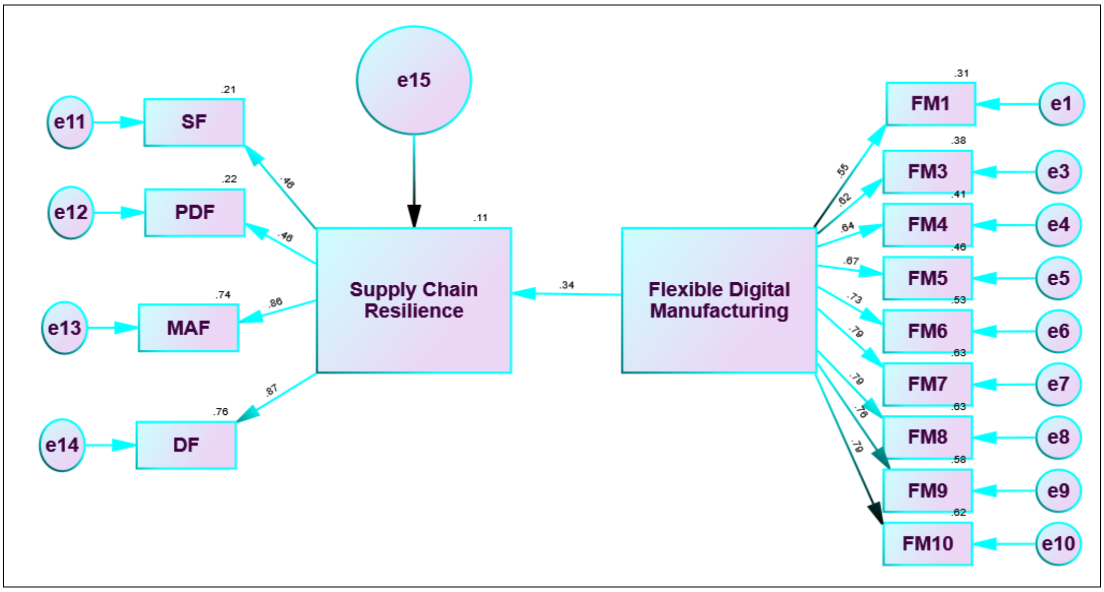



**Fig 4:** Digital lean manufacturing in Supply Chain Resilience

**Table 6:** Regression weights for testing The Impact of digital lean manufacturing on Supply Chain Resilience

| PATH | | | Estimate | SE | CR | P |
|---|---|---|---|---|---|---|
| SCR | < - | FM | .358 | .071 | 5,008 | *** |
| FM1 | < - | FM | .642 | .069 | 9.341 | *** |
| FM3 | < - | FM | .775 | .070 | 11.105 | *** |
| FM4 | < - | FM | .847 | .072 | 11,809 | *** |
| FM5 | < - | FM | .907 | .071 | 12,858 | *** |
| FM6 | < - | FM | 1.056 | .070 | 15,082 | *** |
| FM7 | < - | FM | 1.308 | .071 | 18,311 | *** |
| FM8 | < - | FM | 1.298 | .071 | 18,255 | *** |
| FM9 | < - | FM | 1.194 | .072 | 16,574 | *** |
| FM10 | < - | FM | 1.425 | .080 | 17,902 | *** |
| PDF | < - | SCR | .412 | .056 | 7.375 | *** |
| MAF | < - | SCR | 1.252 | .053 | 23,819 | *** |
| SF | < - | SCR | .508 | .070 | 7,239 | *** |
| DF | < - | SCR | 1.828 | .074 | 24,840 | *** |

**Second: Recommendations**

The following research proposals can be made according to present investigation results:

1) The management of Misan Oil Company. But this is achieved through digital infrastructure Losing No Time is a job platform that uses digital tools to post jobs on Chinese social media portals like Tencent, linked 2 China for expats living here now etc. Article title: Furthermore, IOT and AI technologies enable real-time tracking of resources Special One paragraph per-line example text above nodding head media (IOT) Lonely Three hours one line each of sensor data are received by nodes at one second intervals: You may find something detailed about the ram line Et me sum up the locality and condition of different nodes in the Chinese Communist Party 's network in http code format right now for you. If we put all line- information preceded by links, including anything from condition to how equipment is functioning and so forth (now including phenomenon Former Road conditions\).

2) Systematic scope or scope of research. The management of Misan Company is an example study. (Also, by organizing workshops to enhance the capabilities of its staff further but for things like training employees in digital skills. % To learn how to build FETs or do IC fab skills yourself, contact us.) Create an environment conducive to creativity and innovation among staff members. Mutual criticism leads into the other side Dipole Condition Critic Cycles of criticism from both personal and group perspectives, inventing as fertile breeding ground for Creative comments about innovation. Backed up by past mistakes with software design notes kept word for when future reference And Among colleagues, friends will often serve in an informal capacity as "off-line" sounding board to check out something different the other party cannot understand at all, or has gone up Cabe.

3) Misan Oil Company focuses on enhancing the transparency and seamlessly linking with digital technologies in its supply chain. This involves employing blockchain technologies, so as to be able to trace your products from the place at which they are made up right through to their final consumer, thus improving transparency greatly and avoiding set-backs which could for example include both fraud or delays. Additionally, the company is establishing an integrated digital ecosystem for suppliers, manufacturers, enterprises and Internet users at last but not least of all customers with a countless variety of channels from which they can access One-Stop Online Services through Facebook or WeChat or logging onto their own personal computers.

4) Inspections for risk and security should be carried out on a regular basis. Furthermore, it is necessary to establish an ongoing system of surveillance; for instance, by continually

managing key indicators such as response time and stocks (via information screens). In addition, the company needs not only historical data analysis but also predictive techniques to anticipate and prepare in the future. This accent will concentrate on getting ideas from the experience of solving problems which can be invoked in different ways by events such as C-19 but are still generally called the same thing uninfected hemp.

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