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A theoretical study of hybrid manufacturing systems survey of the opinions of a sample of employees at the Badoush cement plant - Expansion

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Abstract
The purpose of the research is to elucidate the use of hybrid manufacturing systems in industrial units by employing modern production and marketing techniques. It aims to highlight the impact of this system on reducing production costs, enhancing product quality, and meeting customer requirements by offering products that fulfill both current and future needs.
The theoretical framework relies on a literature review approach, utilizing books, research papers, journals, and internet resources.
On the practical side, the researcher adopts an analytical-descriptive approach, employing repetitions and percentages (Frequencies & Percentages), along with the use of statistical analysis software (SPSS).
Conclusion: The research draws several conclusions, notably that the factory did not employ modern methods in production and marketing, relying instead on traditional approaches. This resulted in the production of products that do not meet customer needs, leading to product accumulation in stores and customer reluctance to purchase, ultimately causing the products to become outdated and expensive.

Keywords: Badoush cement plant, hybrid manufacturing systems, employees

Introduction

This study showcases the application of hybrid manufacturing systems in industrial settings through the implementation of contemporary production and marketing strategies. It emphasizes the positive effects of utilizing this system, such as cost reduction, enhanced product quality, and the ability to meet customer demands by offering products that cater to their present and future needs. The study topic pertains to industrial units that depend on conventional production methods, leading to the buildup of products in warehouses. This is costly since traditional production systems work on the premise that all manufactured items would be sold. Nevertheless, this viewpoint is incongruent with the progress made un the corporate realm and the contemporary setting. It is imperative to create a novel manufacturing system that aligns with the rapid advancements and the present competitive landscape.
The investigation utilized statistical techniques such as the SPSS program, percentages, and repetitions. The investigation yielded significant conclusions, namely that the factory employed obsolete traditional methods in both manufacturing and marketing, rather than utilizing current techniques. Consequently, the items manufactured failed to match the demands and wants of customers. As a result, the accumulation of items in stores led to a decrease in client purchases, causing an increase in expenses and product obsolescence.
The research yielded several recommendations, with the most crucial one being the imperative to incorporate the hybrid manufacturing system into the laboratory for further examination. This is due to its favorable outcomes in enhancing performance and substantially cutting down costs by embracing contemporary approaches in production, sales, and marketing. Additionally, it suggests implementing the pull strategy in manufacturing and tailoring products to meet client specifications, while also removing any processes or phases that do not contribute value to the product.

Research, Practical, and Social Impacts: The study adopts scientific and methodological mechanisms to instill a modern manufacturing culture, even in its early stages.

Authenticity and Value

A model is proposed to illustrate the relationship between hybrid manufacturing and creativity, utilizing statistical methods to clarify the correlation and impact between study variables

The Research Problem

The primary research problem is industrial organizations' reliance on traditional production processes, which results in product accumulation in warehouses. That being said, it is costly to push traditional production methodology to the process, because the selling of everything created is the premise of this model and that is no longer related to how the business community is arranged in the current environment. It is important to construct the best current manufacturing system that can work with contemporary technological progress and actual stuff competition. Under reduced costs, product quality and competitors' advantage, this will help the unit gain a competitive role and may be sustained in the long-term.

The significance of Research

This research is significant because it delivers a whole set of the knowledge framework that can be utilized by various manufacturing plants while planning a shift to hybrid manufacturing systems. Additionally, the implementation of hybrid manufacturing systems lowers the costs of production and increases the quality of products. This is achieved through multifaceted processes in production, marketing and sales, which in turn contribute to the relentless quest for self-actualization. Moreover, the unit set out to improve the production capacity besides making the manufacturing and delivery processes shortened and a virtual marketing platform which allows clients to search quickly for all the products that can be purchased.

Research aims

This study is to focus on the role of this combination technology on determining and enhancing the design and the performance of manufacturing methods. This will be achieved by a hybrid processing line that will interconnect all parts of the production process. The study also aims to determine the impact of using this method on lowering manufacturing costs, enhancing product quality, and meeting consumer expectations. This will be accomplished by introducing products that meet all of the wants and demands of the customers.

Hypothesis of the Research

The research hypothesis can be elucidated as follows

1. **First hypothesis:** There is no statistically significant relationship between hybrid manufacturing and the overall design and improvement of production processes.
2. **Second hypothesis:** There is no statistically significant relationship between hybrid manufacturing and the overall design of hybrid processing sequences.
3. **Third hypothesis:** There is no significant mediating effect between hybrid manufacturing and the overall design of hybrid processing sequences on the improvement of production processes.

Research Methodology: The researcher employed an inductive method in the theoretical aspect, utilizing a systematic review approach by referring to books, research articles, journals, magazines, and online resources. In the practical phase, the researcher adopted an analytical-descriptive approach, wherein collected data were analyzed to extract insights and patterns.

The Theoretical Aspect

Historically, industrial units produced without much regard for cost or customer requirements. This was due to the market's low product variety and scarcity. Despite their high product prices, they were able to accomplish decent sales and profits. However, with an expansion in the number of manufacturing units, increased competition among them, and a plethora of products on the market, these units have been pushed to seek more acceptable ways. They can gain a larger customer base than their competitors by using these tactics, Customers nowadays seek products that satisfy their needs at a low cost while maintaining great quality. Industrial units, on the other hand, strive to produce at the lowest possible cost in order to maximize revenues. As a result, many global industrial organizations have turned to new production processes that allow them to meet both their own and their customers' criteria at the same time. The hybrid manufacturing system is one of these creative ways. The hybrid manufacturing is the mixture of the lean and the responsive manufacturing ways. Both of them can look for the lowest price for the customers while decreasing the waste of the resources of the company. A range of definitions connected to the concept of hybrid manufacturing have been offered after a thorough assessment of major research and scientific investigations by scholars a variety of definitions related to the concept of hybrid manufacturing have been presented:A range of definitions connected to the concept of hybrid manufacturing have been offered after a thorough assessment of major research and scientific investigations by scholars a variety of definitions related to the concept of hybrid manufacturing have been presented.

1. In 2016, (Galankashi and Helmi) imply by the hybrid manufacturing term the system that is a company-based manufacturing with the purpose to quickly respond to unforeseen changes for the efficiency in the delivery of services.
2. Besides, in 2015 (Nieuwenhuis and Katsifou) found that the combination of lean and responsive manufacturing techniques helps to improve the flexibility and efficiency of the process, as the sustainable competitive advantage is the goal pursuing.
3. In 2014 (Al Samman) it was defined as a system that includes not only the elimination of unnecessary materials but also the inefficient processes that do not add to the value of the end product. The system is viewed as successful when there is enough flexibility that allows it to continuously realign with customer requirements that are continuously changing.
4. In addition, it is Zhu *et al*. (2013) who defined it as a technique which encompasses a new group which is made up of two or more manufacturing processes and such a grouping is achieved through the leveraging of the individual advantages of each originally separate procedure.
5. On the other hand, (Shahin and Jaberi 2011) [25] to put it simply, it is the system that combine lean and

responsive activities simultaneously which facilitate process flexibility and lead to less waste in production.

The authors created a comprehensive description of hybrid manufacturing whose components are the features chosen from the previous definitions. It is s defined as a concept that combines a lot of things like lean manufacturing and agile manufacturing, to name just a few of them. The fact that they make it possible to cut down on waste, and also improve production, has made them of great help to the companies and they have gotten significant competitive edge over their competitors.

Dimensions of Hybrid Manufacturing

Based on prior scientific investigations and research, researchers and studies agree that hybrid manufacturing has two key dimensions: fast moving factory and fast response manufacturing. Illustrated by these studies, Mowlana (2011), Niuwenhuis and Katsifou (2015) [26], Galankashi and Helmi (2016), and Shahin et al. (2016) have shown that this is the case.

The First Dimension: Lean Manufacturing: This paper will take a thorough look at some of the key papers of importance and scientific researches in relation to the concept of lean manufacturing as you will gain an insight into the meaning of lean manufacturing.

1. Defined by Al-Rahawi (2019) [2], it is a system aimed at eradicating waste in all its forms during the utilization of available resources and capabilities in a manner that adds value to the manufacturing process and, consequently, the final product, while ensuring customer satisfaction.
2. Additionally, as indicated by Omar and Abdul Qadir (2018) [28], lean manufacturing emphasizes process quality along with the elimination of waste in all its forms and activities that do not add value to production processes.
3. Defined by Mumteami and Stefaniga (2018) [29], it is a term encompassing manufacturing and production practices aimed at creating value, reducing waste, shortening the time between customer demand and product delivery, as well as cutting costs and enhancing quality.
4. Similarly, as described by Alefari *et al*. (2017) [30], it is a company's ability to provide high-quality, waste-free products capable of meeting client needs. This means delivering such products at the lowest possible cost and responding quickly to consumer requests. Many businesses are interested in this manufacturing technique because of its effectiveness in assisting enterprises when faced with financial and human issues.
5. Dadashnejad and Valmohammadi (2017) [31] characterized it as a new management strategy aimed at identifying and eliminating waste causes. This method increases productivity and promotes continuous development. It was created by Japanese businesses and industries.

The researchers arrived at a definition of lean manufacturing based on the previous presentation of definitions that shows it as a system focused on applying current production techniques to minimize non-value-added activities and gain a competitive advantage. Previous research has agreed on the key methods of lean manufacturing that aid in waste reduction.

The second dimension is Responsive Manufacturing

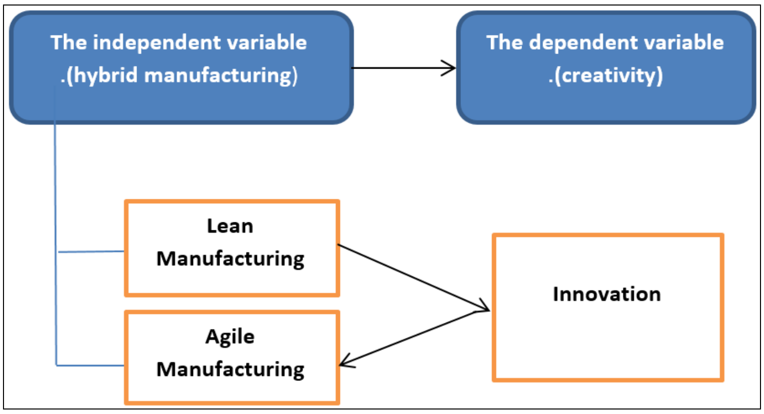
A variety of definitions relating to the concept of responsive manufacturing can be offered by reviewing the most relevant research and scientific studies available to researchers. The industrial environment has changed dramatically in both breadth and pace during the last decade. Due to high levels of complexity and uncertainty, providing industrial enterprises with a lasting competitive edge or even assuring their survival in the market is particularly difficult (Vazquez *et al*., 2006) [32].

Similarly, Ward and Zhou (2006) [33] stated that the hybrid manufacturing system should be considered as a philosophical feature that provides the organization with a unique dimension involving human and production resources, rather than as a coordinating activity between production aspects.

1. Goswami and Kumar (2018) noted that the responsive manufacturing system revolves around competitive dimensions such as speed, flexibility, and quality through the integration of resources. Its aim is to provide customized products and services in a rapidly changing environment.
2. According to Khalil and Obeid (2018) [34], it is a novel manufacturing method used to solve competitive issues and respond quickly to client requests. Thus it results in improved organizational effectiveness and production, acquiring advantage over your competitors by coming up with high-end products and services in timely manner. This quick response to market changes ensures the organization to hold for many years the long-term presence in competitive markets, earn more money and achieve a higher level of competitiveness in the market in which it is working.
3. According to Sindhwani and Malhotra (2017) [35], it denotes a mechanism of organization to enable them to compete robustly and thrive in ever-changing marketplace characterized by continuous change through interacting with the evolving markets.
4. Abdul Ghani (2016) [36] It has been stated as a technique when machines and tools are used to manufacture a variety of products that gratify the demands and wishes of customers. It is also known as fast response manufacturing.
5. Ucakturk *et al*. (2015) [37] point out that responsive manufacturing has a direct function with the unexpected changes that occur within the organization. The faster a change occurs in the organization's activities, the more flexible the organization becomes in responding to those changes.

The researchers arrived at a definition of responsive manufacturing through the previous presentation of definitions for responsive manufacturing as a manufacturing system aimed at keeping up with technological advancements and rapid market changes through components to achieve customer satisfaction and responsiveness to their requirements with the least cost, time, and value. Previous research Yusuf, 2002; Vazquez-Bustelo and Avella) [6] has shown that responsive manufacturing has various components and requirements

Human resources, as mentioned are the individuals whose capabilities and skills need to be developed to make use of their knowledge and job performance, ensuring they are prepared to keep pace with the growth of the organization.
Additionally, Zakaria *et al.* (2017) [38] pointed out that companies' commitment to preparing and assisting their employees in innovation is achieved through training programs that aid in accomplishing tasks within the organization, thereby enhancing operational efficiency.
Production and communication technologies, as defined by Talib *et al.* (2011) [39], encompass all the physical resources (equipment and devices), human resources (Knowledge and skills) and informational resources (Data and communications).



Hybrid Manufacturing System
Often, lean and efficient manufacturing are described as two distinct industrial models, each with different core objectives. Lean manufacturing emphasizes waste reduction. The hybrid manufacturing system is designed to achieve the maximum integration of essential performance criteria (Cost, quality, flexibility, speed, diversity, productivity, etc.).
For example, flexibility allows for more product variety, and product diversity offers favorable economic prospects." This results in cost savings by utilizing sophisticated manufacturing methods and procedures. The hybrid manufacturing system entails increasing resources and eliminating non-value-added operations. In the hybrid system, on the other hand, efficient manufacturing focuses on expediting the production of mixed models, capturing mass production efficiencies while providing a wider range of products. The goal of an efficient system is to be more adaptive and capable of adapting to environmental changes, allowing it to use more resources. To solve the non-convergence point, lean manufacturing principles are used, which are based on a pre-planned production level, to reach the point of separation that distinguishes lean manufacturing from efficient manufacturing on the production line. In contrast, efficient production is employed to directly focus on meeting client requests. The combination of lean and efficient manufacturing concepts gives rise to the hybrid manufacturing system, a modern and advanced strategy that incorporates the benefits of both lean and efficient systems. This integration has resulted in a significant upgrade and improvement in unit performance. The diagram below depicts the locations of the two systems on the production line as well as the separation point (non-convergence).
A hybrid manufacturing system, which combines lean and efficient manufacturing, is regarded as an industrial paradigm with a promising future for global industrial companies." This is because of its significant competitive advantages, which enable businesses to overcome potential competitive issues in the near future. It allows for personalization while also lowering costs. It is also known as a philosophy that blends lean manufacturing for efficiency with efficient manufacturing for responsiveness. The lean manufacturing philosophy consists of a collection of principles and technologies designed to decrease costs and improve quality. Meanwhile, effective manufacturing is distinguished by its ability to respond to unanticipated changes in industrial enterprises' external environments.

Advantages of the hybrid manufacturing system
The hybrid manufacturing system offers several advantages to the units that adopt its use, including the following

1. **Information Exchange:** With the ongoing evolution of e-commerce and information systems, manufacturing company management has recognized the necessity of information sharing throughout all stages of the supply chain, including supplier management, product design and development, material procurement, production, sales, and more.
2. Production planning is better because it is based on the need of the market and stores.

Information exchange is regarded as the cornerstone of implementing hybrid manufacturing, and through information exchange, risks associated with inconsistent and incomplete information can be reduced. It can also improve organizational collaboration and response time to market changes.

1. **Reduced Manufacturing Cycle:** The hybrid manufacturing method begins production on the basis of client orders. Final customer orders drive the procurement, production, and sales processes. Direct sales in the supply chain are used in this sort of production, potentially bypassing middlemen and retailers. It necessitates direct engagement with end users.
2. Reducing the time required for the product manufacturing cycle and delivering it to customers at high speed, and reducing the percentage (Muhammad and Abdullah, 2021, 237) [21]
3. Customer complaints are reduced to a minimum, and errors in production are eliminated.

Therefore, by adopting hybrid manufacturing, you will gain the advantages of cost reduction and high efficiency

1. **Order Direction:** Hybrid manufacturing begins with final client orders, in which functional units or similar ones are separated from the manufacturing process employing hybrid manufacturing. Lean manufacturing is implemented initially and consistently in accordance with standards. Following that, the main manufacturing company produces or assembles the standardized modular unit and customized units as new goods in response to final customer orders.
2. **Close Unit Collaboration:** This style of production requires suppliers or supplier warehouses to identify manufacturing sites within the primary manufacturing unit. This is done to shorten the raw material transit time for production as well as logistics services. The main manufacturing unit selects certain approved suppliers based on quality, service, pricing, capacity, and technical innovation in order to maintain tight collaboration between them.
3. **Reducing the Length of the Processing Chain:** The hybrid processing chain commences manufacturing based on final client orders. This type employs a direct sales strategy, avoiding merchants and dealing directly with end customers.

Secondly: Cost Reduction Through the Use of the Hybrid Manufacturing System: Advanced Technology as a Tool of the Hybrid Manufacturing System.

The importance of sophisticated technology in the hybrid production system is demonstrated by the advantages gained by industrial units when it is used. Previous studies have shown that the importance of incorporating modern technology in manufacturing and marketing lies in its ability to reduce product development time, save labor costs, cut material expenses, maintain competitive unit positioning, economize on financing, adapt to product changes, address environmental or health concerns, boost profitability, improve factory performance, and cater to customer requirements. These elements have a broad strategic impact on the unit, affecting all aspects of its operational environment effectively and fundamentally.

Units that use modern technology enhance numerous performance measures such as sales, general performance, and the organization's market share significantly. It also leads to a reduction in total costs. Researchers have stressed that relying on current manufacturing and marketing technology will provide firms with significant competitive advantages in cost, quality, productivity, and efficiency. These are the aspects in which industrial entities strive to excel.

The researchers also anticipate that incorporating sophisticated technology into the hybrid system's production, marketing, and sales operations will help to cost reduction, product quality enhancement, greater production, and flexibility in supplying varied items. Furthermore, it allows for early market entry and faster reactions to changing client needs.

The Impact of Using the Hybrid Manufacturing System on Cost Reduction: Employing advanced manufacturing and marketing technology in the hybrid manufacturing system will result in significant changes in the cost elements' behavior, as follows

1. Reduction in labor cost, as it now represents a very small percentage of the total manufacturing costs.
2. As a result of the increased reliance on machinery and the use of modern manufacturing techniques, investments in machinery and equipment have increased significantly, resulting in an increase in fixed costs.
3. Identifying customer needs and other necessary information for management is made easier by modern information systems, the internet, and the cost system.
4. Economic units that employ advanced manufacturing emphasize product diversification, inventory cost reduction, and achieving optimal production techniques.
5. Units that rely on modern manufacturing technologies experience an increase in their production efficiency, making them highly dependable sources.
6. Emphasis on designing, manufacturing, and marketing products with high efficiency compared to competitors.

Researchers conclude that the hybrid manufacturing method contributes significantly to cost reduction by utilizing current manufacturing, marketing, and sales processes. It allows for the removal of a significant amount of production expenses as well as the capacity to generate a wide range of items quickly. This results in more efficient distribution of indirect costs among products, as well as reduced inventory levels through the use of just-in-time production processes. Furthermore, it enables simple and convenient client access via the internet and information networks, allowing for the manufacture of products suited to customer desires.

Over the last three decades, Toyota Motor Company has conducted numerous experiments and initiatives to improve its manufacturing processes." However, following WWII, Japanese industries faced substantial material, financial, and human constraints. The manufacturing challenges that Japanese manufacturers faced were vastly different from those faced by their Western counterparts. They took advantage of the situation to develop the most recent and cost-effective production processes Early Japanese pioneers, such as Toyota Motor Company's Sakichi Toyoda and Eiji Toyoda, created a disciplined set of production and operational processes. The goal of these systems was to reduce resource use that did not add value to the product. Toyota's use of these strategies resulted in the creation of a major competitive advantage over its American competitors. As a result, in the 1980s, academics investigated ways to use lean and efficient manufacturing practices. By the 1990s, several Arab manufacturers were also experimenting with lean and efficient manufacturing plans, strategies, policies, procedures, defects, cycle durations, improvements, and product delivery techniques (2015: 34 Fernandez).

Researchers and authors' concepts of lean manufacturing and efficient manufacturing vary. Some consider lean manufacturing to be a production and operational management philosophy aimed at achieving customer value in a product. This is accomplished by employing a collection of tools that eliminate waste and wasteful processes that bring no value to the end output. This method makes the best use of existing resources, ensures a wide product diversity, and provides items at the proper time, place, volume, and cost.

Lean Manufacturing, according to (Dilanthi 2015: 577) [40], is a comprehensive technical-social system whose primary goal is waste elimination. It works in unison and strives to eliminate all types of waste by fast and consistently evolving production processes, resulting in the manufacture of high-quality products and services at cheap prices, with the goal of gaining a competitive edge and achieving customer satisfaction. This is accomplished through top management's workforce development and skill upgrading. Lean Manufacturing, on the other hand, is defined as achieving a smooth and balanced production flow that supports dimensions and tries to reduce impediments, according to (Sander 2016: 814,) [41]. This improves system flexibility by removing surplus and eliminating all sources of waste. The presence of quality issues impedes operations, hence an emphasis is made on maintaining good quality. Supplier development, Just-In-Time (JIT) delivery, customer involvement, production pull, setup time reduction, preventative maintenance, original process control, and staff participation are among the 10 variables identified by Sanders as having a direct impact on the essence of Lean Manufacturing. These elements are critical for achieving a smooth flow of production processes and meeting the desired criteria for final goods. According to (2016: 107, Richard), Lean Manufacturing is a multifaceted scientific method that incorporates numerous areas. It entails producing with as little waste or defect as possible while identifying and fixing problems, maintaining a continuous and uninterrupted flow, performing extensive equipment maintenance, and implementing complete quality systems. Furthermore, it empowers the workforce, which improves organizational competitive performance. This strategy considers quality, affordability, response time, and flexibility.

While defines effective manufacturing as a strategy that allows manufacturing companies to build and deliver a broader range of on-demand products at lower costs, effective manufacturing also includes the ability to respond to customer demands through novel innovations and meet these demands at an appropriate price and high quality. This is consistent with an agile manufacturing paradigm. Effective manufacturing, on the other hand, is defined by (Shaofei 2016: 28,) [42] as a strategy that enables an organization to achieve rapid changes in creating numerous product configurations in a timely way - rapidly answering market demands - in order to improve its competitive positioning.

According to Niraj (2016: 282) [43], effective manufacturing is a technique that allows businesses to generate numerous undetermined sorts and designs of items based on customer-defined parameters for desired goods. This results in excellent customer satisfaction, rapid market entry at cheaper costs, and greater capability to handle different requirements. Effective manufacturing is regarded as the ultimate barometer of customer satisfaction. Scholar (2017: 11) identified it as a revolutionary manufacturing method utilized to face competitive problems and respond quickly to client requests anytime, anyplace. As a result, the organization's production efficiency improves, as does its competitive supremacy, grasp of client requirements, and market conditions. This is accomplished through offering products and services that stand out for their flexibility and high quality, allowing the organization to remain viable in competitive marketplaces over time, boost profitability, and achieve long-term competitiveness.

Second: various global organizations have done investigations and research to support the concept of hybrid manufacturing. Despite their inherent differences, these studies show that the link between the Lean Manufacturing and Effective Manufacturing models generates indications and results that mutually reinforce one other.

As a result, the hybrid manufacturing system has emerged as a critical component for distinguishing between lean and effective operations. (Rajeev 2018: 423,) [] focused on the two primary streams of lean and effective manufacturing that constitute the foundation of developing the hybrid manufacturing strategy. The first school of thought contends that lean and effective production practices are mutually exclusive and cannot coexist. The second stream, on the other hand, feels they are independent techniques, with effective manufacturing being an upgrade of lean manufacturing. As a result, effective manufacturing improves firms' ability to respond to changing client wants and unanticipated requirements.

The practical aspect: The study design in this section is focused on comprehending the essence of the problem, its model, and its hypotheses. It also includes the research methods as well as the theoretical tasks given to it. It entails discussing the relationships and affects between research variables, as well as interpreting the data obtained in terms of agreements and differences. To accomplish this purpose, data were first processed by performing basic data analysis on those variables and their dimensions. This was accomplished by utilizing statistical analysis in line with processing procedures and statistical techniques suited for each question and hypothesis using the Statistical Package for the Social Sciences (SPSS) version 23. To ensure that the specific research objectives are met on a consistent basis.

Firstly: tests of normal distribution were conducted: The researcher used a One-Sample Kolmogorov-Smirnov Test to check that the research data was free of statistical flaws that could have impacted the hypothesis testing outcomes. This test assumes that the data have a normal distribution, and deviations from this assumption may result in spurious connections between research variables. As a result, the relationship's potential to explain or forecast the phenomenon under investigation declines. As seen in Table (1).

Table 1: Displays the results of the tests for normal distribution

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Hybrid Manufacturing	.099	70	.083	.977	70	.234
Designing and Improving Production Processes	.096	70	.180	.978	70	.262
Hybrid Processing Chain	.103	70	.062	.977	70	.232

The researcher prepared by relying on data from the (SPSS) program. We see that the distribution of all variables was normal after applying the preliminary tests, indicated by the linear interaction test of variable dimensions. The normal distribution ratios for all responses were greater than (0.05), the statistical treatment level used in this type of research.

Secondly: the Research Scale: The possible response degrees to the statements are measured using a Likert Scale, distributed across response weights among the sample participants. This scale ranges from its highest weight, which is (5), expressing "Strongly Agree," to its lowest weight, which is (1), representing "Strongly Disagree." There are three intermediate weights between them, as illustrated in Table (2).

Table 2: Presents the results of the agreement degree scale

Degree of Agreement	Relative Weight	Percentage	Statistical Significance
Strongly Agree	5	80% or more	Very High Agreement
Agree	4	From 70% to less than 80%	High Agreement
Neutral	3	From 50% to less than 70%	Moderate Agreement
Disagree	2	From 20% to less than 50%	Low Agreement
Strongly Disagree	1	Less than 20%	Very Low Agreement

The researcher prepared by relying on data from the (SPSS) program.

Thirdly: The Statistical Methods Used in Data Analysis

To answer the study's questions and test its hypotheses, the researcher utilized various statistical software programs, among them.

1. Frequencies and Percentages (Frequencies & Percent) were used to determine the measurement indicators adopted in the research sample.
2. The research sample participants' level of response to the research variables and statements was determined using the arithmetic mean. The standard deviation was utilized to calculate the degree of dispersion of the research sample participants' responses from their arithmetic mean.
3. Coefficient of Variability: To reflect the degree of agreement or disagreement among the sample's replies, if the coefficient of variability is less than (50%), it suggests agreement or convergence in the responses of the study sample. Greater variability in replies indicates the expected dispersion.

Fourthly: Testing Research Hypotheses

Testing the First Hypothesis: This hypothesis states that there is no significant correlation between hybrid manufacturing in design (Overall) and production process improvement (Overall). As illustrated in Table (3).

Table 3: Presents the results of the correlations between hybrid manufacturing in design (Overall) and production process improvement (Overall).

The Interactive Variable	Correlation
	Hybrid Manufacturing in Design
The Dependent Variable	**0.523
Production Process Improvement	

(**) The relationship is significant at the 0.01 level N=70

The researcher prepared by relying on the results from the (SPSS) program.

Table (3) shows a statistically significant positive link between hybrid manufacturing in design and improvement of production processes. The total correlation coefficient result was (**0.523) at a significance level of (0.05), indicating that the variables were related. This finding implies that the more attention the study sample pays to hybrid manufacturing, the more they contribute to improving production processes by inventing new ones and upgrading existing ones. As a result, factories' costs may be reduced, leading to the development of production operations, and ultimately raising demand. The first hypothesis is rejected in favor of the alternative hypothesis based on the statistical analysis results of the correlation between the research variables.

Hypothesis Testing two: This hypothesis states that there is no significant correlation between hybrid manufacturing in design (Overall) and the hybrid assembly sequence (overall). As illustrated in Table (4).

Table 4: Illustrates the results of the correlations between hybrid manufacturing in design (Overall) and hybrid assembly sequence (Overall).

The Interactive Variable	Correlation
	Hybrid Manufacturing in Design
The Dependent Variable	**0.398
Hybrid Assembly Sequence	

(**) The relationship is statistically significant at the (0.01) level. N=70

The researcher relied on the results obtained from the (SPSS) software program.

Table (4) shows that in the research sample, there is a statistically significant association between the dimensions of hybrid manufacturing in design (overall) and the hybrid assembly line. The strongest correlation coefficient value (0.398) was obtained, demonstrating that as the emphasis on hybrid manufacturing in design grows, the hybrid assembly line is activated. The research sample places a premium on customer happiness and product quality.

Based on the results of the statistical analysis of the correlation between the research variables, the null hypothesis is rejected and the alternative hypothesis is accepted.

Testing Hypothesis Three

This hypothesis states that there is no significant effect between hybrid manufacturing in design (Overall) and the improvement of production processes (overall) and the hybrid processing chain (Overall). As shown in Table (5).

Table 5: Displays the results of the indicators related to the relationships and effects between hybrid manufacturing in design (overall), the improvement of production processes (Overall), and the hybrid processing chain (Overall).

Hybrid manufacturing in design						Responsive variable/ Explanatory variable
Sig. Statistical significance	T Estimated	F Estimated	R^2	B_1	B_0	
0,000	4.204	25.608	0.274	0.556	1.396	Improving production processes
0.000	6.025	71.504	0.441	0.887	0.668	Hybrid processing chain

*$p \leq 0.05$ d.f (1, 69) N=70

***Source*:** Researcher's preparation based on the results from the (SPSS) program

The table (5) indicates the presence of a statistically significant relationship and effect of hybrid manufacturing in design (overall) on improving production processes in the research sample. The cumulative explained variance of hybrid manufacturing in design, according to the value of R^2, reached approximately (27.4%). Meanwhile, (72.6%) of the variance in improving production processes is attributed to other uncontrollable factors or factors that were not included in the regression model. This is supported by the regression coefficient value (B1) of (0.556), indicating that an increase of one unit in the hybrid manufacturing in design variable leads to an increase of (0.556) units in the variable of improving production processes. This increase is statistically significant, as evidenced by the computed F-value of 25.608, which is greater than its tabulated value (3.98) at degrees of freedom (1, 69) and a significance level of (0.00) less than the significance level of (0.05). Similarly, based on the computed T-value of 4.204, which is greater than its tabulated value of (1.671) at a significance level of (0.05), these results underscore the importance of hybrid manufacturing in design for achieving improvements in production processes.

Table (5) shows that in the research sample, there is a statistically significant relationship and effect of hybrid manufacturing in design (Overall) on hybrid processing sequence. The value of R2 indicates that the cumulative explained variance of hybrid manufacturing in design was roughly (44.1%). However, other uncontrolled factors or those not included in the regression model account for 53.9% of the variance in the hybrid processing sequence. The regression coefficient value (B1) of (0.887) supports this, indicating that an increase of one unit in the hybrid manufacturing in design variable leads to an increase of (0.887) units in the hybrid processing sequence variable. This increase is statistically significant, as indicated by the computed F-value of (71.504), which is more than its tabular value (3.98) at degrees of freedom (1, 69) and a significance threshold of (0.00) less than (0.05). Similarly, the computed T-value of (6.025), which is bigger than the tabular value of (1.671) at a significance level of (0.05), emphasizes the relevance of hybrid manufacturing in design for attaining the hybrid processing sequence.

As a result, the null hypothesis of the third hypothesis, which asserts that there is no significant relationship effect between hybrid manufacturing in design (Overall), enhancing production processes (Overall), and hybrid processing sequence (Overall), is rejected. Instead, the alternative hypothesis is adopted, which claims that hybrid manufacturing in design (overall), enhancing production processes (Overall), and hybrid processing sequence (Overall) have a substantial relationship effect.

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