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The impact of modern technology on production efficiency in Iraqi industrial companies

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Abstract
This study tries to investigate the impact of first modern technology on production efficiency in Iraqi industrial Companies secondly it attempts also to identify how can affect new Technologies product quality and productivity. The study was an analytical methodology, with a sample consisting of 100 subjects from the approximate total population (employees at industrial firms). A 15-question questionnaire was prepared for gathering details and Tech use in Production. More respondents agree that technology increases productivity and product value, although resistance to change in work practices and for funding are areas of major concern. After these results, the study suggested higher investments in technology and training of professionals as well improvements on decision making using data can be done as well new funding sources to support companies transformation.

Keywords: Modern technology, production efficiency, Iraqi industrial companies

Introduction
Technology has made a transformation in manufacturing, ushering in limitless creativity and potential. As this age-old business experiences a change that affects its trajectory — tradition and modernity intertwine.

We live in an era where automation, robots, and artificial intelligence help expedite manufacturing while also improving accuracy. Big data, IoT, and cloud computing improve decision-making by allowing for real-time data analysis, predictive maintenance, and better supply chain management. These advances boost efficiency and promote sensible, long-term manufacturing practices.

Automation technologies can improve manufacturing productivity by streamlining processes and increasing efficiency. For example, robotics and automation can reduce the risk of human error and omissions resulting in product defects.

Thus, this study examines how applying cutting-edge technology enters into it and across its production processes lead to increased operating procedures effective, cost-saving advantages as well as high-quality products from Iraqi industrial-based firms. The study elaborates on pressures experienced by Iraqi companies in utilizing modern technology and how to tackle these obstacles... so that production rates are high.

The study seeks to analyse the direct impact of technology on production efficiency by studying various Iraqi industrial companies, and presents recommendations that could enable this sector in Iraq to develop and excel under fierce competition arising from rapid technological development as well economic globalization.

Study problem
The rapid development of modern technology and the continuous changes in global economic environment are among the main obstacles entered by Iraqi industrial firms towards adopting novel technologies. Technology is a major factor in growing competitiveness and industrial efficiency, but many Iraqi companies are bogged down with outdated manufacturing techniques that prevent them from attaining the best-in-class quality standards.

The challenge of this study is to determine the extent by which can affect productivity production industrial enterprises in Iraq, and if its implement successfully will raise quality products, reduce prices and increase efficiency.

It also intends to research the obstacles these businesses have, when working with current technology such as lack of know-how, unavailability of technological infrastructure and resistance to change.

Thus, the main question the study addresses is this: What are those constraints to utilizing contemporary technology and more critically how much do they affect production efficiency in Iraqi industrial firms?

Study objectives

In order to healthier understand how present technology affects manufacture efficiency in Iraqi manufacturing enterprises, this schoolwork seeks to achieve the following goalmouths:

1. Evaluate the effects of modern technology on Iraqi manufacturing enterprises' production competence in terms of ornamental production events and raising output and excellence.
2. Examine how skill may lower operational expenditures for trades in the industrial sector by rationalisation manufacture and saving period and effort.
3. Examine the problems and barriers Iraqi manufacturing firms have while applying contemporary skill, such as a lack of the monetary or human capitals required for fruitful application.
4. Measure the degree to which Iraqi manufacturing firms are ready to embrace cutting-edge skill and the accessibility of the substructure needed to ease this shift.
5. Deliver tactics and proposals that help Iraqi manufacturing firms use modern technology to upsurge production competence, which raises their level of keenness both domestically and globally.
6. Inspect how technology touches industrial goods' excellence and their capacity to please domestic and global marketplace demands.

Significance of Study

This work is performed at a decisive point in time when the support of useful systems for national economic industry and consumer deliveries can be realized only with current technology. It is extremely important to learn more about the real impact of current technology on productivity, as industrial enterprises are a driving force behind Iraq´s expanding economy. This rules can elucidate about how to benefit from engineering improvements for competitive advantage and making one's operation efficient. The research provides insight into how organizations may address the challenges they encounter when deploying cutting-edge technology, which is critical for maintaining and scaling capabilities over time.

In addition to already stiffening competition in both domestic and international markets, this study emphasizes the importance of technology upgrading for improving product quality as well as enhancing overall consumer satisfaction. The study brings benefit to the decision makers and economic policy formulators in Iraq as well as industrial companies which help them make decisions, that eventually result in facilitated use of digital transformation leading to enhanced efficacy and success for the Iraqi industry by exploring direct effects related technology on production efficiency.

Study Concepts

Modern technology: refers to the convergence of computing and networking, empowering users with decentralized control over advanced equipment and knowledge essential for its use.

Production efficiency: Production efficiency is an economic term describing a level at which an economy or entity can no longer produce additional amounts of a good without lowering the production level of another product.

Study Limitations

Geographical scope: The study does not cover industrial trades in other nations since it distillates on those that are founded in Iraq. We shall lone examine the knowledges and difficulties sole to the industrial setting in Iraq.

Time scope: Technical developments that removed place prior to 2024 will not be taken into explanation because the study's emphasis will be on how modern technology has affected industrial efficiency in new years.

Subject scope: The investigation may not fully speech other elements that might effect productivity, such as organization, governmental rules, or overall financial conditions, as it chiefly examines the connection amid contemporary skill and production competence.

Literature Review

The article by Hasan Yasien Touama (2014) [1] titled Role of the Computerized Information Systems in Rationalization the Administrative Decisions: An Empirical Study in Babylon Tires Factory provides a detailed examination on how computerized information systems are valuable for improving administrative decisions at Babylon's Tires factory. For critical managerial functions, a factory does not have access to an integrated information system and relies on manual processes for data entry which calls into question the effectiveness of this type of solution in supporting increasingly sophisticated decision-making requirements within such a complex environment.

Touama used this data to illustrate the necessity of complex information systems for informing administrative decisions. The research found that the current Babylon Tires Factory system is not advanced enough for full operation,ble to move into, so it was concluded that a separate information systems unit should be formed within the organiza. pub. structure.tar Ch Our recommendation is consistent with the literature on ensuring quick and well-informed decision-making in today's industry that gives priority to reliable information systems.

The publication also calls for increasing state support in the framework of forming an information system and updating equipment used to spread rubber. This position is very important because joining technology in terms of the most advanced can increase productivity and speed up administrative procedures, leading to an organizational structure more agile. The recommendation about installing computer programs is crucial because a complete information system to adapt the factory operating conditions must include these too.

Touama also emphasized the importance of building a quick-thinking workforce, which is particularly relevant to employees within administrative information systems. This focus on human capital is crucial because the skills and motivation of the people behind these systems play a significant role in determining how effective any technology

deployment will be. Suggesting simply that they give courses to their staff and internship programs gives a good sign of wanting to develop the workforce necessary for having as technological intermediates really enable production.

In his essay "Industrial robotics in the lean enterprise: a case study at semi-conductor company" (Safady, 2017), Hammam M. H. Safady provides clear insight on how robots have become integrated into plants where they are producing product of all scale, and with reference to this paper for example (a very good one in terms of looking through incorporating electronics industry). The report highlighted productivity was transformed by technology over the past three decades with robots leading the way.

Safady leads here by listing the rate at which technology is rapidly advancing and how that affects industrial processes. This point the author makes because improvements in robotics and AI have significantly enhanced human-robot interaction which had made it more possible to automate manufacturing processes. Use of these technologies could be beneficial for a lot Iraqi industrial business particularly since this will result in huge augmentations operational effectiveness. (Al-Sabaawe *et al*., 2024:239) [2].

The essay is a critical review of how the competitive pressures on business to adopt cutting-edge technology, so they can investment human labor with top output and quality. Robots, said Safady, have many clear advantages when it comes to performing labor-intensive tasks over and over again with precision—and often in environments that are either unpleasant or dangerous. The assertion falls in line with the wider drive among this sector towards automation, widely regarded as vital to remain competitive on a global stage.

The writer also mentioned of the lean production approach which has to do with reducing waste and increase performance. They Claim Robotics integration as an easy path to full automation, it will no doubt boost quality many folds as well as productivity. However, How does one ensure that every this new technology would in fact support the lean concepts rather than run against them? This nuanced perspective is necessary to comprehend the challenges of how to reconcile modern technologies with industrial settings.

Safady's study suggests robotics similarly require a strategic approach in firms inclined toward lean thinking as they introduce these technologies into industrial processes. While the paper acknowledges that robots have many benefits, it also notes as to how and where they are applied.

In the paper Application of modern warehouse technology in Slovenian automotive industry Škerlič, Muha and Sokolovskij (2017) [6] comprehensively analyzed consequences automated technologically advanced warehouses brings to the warehousing operations especially regarding car making sector. They also emphasize that it is crucial for businesses to know what contemporary technology brings and how they can take advantage of them in the service era if they want to stay on top fulfilling consumer demands. This awareness is very relevant to the Iraqi industrial enterprises as these concepts can be used to understand larger implications of technology on overall production efficiency.

For that reason, one of the main things writers call our attention to is that some people like automation more than others. This is particularly important for industrial firms in Iraq, since not reaching an agreement as to the benefits about modern technology may represent a barrier against adopting effective operations. Those who have shunned automation may struggle to adapt, potentially reducing their ability to provide for clients and drive future business.

They also note that implementing warehouse technology haphazardly or non-uniform can lead to downsides. This caution is relevant primarily for Iraqi industrial companies as in many instances they find themselves unable to synthesize technology with their operational objectives. Their findings also champion for a multifaceted view of warehouse automation, claiming that the right approach could lead to considerable improvements in efficiency and client experience.

They investigate how organizational learning and empowerment strategies work in tandem to increase competitive advantage by examining the industrial companies in Iraq (Kadhim, Mohammed *et al*.) [7] As the authors explain, organizational learning is the missing link between competitive advantage and empowerment tactics —a point of connection particularly relevant in what can be a fast-moving opportunity (or problem) in business life uprooted by subsequent events—the state of Iraq after about forty years under Saddam.

The findings of the study underlines the importance that organizational learning plays in providing businesses with current knowledge as to what is happening within its market and environmental setting. It is this insight that drives lasting competitive advantage through resource development and integration. The authors said companies could enhance resource management and flexibility in response to changing market conditions by creating an environment that values learning. This is especially crucial for Iraqi industrial firms, who already face extra challenges and stresses from competition. (Al-Sabaawe *et al*., 2020: 150) [5].

The paper also places a great deal of importance on the fact that empowerment approaches are not merely beneficial — they will in some cases become necessary for firms to maintain their competitive positions. The authors argue that by empowering their employees with the power and means to devise better solutions, companies make a hypothetically worthwhile investment. When combined with a solid framework of organizational learning, this empowerment creates the basis for businesses to effectively navigate through operational challenges and market changes. These factors should be top of mind for managers and legislators, the report said, because they can result in a dramatic increase in efficiency — or lead to up higher output.

More importantly, it may explore in more practical terms of how to implement things from this paper; but though the findings would contribute significant information about organizational learning-to-competitive advantage as well as empowerment. The addition of a few actual examples or case-study chapters, applying these techniques to Iraqi industrial firms and illustrating their successful application might help make the point. Future studies should also explore barriers, which may hinder the operationalization of empowerment and educational programs in an Iraqi context.

Ronell Leo (2018) [8] explores this issue at length in her article "A model for smart factories into automotive sector," where she looks into the ways modern tech could streamline production process, especially when it is mediated through smart factories. The author elaborates on how

manufacturing firms are being pressured due to the evolution of demand for more personalized products and faster innovation push in them out from reactive towards Proactive or Predictive operating paradigms.

Leo deems it critical to combine these networked, real-time solutions with cognitive and probabilistic approaches which are best suited for the complexity of today's production environments. To watch this video and other Tech-talk videos please subscribe our channel “The idea of smart factories are perceived as the solution, where extremely modern technology including cloud computing, big data, collaborative robotics cyber physical systems and internet of things. This is about positioning these technologies as strategic investments that offer large and growing immediate (and possibly long-term) financial returns, aligned with broader organizational objectives rather than just the costed parts of needed operations. (Sadeghi *et al*., 2024: 103) [5].

For an in-depth look at how the redesign of manufacturing processes to accommodate modern information technology can substantially increase production efficiencies, see Basil Mugwagwa's essay "A model for smart factories in pharmaceutical manufacturing sector" (Mugwagwa, 2019) [9]. A common theme found throughout the article is that modern industrial competition mandates levels of quality, delivery speed and especially creativity can only be supported by using cutting edge technology on your products.

The transitional nature of the manufacturing sector toward smart factories — as Mugwagwa describes it— is measured by its capability to be self-aware, predictive, comparative and re-configurative i.e. adaptable without loss in efficiency or productivity: all means of better maintenance independent from human interference. Since both are the prerequisites of each other for overall production efficiency and service innovation. As the article explains, monitoring in real time can align operations to meet demand from the market reducing waste and increasing productivity – converting to costs. This underlines the importance of system integration when it comes to designing smart industrial environments. It supports the more modern theories of just-in-time production and lean manufacturing, in relation to adapting process time scales to shifting market conditions.

The author also presses on how firms can derive strategic benefit of it from improved production technologies. Furthermore, investment in technology can help businesses get an advantage over their competitors and even enhance operational efficiencies. It does not, however, shy from harsh criticism of the ways in which technology is taken up more broadly by people. According to Mugwagwa, the influence of your workforce in terms of their mood towards and sentiments about new systems have a lot effect upon how well technology is integrated. This research is important because it suggests that managers must create an environment of trust and cooperation in order to encourage the use of technology. Not even the highest technology development can take off if we overlook this human factor.

The article further implies that competition in the manufacturing sector has revived and businesses cannot afford to become dormant for long as they need innovation-economic, technological or surgical one after another. with each product. Because of this changed situation more than ever, automated production systems are being presented as a key means to achieve and maintain competitiveness. In this context Mugwagwa's suggestion that technological investment should be central to strategic decision-making would appear highly relevant, not least for Iraqi industrial firms which are likely facing similar challenges in adapting to more modern forms of production.

To understand how they are transforming the industrial manufacturing world and their role in increasing production efficiency within Iraqi industrial companies, Sanneman *et al*. (2020) [10] published an article "The State of Industrial Robotics: Emerging Technologies, Challenges, and Key Research Directions" were crucial to follow for creating my research question or acquiring potential information sources. The report authors highlight the role of production-process-embedded robotics in driving this ongoing digitalization trend within industry. That said, while increasing the efficiency of production lines is important in itself, this level of integration also helps make an industrial environment even more connected. The paper stresses that modern robotics would simplify operations through automation of repetitive processes, reducing human error and increasing efficiency. For Iraqi industrial firms, many of which are already finding limited workers or in need of greater productivity to compete at a global level this is particularly key. (Maan & Al-Sabaawe,2018: 75) [14].

Additionally, Sanneman *et al*. Discussion in Sanneman *et al*. (2020) [10] covers several of these promising robotics technologies, for example cobots or collaborative robots that collaborate with human operators. This alliance might lead to production settings that are more flexible and efficient, thereby enabling amenable manufacturing techniques. Such developments are essential for Iraqi enterprises to achieve the modernization and strengthening of industrial capacity.

They also mention barriers to the more extensive deployment of robots, such as their cost and a potential skills mismatch in workers. However, there are gaps that need to be bridged by the Iraqi industrial businesses before they can significantly benefit from profitable robots. The paper points out that these challenges must be overcome, and also claims it could lead to more efficient manufacturing with targeted research and development initiatives.

The paper Mapping Industry 4.0 Technologies: From Cyber-Physical Systems to Artificial Intelligence by Meindl and Mendonça (Meindl & Mendonça, 2021) [11] conducts a comprehensive review of evidence on how recent technologies are transforming production processes in industrial contexts such as Iraq using the understanding derived from the Fourth Industrial Revolution onwards. According to the authors modern technological advances—specifically through innovations like IIoT, or Industrial Internet of Things—are changing how production is managed and are helping reduce the necessity for traditional local control systems while enhancing shop floor productivity.

One of the most interesting findings in this report is on cloud computing as a critical part of IIoT. The successful realization of edge solutions and smart sensors–key components in modern industrial processes rely on reliable cloud infrastructure. This shift to decentralized architectures also leads towards a more dynamic and adaptable production environment as well allowing faster data processing for quick decisions. Such advancements arematerially important for Iraqi industrial manufacturers, as

the modern technology architecture could radically improve outdated manufacturing process.

A separate emphasis is placed on the need for blockchain technology to ensure the reliability of these networked systems. Blockchain can help build stakeholder confidence and streamline operations of the supply chain, through a transparent and secure data exchange. This is important for Iraqi industries, which might face integrity of data and transparency operation.

They also touch on how smart systems have made AI for manufacturing even more crucial. AI adds to automation, but also enables powerful new predictive maintenance methods and more advanced use of augmented reality apps as well as human-robot collaboration. These advances are required to improve manufacturing speed and compete in global market sociology.

The paper by Črešnar, Dabić, Stojčić and Nedelko (2022) [12] entitled: 'It takes two to tango: technological/non-technological factors of Industry 4.0 implementation in manufacturing firms' provides a comprehensive insight into the determinants that have been established as significant when it comes to adopting Industry 4.0 within organizations dedicated primarily towards improving their production process sting set Text Color(color = "amber")** While the use of such technical innovations is necessary to increase productivity, they suggest that factors other than those strictly technological are likely at least as critical — if not more so— for ensuring new technologies successfully reach widespread adoption and integration.

A systematic review of the paper “Applications and Societal Implications of Artificial Intelligence in Manufacturing” by John P. Nelson, Justin B. Biddle & Philip Shapira (Nelson *et al*., 2023) [13] examined how artificial intelligence (AI) can bring relief to manufacturing operations through detailed discussion on vulnerability spots where AI could contribute most significantly within production stages or throughput sequences; Authors say this possibility enables a myriad of customization and operational efficiency solutions by injecting AI into the mix. If they are realized, these prospects will be the most significant for Iraq's industrial enterprises interested in improving production efficiency.

Research Methodology

The descriptive analytical method was used in this study to ascertain how contemporary technology affected the productivity of Iraqi industrial firms. This method seeks to outline the existing situation, examine data pertaining to the use of technology and its effects on production processes, and investigate the difficulties and barriers that businesses face. The target sample was given a questionnaire to complete in order to obtain quantitative data, and the data was then analyzed using the proper statistical techniques.

Population

The population of this study refers to all Iraqi industrial firms carrying out activities in Iraq belonging one way or another to the construction, petrochemicals and manufacturing sectors. This category includes technology based large and medium businesses. The research aims at discovering how current companies use technology and its effect on productivity.

Sample

A statistical sample of employees in Iraqi industrial companies, and consisting presented to official randomly 100sample. The participants are employees of different hierarchical levels (managers, engineers and production field workers). The sample was drawn at random so as to give a complete picture of the study population and include all facets possible related on technology in their workplace.

Study Tool

This study used 15 questions that were constructed for this survey and collected relevant data which was also utilized. The questions related to various dimensions like the level of technology adoption which is modern; effect on productivity, issues with company in using those technologies and how comfortable are employees about it happening there. The questionnaire was also distributed to the sample electronically, and data accuracy and validity will promoted privacy ascertained.

Statistical Analysis

The results were extracted from the questionnaires and parsed using statistical analysis. All data quantitative, were analyzed using the statistical analysis programs (SPSS), where average was made arithmetic and standard deviation. This analysis enabled to obtain an accurate picture of the extent impact that technology has on production efficiency, and recognize the main trends and challenges facing Iraqi industrial companies.

Results

Phrase	Mean	Standard deviation
Our company is constantly adopting modern technology to improve production processes.	3.66	1.35005
The use of modern technology has increased the productivity of employees in the company.	4.12	1.01782
Technology contributes to improving the quality of products manufactured in our company.	4.31	0.92872
The application of technology has reduced our production costs.	3.8	1.07309
Employees are regularly trained to use modern technologies in our company.	4.24	0.90028
Technology contributes to reducing production errors in daily operations.	4.68	0.60101
We have the necessary technological infrastructure to support the digital transformation in the company.	4.48	0.83461
Our company faces challenges in providing the financial resources needed to adopt modern technology.	4.101	1.01514
The use of technology has improved the efficiency of communication between work teams.	4.01	0.83479
Automation processes in the company are one of the main factors in improving production efficiency.	4.04	1.00423
Our company faces difficulty in some employees resisting technological change.	3.88	1.05677
Technology contributes to reducing the time spent in the production cycle.	3.68	1.21339
The use of data analytics helps improve management decision-making related to production.	3.34	1.3121
The technology we currently use is compatible with international quality standards.	3.62	1.18731
The application of technology in our company helps enhance competitiveness in the local and international market.	3.69	1.09816

Analysis of the results shows a clear consensus among participants about the role of modern technology in improving various aspects of production efficiency. Statements related to improving product quality, reducing errors, and providing technological infrastructure came with high average rates (such as 4.31, 4.68, and 4.48, respectively), indicating employee satisfaction with the impact of technology on these aspects. Regular training of employees (with an average of 4.24) indicates an awareness of the importance of enhancing technological capabilities.

However, the lower average for statements such as using data analytics in decision-making (3.34) and some employees' resistance to technological change (3.88) show challenges in absorbing and adopting some aspects of technology. Also, the prominence of the issue of providing financial resources to adopt modern technology (4.101) reflects financial challenges faced by companies.

This discrepancy reflects that technology may be advanced in some aspects, but there are difficulties related to comprehensive adoption and optimal analysis of production data. In general, the survey shows a positive attitude towards technology, with the need to address some challenges related to resources and the ability to exploit technology more efficiently.

Conclusion

Based on the survey result, it can be concluded that modern technology has a significant positive effect in increasing production efficiency for Iraqi industrial companies which can be seen by large of number satisfied participants with regards to impact product quality improvement; good person error reduction and team relation enhancement. Ensuring that employees are well-trained in using advanced technologies is another major motivator of this shift. However, companies find it difficult to provide the finance required for adoption of technology on a large scale and also there is resistance from some employees in accepting technological change. The discrepancy between the use of data analytics also indicates that harnessing information for management decision-making with respect to production needs an augmentation. The research reflects a general opinion that technology is massively contributing to production efficiency while reaching full potential may require other management challenges such as resources and adjusting the way work is performed in relation with the introduction of new technologies.

One of the most things that should be done by Iraqi industrial companies is intensify their investment in modern technology and spend an enough amount of budget for adopting suitable technological systems based on the results, recommendation. Efficient training programs should be rolled out so as to upgrade employees on the necessary skills in utilizing modern technology, hence reducing reluctance and enhancing work output. The use of data and analysis in managerial decisions also needs to improve, as this can help enhance a company's competitive edge.

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