

العنوان باللغة العربية

أثر الذكاء الاصطناعي و التحول الرقمي على سلاسل الإمداد في المملكة العربية السعودية

إعداد الطالب/

محمد العميري

إشراف/

د. وليد سليمان

د. الفيصل

د. رنا

د. شيماء

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Midocean University

College of Management

Department of Project Management



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**The impact of Artificial Intelligence and Digital Transformation on
Supply Chain in Saudi Arabia**

Prepared by/

Mohammed Aomayri

Supervisor/

Dr. Waleed Sulaiman

Dr. Al Faisal

Dr. Rana

Dr. Shayma

Year/

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1- Introduction:

“Success in creating AI would be the biggest event in human history. Unfortunately, it might also be the last, unless we learn how to avoid the risks.” Stephen Hawking

In recent years, there has been a rapid rise in the adoption of artificial intelligence and digital transformation across various industries. This has resulted in significant advancements in business performance, as AI technologies improve efficiency, decision-making processes, and overall operational effectiveness. With Saudi Arabia's Vision 2030 emphasizing the importance of digitalization and AI knowledge, it is crucial to investigate how these technologies can be applied in the supply chain management context to enhance the competitiveness and efficiency of Saudi businesses.

1.1 Artificial Intelligence and digital transformation in supply chain:

The digital revolution, driven predominantly by Artificial Intelligence (AI), digital transformation and other advanced technologies, is profoundly altering the way businesses operate. This transformation transcends sectors and industries, with supply chain management emerging as a critical beneficiary. With the proliferation of the Internet, mobile technology, and cloud computing, there has been an exponential growth in data. AI thrives on this data, utilizing algorithms to discern patterns, predict trends, and make decisions with minimal human intervention. The introduction of AI in supply chain management means that tasks like demand forecasting, inventory management, and logistics optimization can now be executed with unparalleled precision. Machine learning models can predict consumer behavior, allowing businesses to preemptively adjust their stocks, thus reducing wastage and improving efficiency. With AI-driven tools, supply

chains have transitioned from being reactive to proactive. Real-time analytics empower businesses to respond instantaneously to changes in the market or disruptions, ensuring resilience and continuity. The physical aspects of the supply chain, from warehousing to transportation, are witnessing a transformation with the integration of robotics. Automated warehousing systems, for example, streamline storage and retrieval processes, maximize space and minimize errors. Beyond AI, the digital transformation wave has brought blockchain into the supply chain domain. With its decentralized ledger system, blockchain provides transparency, traceability, and security, ensuring authentic product verifications and secure transactions. Efficient supply chain management has always been about ensuring the right products reach the right places at the right time. AI and digital tools magnify this efficiency manifold, bringing cost savings, speed, and adaptability. As global supply chains face increasing complexities due to geopolitical issues, climate change, and consumer demands, these technologies become not just beneficial but essential. As the world becomes increasingly interconnected and digital, the fusion of AI and digital transformation with supply chain management promises a future of enhanced efficiency, accuracy, and innovation. For businesses and economies at large, adapting to and integrating these technologies is not just a competitive advantage but a necessary evolution. (Banker, n.d.)

1.2 Supply chain in Saudi Arabia:

Saudi Arabia's supply chain and coordination sector has evolved significantly over the years, especially considering its ambitious economic transformation plans, such as Vision 2030. Saudi Arabia's Vision 2030 aims to reduce the nation's dependence on oil revenues. This has prompted the development and expansion of other industries, necessitating the growth of robust supply chain mechanisms to support sectors like mining,

entertainment, tourism, and manufacturing. The country has been investing heavily in its infrastructure, including ports, railways, and airports. King Abdullah Port, for example, is one of the world's fastest-growing ports. Improved infrastructure facilitates smoother trade and transport within the country and with its trading partners. Saudi Arabia's position bridging Asia, Europe, and Africa places it at a strategic crossroads for international trade. This geographic advantage can lead to the country becoming a coordination hub for the broader region, especially if it continues to improve its logistical infrastructure. While there are opportunities, the supply chain in Saudi Arabia has faced challenges, including bureaucratic hurdles, the need for modernization in certain areas, and adapting to new technological advancements. With the global trend towards the digitalization of supply chains (including the use of AI, blockchain, and Internet of things), Saudi Arabia has been working to incorporate these technologies to enhance efficiency, visibility, and reliability. Various cities and zones are being developed as logistics and industrial hubs, such as the King Salman Energy Park (SPARK) and NEOM, a planned cross-border city in the Tabuk Province. The Red Sea, on Saudi Arabia's west coast, is a significant trade route connecting Europe, Africa, and Asia. The country is looking to enhance its maritime logistics capabilities along this corridor. There's an increasing demand for advanced warehousing solutions, especially for temperature-controlled storage, given the country's extreme temperatures and growing food and pharmaceutical sectors. "In-Kingdom Total Value Add" (IKTVA) is a program by Saudi Aramco aiming to increase the localization of goods and services. It impacts the supply chain by emphasizing local sourcing and production. Saudi Arabia has recognized the need for skilled professionals in the logistics and supply chain sector. Efforts are being made to provide training and education to the local population to fill these roles. (*Saudi Vision 2030*, n.d.)

2- Research Problem:

In recent years, Saudi Arabia has been rapidly integrating artificial intelligence and digital tools into its industries as part of its Vision 2030 objectives. While global trends suggest that AI and digital transformation have the potential to significantly enhance supply chain efficiency, there is a dearth of comprehensive studies examining the specific impacts, both positive and negative, of these technologies on the supply chain ecosystem within Saudi Arabia's unique socio-economic context. Given Saudi Arabia's strategic importance as a trade hub and its ongoing economic diversification efforts, understanding these impacts is crucial. The main problem of this research is that there is lack of studies that link AI and digital transformation to supply chain in Saudi Arabia. Therefore, this research paper will shed the light on investigating the influence of artificial intelligence and digital transformation in reshaping the supply chain processes, dynamics, and outcomes in Saudi Arabia.

3- Research questions:

1. What are the current trends and strategies in supply chain management in Saudi Arabia?
2. How is artificial intelligence being applied in supply chain management in Saudi Arabia?
3. What are the potential barriers and risks associated with the integration of artificial intelligence and digital transformation in supply chain management in Saudi Arabia?

4- Research importance and objectives:

The importance of this research lies in its potential to provide valuable insights and recommendations for the Saudi supply chain industry, policymakers, and stakeholders. By understanding the current state of AI and digital transformation adoption in the Saudi supply chain, as well as identifying the barriers and challenges, opportunities and benefits, and best practices for implementation, this research can contribute to the development of effective strategies and interventions that promote the successful integration of AI and digital transformation in the Saudi supply chain. This, in turn, can lead to improved supply chain efficiency, cost savings, increased competitiveness, and overall economic growth for Saudi Arabia. Furthermore, this research aims to contribute to the existing body of knowledge on AI and digital transformation in supply chain management by specifically focusing on the Saudi context.

The objectives of this research are to:

1. To examine the impact of digital transformation on firm performance in the Saudi supply chain context, with a focus on variables such as market share, earnings growth, and customer satisfaction.
2. To investigate the role of AI and digital technologies in improving key supply chain processes such as demand forecasting, inventory management, and decision-making.
3. To explore the potential barriers and challenges faced by Saudi organizations in implementing AI and digital transformation in their supply chain.

5- Research Hypothesis:

Hypothesis1: Organizations that have adopted AI and digital transformation in their supply chain will experience improved performance measures such as increased market share, earnings growth, and customer satisfaction.

Hypothesis 2: AI and digital technologies will significantly improve key supply chain processes such as demand forecasting, inventory management, and decision-making in the Saudi context.

Hypothesis 3: The implementation of AI and digital transformation in the Saudi supply chain will be hindered by various barriers and challenges, such as limited resources and expertise, cultural resistance to change, and regulatory constraints.

6- Literature review:

- (Pandian, 2019), the emergence of smart warehousing has been driven by advancements in technology, business procedures, and the need to modify operations due to accumulating orders, complications, and management skills shortages. Smart warehousing is crucial for enhancing organizational management and success, as it plays a vital role in the supply chain and logistics. The application of artificial intelligence in warehousing operations enhances its potential in logistics, management, and coordination. The paper proposes the use of the internet of things, artificial intelligence, and cloud computing for automated storage and retrieval, allowing for anytime access to stock in the warehouse.

Warehousing is essential for storing goods produced in offseason and those demanded in offseason, ensuring quick supply, price stabilization, bulk breaking, and economic benefits for businesses and customers. However, growing demands and difficulties have made

conventional warehousing operations incompatible for smooth handling. Several researches have involved the application of the internet of things, cloud computing, wireless sensor networks, RFID, tag readers, drones, robots, and artificial intelligence to automate warehouse processes, ensuring efficient storage and retrieval of products and efficient functioning of the warehouse.

- (Gonçalves, 2019), this dissertation explores the potential of implementing intelligent systems and the impact of Artificial Intelligence on inventory management and warehousing. The author, Mafalda Correia Piçarra Gonçalves, a Master's in Business Administration student, acknowledges the support and advice she received from her supervisors, colleagues, friends, family, boyfriend Rafael, and parents. The study aims to investigate the concept of artificial intelligence and its benefits, confidence, and risks in analyzing its application in stock and warehousing management.

The research uses a literature review and online questionnaires to analyze the results. The online questionnaire concludes that Artificial Intelligence has benefits and confidence indicators that positively influence stock and warehousing management. However, it is still considered an investment, particularly for small industrial companies. The applications being developed are considered beneficial by AI specialists, such as machine learning, robotics, and computer vision technologies.

The study also highlights the importance of understanding the impact of AI on inventory management and warehousing management, as well as the potential benefits and risks associated with its implementation.

- (Al-Fattah, 2021), the paper presents a study on the application of artificial intelligence (AI) in forecasting crude oil demand for Saudi Arabia and China. The study uses a hybrid approach of genetic algorithms, neural networks, and data-mining for time-series models (GANNATS) to

develop crude oil demand forecasts. The models were applied to two country cases, one for a high oil producer (Saudi Arabia) and one for a high oil consumer (China). The input variables of the neural network models include GDP, population, oil prices, gas prices, and transport data, as well as transformed variables and functional links. The artificial intelligence predictive models of oil demand were successfully developed, trained, validated, and tested using historical oil-market data, yielding excellent oil demand predictions. The study found that crude oil demand for both Saudi Arabia and China will continue to increase over the forecast period, with a mildly declining growth, particularly for Saudi Arabia. The proposed GANNATS methodology optimizes and upgrades the conventional process of developing oil demand forecasts, improving the predictability and accuracy of current models.

7- Research Methodology:

The research methodology for this study will involve a quantitative approach. Quantitative methods, such as surveys and data analysis, will be used to collect and analyze data on the adoption and impact of AI and digital transformation in the Saudi supply chain.

8- Research Limitations:

Location: Electrical wires and cables factories in Saudi Arabia

Time: 2023

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