

Research Title:

**The Impact of Application of Artificial
Intelligence on The Supply Chains
Management of Almarai Company**

2023

1. Introduction

The use of AI has significantly impacted supply chain management, particularly in logistics firms. AI's capacity to monitor freight forwarding on a large scale and predict shipping requirements has proven advantageous (Rahimi & Alemtabriz, 2022). Through the integration of AI, supply chain managers now have a better understanding of the entire system, enabling them to make more informed decisions and provide more attentive customer service. This progression originated with the introduction of expert systems and fuzzy logic, and it reached its full potential after 2010. Today's cutting-edge AI has been shaped by the advancements in big data, analytics, graphics processing units (GPU), and deep learning (DL) applications (Li, 2020).

The popularity of AI applications has surged since early 2010, creating both enthusiasm and concern regarding the future of employment and corporate management (Li, 2020). Additionally, assessing performance is crucial for businesses as it enables them to improve customer service and achieve long-term goals. Evaluating the degree of customer satisfaction and efficient resource utilization is essential in attaining the desired level of satisfaction. Instead of focusing solely on an individual company's performance within the supply chain, a comprehensive evaluation considers the interconnectedness of all the businesses involved. This approach provides a broader understanding of the entire system, influences people's actions, and reveals the effectiveness of stakeholders and supply chain participants. Performance measures play a significant role in management, facilitating transparency and a deep understanding of the supply chain. Within a company, supply chain effectiveness can be evaluated by monitoring key indicators such as lead time, fill rate, and on-time performance (Yu et al., 2017).

1.1. Research Problem

The research problem addressed in this study is to examine the impact of applying artificial intelligence (AI) on the supply chain management of the Saudi Almarai Company. As AI technology continues to advance, it has the potential to revolutionize various industries, including supply chain management. However, the specific implications and consequences

of implementing AI in the context of the Almarai Company's supply chain operations remain largely unexplored. Therefore, this research aims to investigate how the integration of AI can enhance supply chain processes, improve efficiency, reduce costs, and enhance decision-making within the Almarai Company. By examining the potential benefits, challenges, and strategies associated with AI adoption in supply chain management, this research aims to provide valuable insights and recommendations to help the Almarai Company leverage AI technology effectively and maximize its competitive advantage in the dynamic marketplace.

1.2. Research Aim and Objectives:

The main aim of this research is to explore and analyze the impact of the application of artificial intelligence (AI) on the supply chain management of the Saudi Almarai Company. By investigating the integration of AI technologies in supply chain processes, the study aims to identify the benefits, challenges, and potential opportunities that AI can bring to Almarai's supply chain operations.

To achieve this aim, the research will pursue the following objectives:

- **Assess the current state of Almarai supply chain management:** This objective involves evaluating the existing supply chain practices, processes, and technologies employed by Almarai Company. It will provide a baseline understanding of the company's supply chain operations and highlight the areas where AI can potentially enhance efficiency and effectiveness.
- **Investigate the potential applications of AI in supply chain management:** This objective focuses on exploring various AI technologies that can be implemented in different stages of Almarai's supply chain, including demand forecasting, inventory management, logistics optimization, and supplier relationship management. The research will examine how AI can automate tasks, enable predictive analytics, improve decision-making, and enhance overall supply chain performance.
- **Evaluate the benefits and challenges of AI implementation:** This objective aims to analyze the potential benefits and challenges associated with the application of AI in Almarai's supply chain management. It will investigate the expected improvements

in operational efficiency, cost reduction, customer service, and risk mitigation, as well as potential challenges related to data quality, integration issues, organizational change, and ethical considerations.

- Provide recommendations for AI adoption in Almarai's supply chain: This objective involves synthesizing the research findings and proposing actionable recommendations for Almarai to effectively adopt and leverage AI in its supply chain management.

1.3.Research Importance:

The importance of this research lies in the current business landscape. With the increasing integration of AI technologies in various industries, understanding its implications on supply chain management becomes crucial for companies striving to optimize their operations. Almarai, as one of the largest food and beverage companies in the Middle East, plays a vital role in the region's supply chain ecosystem. By investigating the implementation of AI in Almarai's supply chain management, this research aims to shed light on the potential benefits, challenges, and strategies associated with AI adoption. Furthermore, the findings of this study can provide valuable insights for other companies in the food and beverage sector, as well as those in different industries, seeking to leverage AI to enhance their supply chain performance. Ultimately, this research can contribute to enhancing operational efficiency, cost-effectiveness, and overall competitiveness of Almarai and similar organizations, while also advancing the broader understanding of AI's impact on supply chain management in the context of the Saudi Arabian market.

1.4.Research Hypotheses

- 1) **Research Hypothesis 1:** The application of artificial intelligence (AI) in the supply chain management of the Saudi Almarai Company leads to increased operational efficiency.
- 2) **Research Hypothesis 2:** The implementation of AI in supply chain management at the Saudi Almarai Company enhances demand forecasting accuracy and reduces inventory holding costs.

- 3) **Research Hypothesis 3:** The utilization of AI technologies in the supply chain management of the Saudi Almarai Company improves customer satisfaction and reduces order fulfillment time.

2. Literature Review

2.1.Introduction

The impact of the application of artificial intelligence (AI) on supply chain management has gained significant attention in recent years. With advancements in technology and the increasing complexity of supply chains, companies are exploring innovative ways to optimize their operations. This literature review aims to investigate the specific case of the Saudi Almarai Company and its adoption of AI in supply chain management. The literature suggests that AI has the potential to revolutionize various aspects of supply chain management, including demand forecasting, inventory management, transportation logistics, and overall operational efficiency. Studies have shown that AI-driven solutions can enhance decision-making processes, minimize costs, reduce lead times, and improve customer satisfaction. Additionally, AI can facilitate real-time data analysis, enabling proactive decision-making and mitigating supply chain disruptions. While several studies have explored the impact of AI on supply chains, there is limited research focused on its implementation within the Saudi Arabian context and specifically within Almarai. Therefore, this research aims to fill this gap by examining the benefits, challenges, and outcomes of AI application in the supply chain management of Almarai, providing valuable insights for both academia and industry practitioners.

2.2.Almarai Company

Almarai, a prominent Saudi Arabian company, is widely recognized as a leading player in the food and beverage industry. With a rich history dating back to 1977, Almarai has grown to become a household name, not only within Saudi Arabia but also across the Middle East and beyond. The company has gained a reputation for its unwavering commitment to quality, innovation, and customer satisfaction. Almarai's diverse product portfolio encompasses

dairy, bakery, juice, poultry, and infant nutrition, catering to a wide range of consumer needs. Through its state-of-the-art facilities, stringent quality control measures, and a relentless focus on sustainability, Almarai continues to be a symbol of excellence and a driving force in the region's agricultural and food processing sectors (Almarai website).

2.3. Almarai Supply Chains (SC)

Almarai, a leading Saudi company, boasts a robust and efficient supply chain that serves as a backbone for its operations. The company's supply chain management ensures the seamless flow of products from their sources to the end consumers, encompassing procurement, manufacturing, distribution, and logistics. Almarai prioritizes the use of advanced technologies and best practices to optimize its supply chain, enhancing speed, accuracy, and traceability. By maintaining strong relationships with trusted suppliers and implementing stringent quality control measures, Almarai ensures the availability of high-quality raw materials for its diverse product portfolio, which includes dairy, bakery, poultry, and juice. Through strategically located production facilities and a vast network of distribution centers, the company efficiently delivers its products to retail outlets, ensuring freshness and meeting customer demands promptly. Almarai's commitment to continuous improvement and innovation in its supply chain processes has positioned the company as a leader in the food and beverage industry in Saudi Arabia and beyond (Sitek, et al., 2015).

2.4. Artificial Intelligence in Supply Chain Management (SCM)

AI refers to a network of computers that can imitate human intelligence in order to make decisions regarding business problems (Huang & Rust, 2018). It assists in the design of business systems and acquires insights from data without requiring human input. Utilizing AI, organizations can identify weaknesses in their supply chain management and allocate resources accordingly (FossoWamba & Akter, 2019). Through the rapid extraction of client expectations, market sensing, utilization of failure modes, optimization of internal and external supply chains, and promotion of a more innovative workforce by automating repetitive tasks, AI has the potential to assist businesses in creating superior products (Jabbour et al., 2020).

Industries across various sectors, such as manufacturing and e-commerce, have increasingly adopted artificial intelligence (AI) to address supply chain issues (Zouari et al., 2021). In the modern corporate landscape, customers expect supply chains to deliver customized solutions and reliability. To meet these expectations, an AI-based system has been developed to identify customer profiles and offer personalized products without compromising security or privacy. In summary, the use of AI is rapidly expanding, and organizations and supply chains that fail to acknowledge and leverage AI in their operations may struggle to achieve the necessary resilience in the dynamic business market, especially in the face of potential disasters like the COVID-19 pandemic (Pournader et al., 2021).

In the past few years, there has been an increasing interest in the application of AI techniques to model and simulate complex supply chain systems (Chen et al., 2022). By using AI in the form of modeling and simulation, individuals can gain a deeper understanding of how a system operates, thereby improving their decision-making capabilities (Bennett & Hauser, 2013). The term "AI planning and scheduling in supply chain management" refers to a range of methods aimed at making intelligent decisions in systems with limitations, such as resource availability in a manufacturing facility (Barták et al., 2010). Furthermore, recent advancements in AI have enabled managers to identify and predict disruptions that could hinder normal system operations, including fraud detection, predictive maintenance, and system failures, while also aiding in responsive and data-driven system recovery. These advancements have empowered managers to proactively identify and anticipate disruptions that could affect normal system operations (Abedinnia et al., 2017).

2.5.Impact of Artificial Intelligence (AI) on Supply Chain Management (SCM)

The utilization of Artificial Intelligence (AI) holds great promise in enhancing supply chain management performance through various means. AI has the capability to analyze vast amounts of data obtained from different sources, including sensor data, weather forecasts, and social media. This analysis enables the prediction of future demand and optimization of inventory levels. Additionally, AI can optimize logistics, such as transportation routes and production and delivery scheduling, resulting in cost reduction and improved efficiency. Furthermore, AI can predict equipment failures and schedule maintenance accordingly, thereby reducing downtime and expenses. Lastly, AI can identify and address potential risks

in the supply chain, such as natural disasters, supply shortages, and political instability (McKinsey & Company, 2021).

AI has the potential to enhance the monitoring and inspection of products throughout their production and transportation phases, ensuring high quality and minimizing the likelihood of defects or damage. By automating repetitive tasks like data entry, AI enables employees to dedicate more time to valuable work. It also facilitates improved communication and collaboration among various stakeholders in the supply chain, such as suppliers, manufacturers, and retailers. Consequently, companies can enhance their supply chain performance by boosting efficiency, reducing costs, and elevating the quality of their products and services (Gülen, 2023). Additionally, the utilization of digital technologies like AI and IoT in the manufacturing industry has been explored in relation to supply chain efficiency by (Wang et al., 2022). Their research indicated that numerous AI technologies, including Artificial Neural Networks (ANN), Genetic Algorithms (GA), Virtual Reality (VR), and Artificial Immune Systems (AIS), have been implemented in supply chain management. The findings highlighted that AI positively impacts prediction-making and planning in supply chain management, leading to the minimization of resource waste and business risks.

Artificial intelligence (AI) is revolutionizing multiple industries, including supply chain management. It is profoundly influencing how businesses handle their supply chains by enhancing efficiency, reducing expenses, and ultimately boosting profitability. This article examines the impact of AI on supply chain management and how businesses can utilize this technology to accomplish their supply chain objectives. One of the primary ways in which AI is transforming supply chain management is through the provision of real-time data and insights regarding supply chain operations. By utilizing AI, businesses can collect and analyze vast quantities of data from diverse sources, such as sales trends, customer behavior, and supply chain metrics. This wealth of data enables informed decision-making in supply chain operations. Taking a data-driven approach empowers businesses to make more precise demand predictions, optimize their operations, and make improved choices regarding inventory management and resource allocation (Martin, 2023).

AI is revolutionizing supply chain management in multiple ways, one being the automation of repetitive and mundane tasks. By training AI algorithms to handle activities like demand forecasting, order processing, and inventory management, organizations can save valuable time and resources that can be redirected towards more strategic endeavors. Moreover, AI-driven automation minimizes the likelihood of human error, leading to increased efficiency

and accuracy within the supply chain. Furthermore, AI is transforming supply chain management by facilitating real-time monitoring and tracking of goods during transportation. Through AI-powered tracking and monitoring systems, businesses can enhance visibility across their supply chain operations. This enhanced visibility enables them to promptly identify and resolve potential bottlenecks and delays. Leveraging real-time data, organizations can optimize the flow of goods, mitigating the risks of stockouts and overstocking while bolstering overall supply chain efficiency.

AI is revolutionizing the logistics and transportation aspects of supply chain management, leading to significant advancements. By utilizing AI-powered logistics, companies can enhance their delivery routes, decrease transit durations, and decrease transportation expenses (Mohsen, 2022). Moreover, AI algorithms have the capability to analyze real-time traffic patterns, road conditions, and other relevant data, resulting in optimized delivery routes, improved delivery times, and reduced potential for delays.

Furthermore, AI is facilitating more efficient risk management in supply chain management. Through AI, enterprises can analyze vast amounts of data, detect potential risks, and create contingency plans to mitigate their impact. For instance, AI algorithms can predict supply chain disruptions, such as natural calamities or production interruptions, enabling prompt responses and minimizing operational disruptions (Mohsen, 2023).

3. Research Methodology

This study is based solely on a review of existing literature and does not involve primary data collection. The methodology employed aims to provide a rigorous and systematic analysis of the available literature to gain insights into the impact of AI on supply chain management within the specific context of the Saudi Almarai Company. The study will begin with an extensive review of relevant academic databases, such as PubMed, Scopus, IEEE Xplore, and Google Scholar, to identify peer-reviewed articles, conference papers, and research reports that explore the integration of AI in supply chain management within the context of the Saudi Almarai Company. The search terms used will include variations of "artificial intelligence," "supply chain management," "Almarai," and related keywords.

To ensure the inclusion of the most recent and relevant literature, the search will be limited to publications from the last few years. The initial search will be supplemented by manual screening of the reference lists of retrieved articles to identify additional relevant sources that may have been missed in the initial search process. The selected articles will undergo a

thorough evaluation to determine their suitability for inclusion in the study. The evaluation criteria will include relevance to the research topic, quality of methodology, credibility of authors and affiliations, and alignment with the specific focus on the Saudi Almarai Company. Articles that meet the inclusion criteria will be further analyzed to extract key findings, methodologies used, and any limitations or gaps identified by the authors. The findings from the selected articles will then be synthesized and organized thematically to identify common trends, challenges, and opportunities associated with the application of AI in the supply chain management of the Saudi Almarai Company. The synthesized information will be used to present a comprehensive overview of the current state of knowledge and identify potential areas for further research or improvement.

4. Research Limits

Time constraints: Conducting an extensive literature review and analysis within a limited time frame may impose certain constraints on the depth and breadth of the research. The scope of the study might not cover all relevant articles and publications, potentially missing out on crucial insights and findings.

Lack of access to proprietary information: As an external researcher, there may be limitations in accessing proprietary information and confidential data related to Almarai's supply chain operations. This restriction may hinder a comprehensive understanding of the company's AI initiatives and their precise impact on supply chain management.

Research Structure

1. Introduction

1.1. Background of the Study

1.2. Research Problem

1.3. Research Aim and Objectives

1.4. Research Importance

1.5. Research Hypotheses

2. Literature Review

3. Research Methodology

4. Results

5. Discussion and Conclusion

6. Recommendations

7. References

Research Timeline:

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