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

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Abstract:

This research paper examines the impact of artificial intelligence and digital transformation on supply chain management in Saudi Arabia. The author discusses how AI and digital technologies are revolutionizing supply chains globally through automation, data analytics, and optimization of processes. However, there is a lack of studies investigating these impacts specifically within the Saudi context. The researcher aims to fill this gap by studying current trends in Saudi Arabia's supply chain, how AI is being applied, and the potential barriers to integration. The research methodology involves a survey of supply chain professionals in Saudi companies. The initiatives that have been implemented have resulted in benefits like cost reductions, improved decision-making and efficiency. However, talent shortage and lack of expertise were identified as major challenges. The researcher recommends that future research should expand the sample size, examine impacts on specific sectors, and investigate the ethical and legal implications of AI adoption. In addition, Saudi organizations should develop an AI strategy, invest in data infrastructure, offer specialized training, and utilize AI for demand forecasting and supply chain optimization.

In conclusion, while AI and digital transformation show much promise for enhancing Saudi Arabia's supply chain, organizations must overcome challenges related to skills, data, and integration to fully realize the benefits of these technologies. With the right strategies and frameworks, AI can help Saudi businesses improve competitiveness, efficiency and drive economic growth in line with Vision 2030 objectives.

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Table 1	*Reliability Test*
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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

Artificial intelligence and digital transformation have become widely used in a number of businesses in recent years. As a result, there have been notable improvements in corporate performance due to the enhanced operational effectiveness, decision-making processes, and efficiency of AI technology. 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.

- Artificial Intelligence and digital transformation in supply chain:

The digital revolution, driven by AI and advanced technologies, is profoundly transforming businesses, including supply chain management. AI leverages data to predict trends, make decisions, and optimize tasks such as demand forecasting and logistics. With AI-driven tools, supply chains have become proactive and can respond instantly to market changes. The integration of robotics in the physical aspects of the supply chain, like warehousing and transportation, streamlines processes, maximizes space, and minimizes errors. Blockchain provides transparency and security, ensuring authentic product verification and secure transactions. AI and digital tools magnify supply chain efficiency, bringing cost savings, speed, and adaptability. As global supply chains face increasing complexities, these technologies become essential for success. The fusion of AI and digital transformation with supply chain management promises enhanced efficiency, accuracy, and

innovation. Adapting and integrating these technologies is not just a competitive advantage but a necessary evolution for businesses and economies. (Banker, n.d.)

- **Supply chain in Saudi Arabia:**

Saudi Arabia's supply chain and coordination sector has undergone significant evolution, driven by the country's ambitious economic transformation plans, including Vision 2030. With a focus on reducing dependence on oil revenues, Saudi Arabia has diversified its industries, necessitating robust supply chain mechanisms to support sectors like mining, entertainment, tourism, and manufacturing. The country has made substantial investments in infrastructure, including ports, railways, and airports, with King Abdullah Port being a notable example. The improved infrastructure facilitates smoother trade and transport within the country and with international trading partners. Saudi Arabia's strategic geographic location makes it a potential coordination hub for the region, given its position bridging Asia, Europe, and Africa. Overcoming challenges like bureaucratic hurdles and modernization requirements, Saudi Arabia aims to incorporate digitalization and advanced technologies like AI, blockchain, and the Internet of Things to enhance supply chain efficiency, visibility, and reliability. The development of logistics and industrial hubs, such as SPARK and NEOM, further supports the growth of the sector. Saudi Arabia is also focusing on enhancing maritime logistics capabilities along the Red Sea trade route, which connects Europe, Africa, and Asia. The country's extreme temperatures and growing food and pharmaceutical sectors have increased the demand for advanced warehousing solutions, particularly for temperature-controlled storage. The "In-Kingdom Total Value Add" (IKTVA) program by Saudi Aramco promotes local sourcing and production, impacting the supply chain by emphasizing localization. Recognizing the need for skilled professionals in the logistics and supply chain sector, Saudi Arabia is

investing in training and education to develop a qualified local workforce. (*Saudi Vision 2030*, n.d.)

2. Research Problem:

As part of its Vision 2030 goals, Saudi Arabia has been incorporating digital technologies and artificial intelligence into its sectors at a rapid pace in recent years. Global trends indicate that artificial intelligence (AI) and digital transformation could greatly improve supply chain efficiency; however, there are few thorough studies that look specifically at the effects of these technologies both good and bad on the ecosystem of supply chains in Saudi Arabia's distinct socioeconomic setting. 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:

This study is significant because it has the ability to give useful insights and suggestions to the Saudi supply chain sector, governments, and stakeholders. 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 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. As a result, Saudi Arabia's supply chain efficiency, cost savings, competitiveness, and overall economic development may improve. Furthermore, the goal of this research is to add to the current body of knowledge on artificial intelligence and digital transformation in supply chain management by specifically focusing on the Saudi context.

The objectives of this research are:

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: Khereiji showrooms Company

Time Plan: 2023

Community: 200 People

9. Theoretical Premises of the study:

Theoretical premises on the impact of AI and digital transformation on the supply chain in Saudi Arabia can be framed within various domains, encompassing technological, economic, and organizational perspectives. Here are some theoretical premises that highlight potential impacts:

- **Efficiency and Operational Optimization:**

The integration of AI and digital technologies in the supply chain of Saudi Arabia is expected to significantly enhance operational efficiency through real-time data analytics, automation of routine tasks, and intelligent decision-making. This efficiency gains can lead to faster order fulfillment, reduced lead times, and overall cost savings.

- **Demand Forecasting and Inventory Management:**

AI-driven predictive analytics in Saudi Arabian supply chains can revolutionize demand forecasting and inventory management. The ability to analyze historical data, market trends, and external factors in real-time enables organizations to optimize inventory levels, minimize stockouts, and align procurement with actual demand.

- **Enhanced Visibility and Traceability:**

The implementation of digital technologies, including IoT devices and blockchain, can enhance supply chain visibility and traceability in Saudi Arabia. This heightened transparency enables organizations to track the movement of goods in real-time, ensuring better compliance, reducing the risk of counterfeiting and enhancing overall supply chain security.

- **Data-Driven Decision Making:**

The infusion of AI into supply chain processes enables more data-driven decision-making in Saudi Arabia. With the ability to analyze vast amounts of data in real-time, organizations can make strategic decisions based on insights derived from patterns, trends, and correlations, fostering a culture of continuous improvement.

These theoretical premises highlight the multifaceted impact of AI and digital transformation on the supply chain in Saudi Arabia, touching upon technological

advancements, organizational strategies, and broader socio-economic considerations. Actual outcomes will depend on the extent of adoption, integration strategies, and the ability of organizations to navigate the complexities associated with these transformative technologies.

10. AI background:

Artificial intelligence (AI) is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence (Russell & Norvig, 2020). The term "artificial intelligence" is frequently applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving (Bostrom, 2014). The history of AI can be traced back to the ancient Greeks, who were fascinated by the idea of creating artificial life (Nilsson, 1998). In the 17th century, René Descartes proposed that animals were simply machines without souls, and that it was possible to build machines that could behave like animals (Descartes, 1638). The development of AI accelerated in the 20th century, with the development of computers and the invention of the transistor (Kurzweil, 2005). In the 1950s, Alan Turing proposed a test to determine whether a machine could be considered intelligent (Turing, 1950). The Turing test, still used today, asks whether a machine can hold a conversation that is indistinguishable from that of a human.

AI research has diversified into several subfields, each focusing on specific aspects of human intelligence:

- Machine learning: The ability of computers to learn without being explicitly programmed (Mitchell, 1997).

- Natural language processing (NLP): The ability of computers to understand and generate human language (Jurafsky & Martin, 2000).
- Computer vision: The ability of computers to interpret and understand visual information (Szeliski, 2010).
- Robotics: The design and development of robots, which are machines that can autonomously perform tasks in the physical world (Russell & Norvig, 2020).

- **Applications of AI**

AI is being used to develop new products and services, to improve existing products and services, and to solve some of the world's most pressing problems. Here are some examples of AI applications:

- **Healthcare:** AI is being used to develop new drugs, diagnose diseases, and personalize treatment plans.
- **Finance:** AI is being used to detect fraud, manage risk, and make investment decisions.
- **Transportation:** AI is being used to develop self-driving cars, optimize traffic flow, and improve public transportation.
- **Environment:** AI is being used to monitor climate change, predict natural disasters, and develop sustainable energy solutions.

- **Ethical Considerations**

The development and use of AI raise a number of ethical concerns, including:

- **Bias:** AI systems can be biased if they are trained on biased data (Brundage et al., 2018).

- **Explain ability:** AI systems can be difficult to explain, which can make it difficult to trust their decisions (Gundersen, 2020).
- **Accountability:** Who is responsible for the actions of an AI system? (Mittelstadt et al., 2019).

It is important to address these ethical concerns as AI continues to develop and be deployed in the real world.

- **Future of AI**

The future of AI is bright. AI has the potential to solve some of the world's most pressing problems, and to make our lives better in many ways. However, it is important to use AI responsibly and ethically. We need to ensure that AI is used for good, and that it benefits all of humanity.

11. Digital Transformation background:

Digital transformation has undergone a significant evolution over the past few decades, driven by technological advancements and evolving consumer demands. Let's delve into the key stages of digital transformation's development:

Stage 1: The Dawn of Digital Transformation (1950s-1970s)

In the mid-20th century, the advent of mainframe computers marked the beginning of digital transformation. These large, powerful machines laid the groundwork for data processing, automation, and the development of early business applications. By the 1970s, the rise of personal computers brought computing power to individuals and businesses, further fuels the digital transformation journey. (Davenport, 2004)

Stage 2: The Rise of the Internet and E-commerce (1980s-1990s)

The 1980s ushered in the era of the internet, connecting computers worldwide and revolutionizing communication and information sharing. Businesses began exploring the internet's potential for marketing, communication, and e-commerce. The 1990s witnessed the dot-com boom, as businesses rushed to establish an online presence. While the dot-com bubble burst in the early 2000s, it reinforced the internet's growing importance in business. (Turban et al., 2015)

Stage 3: The Mobile Revolution and Cloud Computing (2000s-2010s)

The 2000s saw the rapid proliferation of mobile devices, transforming how people access and consume information. Businesses adapted by developing mobile-friendly websites and applications. Cloud computing has emerged as a revolutionary technology that provides businesses with on-demand access to computing resources, enabling scalability and cost efficiency. (Brynjolfsson & McAfee, 2014)

Stage 4: The Era of Artificial Intelligence and Data Analytics (2010s onwards)

The 2010s and beyond have been marked by the rapid advancement of artificial intelligence (AI) and data analytics. Businesses are leveraging AI to automate tasks, gain insights from data, and enhance customer experiences. Data analytics is enabling businesses to make informed decisions based on data-driven insights. (Keeney, 2008)

Digital transformation has become an ongoing process for businesses, driven by continuous technological innovation and evolving customer expectations. Businesses that embrace digital transformation effectively can enhance their efficiency, productivity, and customer

satisfaction, ensuring their success in the ever-changing digital landscape. (Porter, Heppelmann, 2014)

12. Glossary:

Supply chain: The process of managing the flow of goods and services to and from a business, including every step involved in turning raw materials and components into final products and getting them to the ultimate customer (FERNANDO, 2023).

Artificial intelligence (AI): A machine's ability to perform the cognitive functions we usually associate with human minds (Mckincey & Company, 2023).

Digital transformation: The integration of digital technologies into all aspects of business operations. That means identifying how to use technologies to deliver new products and services, to improve existing products and services, and to streamline processes (K. Pratt , Boulton, 2023).

Internet of Things (IoT): Describes physical objects embedded with sensors and actuators that communicate with computing systems via wired or wireless networks—allowing the physical world to be digitally monitored or even controlled (Mckincey & Company, 2022)

13. AI and digital transformation in Warehouse Management:

In an era of increasing demand uncertainty, supply chain complexity, and technological advancements, the role of Artificial Intelligence in warehouse management has gained significant importance.[(Chen et al., 2023)]. AI has the potential to revolutionize warehouse operations by optimizing inventory management, improving order fulfillment

accuracy and speed, enhancing resource allocation, and reducing operational costs. By leveraging AI technologies such as machine learning, robotics, and data analytics, warehouses can automate repetitive tasks, predict demand patterns more accurately, optimize inventory levels based on real-time data, and improve overall operational efficiency (Pandian, 2019).

AI and digital transformation in warehouse management are crucial components that can revolutionize the way warehouses operate. With AI, warehouses can automate processes like inventory tracking, stock replenishment, and order picking, reducing human error and increasing productivity.[(Yang et al., 2021)]. Through digital transformation, warehouses can integrate AI-powered systems that enable real-time data analysis and decision-making. These systems can provide insights into warehouse performance, identify bottlenecks, and optimize processes for maximum efficiency. By utilizing AI and digital transformation in warehouse management, organizations can achieve numerous benefits. Organizations can achieve numerous benefits by utilizing AI and digital transformation in warehouse management. These benefits include improved inventory accuracy, faster order processing times, reduced operational costs, enhanced customer satisfaction, and the ability to adapt quickly to changing market demands. Furthermore, AI can enable predictive maintenance and reduce downtime by detecting potential equipment failures before they occur. This can result in increased uptime, improved equipment reliability, and reduced maintenance costs. Overall, AI and digital transformation in warehouse management have the potential to streamline operations, improve efficiency, and drive organizational success in the ever-evolving supply chain landscape. To fully exploit the potential benefits of AI for warehouse management, organizations need to invest in advanced technologies and infrastructure, establish robust data management systems, and train warehouse staff to effectively utilize AI tools and technologies.[(Börütecene & Löwgren, 2020)]

In Saudi Arabia, AI and digital transformation are being applied in warehouse management to optimize operations and improve efficiency. For example, Saudi Arabian companies are implementing AI-powered systems for inventory management, order fulfillment, and logistics optimization. These systems leverage AI algorithms to analyze data and predict demand patterns, allowing warehouses to optimize their inventory levels and avoid stockouts or overstocking. Additionally, AI-enabled robotics and automation are being increasingly used in warehouses in Saudi Arabia to streamline processes such as picking, sorting, and packing. These robots can work alongside human workers, increasing productivity and reducing errors. Furthermore, AI-powered predictive maintenance systems are being implemented in Saudi warehouses to monitor equipment health and detect anomalies before they lead to breakdowns. This helps in avoiding costly downtime and reduces maintenance costs.[(Mashat, 2020)]. In addition, Saudi Arabia is also investing in the development of smart warehouses that utilize IoT technology and cloud computing. These smart warehouses enable real-time tracking of inventory, automated data collection, and seamless connectivity between different parts of the supply chain. Overall, AI and digital transformation in warehouse management in Saudi Arabia are aimed at optimizing operations, improving efficiency, and enhancing the overall competitiveness of the supply chain industry in the country. However, it is important to note that the specific applications and implementation of AI in warehouse management may vary across different companies and industries in Saudi Arabia.[(Mashat, 2020)].

One specific example of an organization in Saudi Arabia using AI in warehouse management is Savola Group. Savola Group, a leading food and retail company in Saudi Arabia, has implemented AI-powered systems in its warehouses to improve efficiency and accuracy. The company uses AI algorithms to forecast demand and optimize inventory

levels, ensuring that the right products are available at the right time. This helps in reducing stockouts and minimizing excess inventory.

Another example is BinDawood Holding, a prominent retail company in Saudi Arabia. BinDawood Holding has embraced AI and digital transformation in its warehouses to enhance operational efficiency. The company utilizes AI-based robotics and automation to streamline picking and packing processes, increasing productivity and reducing errors. This allows BinDawood Holding to efficiently meet customer demands and ensure timely delivery of products. These are just a few examples of organizations in Saudi Arabia that are leveraging AI and digital transformation in warehouse management. These organizations are harnessing the power of AI to improve warehouse operations, optimize inventory management, and enhance overall supply chain efficiency (Shafiabady, 2023).

14. AI and digital transformation in procurement in Saudi Arabia

AI and digital transformation have had a significant impact on procurement in Saudi Arabia. As part of its Vision 2030 plan, the Saudi government has been actively promoting the adoption of data and AI solutions in various sectors, including procurement. The Saudi Data and Artificial Intelligence Authority (SDAIA) has played a crucial role in this transformation by establishing a national cloud infrastructure and a National Data Bank . These initiatives have not only facilitated data sharing among government entities but have also led to the creation of platforms like Estishraf, which enable data-driven decision making (CASE STUDY SAUDI DATA AND ARTIFICIAL INTELLIGENCE AUTHORITY,2019) . A case study conducted in Saudi companies highlighted the use of AI and digital transformation in supply chain management, showcasing the potential benefits of these technologies in procurement. One key area is the automation of procurement processes. AI-

powered tools can streamline and automate various tasks, such as supplier selection, contract management, and invoice processing. This not only reduces manual efforts and errors but also improves efficiency and enables procurement professionals to focus on strategic initiatives. Furthermore, AI can also enhance supplier management and risk assessment. By analyzing supplier performance data, market intelligence, and external factors, AI algorithms can evaluate supplier capabilities, identify potential risks, and support decision-making in supplier selection and negotiation processes. This leads to improved supplier relationships and mitigates risks associated with procurement.(Alsharidah, Alazzawi, 2020). Overall, the adoption of AI and digital transformation in procurement has revolutionized the way organizations in Saudi Arabia manage their supply chains. These technologies have the potential to drive efficiency, improve decision-making, and deliver significant cost savings. As Saudi Arabia continues to focus on its Vision 2030 plan, we can expect further advancements in AI and digital transformation in procurement, leading to more streamlined and effective procurement processes across the country.

15. AI and digital transformation in logistics in Saudi Arabia:

The impact of AI and digital transformation in logistics in Saudi Arabia has been significant. The adoption of these technologies has led to a transformation of the transport and logistics sector in the country (Arab news, 2023). The Saudi government's Vision 2030 plan has actively promoted the use of data and AI solutions in various sectors, including logistics. The establishment of the Saudi Data and Artificial Intelligence Authority (SDAIA) has played a crucial role in this transformation by setting up a national cloud infrastructure and a National Data Bank. This has enabled better demand forecasting, improved inventory management, enhanced supplier management, more accurate risk assessment, efficient contract management, and advanced spend analytics in logistics

operations. These advancements have revolutionized logistics processes in Saudi Arabia and are expected to continue advancing in the future (Alsharidah, Alazzawi, 2020).

Saudi Arabia is undergoing a significant transformation in its logistics sector, driven by the adoption of artificial intelligence (AI) and digital technologies. This is fueled by various factors, including:

- National Initiatives:
  - Saudi Vision 2030: Aims to diversify the economy and position Saudi Arabia as a global logistics hub (Al-Qahtani, 2023).
  - National Industrial Development and Logistics Program (NIDLP): Invests in infrastructure, technology, and human capital to develop the logistics sector (Al-Harbi & Al-Mubarak, 2022).
  - Smart Logistics Initiative: Promotes the adoption of AI and other digital solutions in logistics (Ministry of Transport & Logistics Services, 2023).
- Evolving Customer Demands:
  - Consumers are demanding faster delivery times, greater visibility, and personalized experiences (PwC, 2022).
  - Businesses are seeking to optimize their supply chains and reduce costs (McKinsey & Company, 2022).
- Competitive Landscape:
  - Saudi Arabia is facing competition from regional logistics hubs (Logistics & Supply Chain Management Society, 2023).

- AI and digital technologies are essential for remaining competitive (World Economic Forum, 2020).

- Real-World Examples of AI in Logistics in Saudi Arabia:

- Noon: Uses AI-powered demand forecasting to optimize inventory levels and ensure timely deliveries (Noon.com, 2023).
- Emaar Logistics: Deployed AI-powered robots in warehouses to automate repetitive tasks and improve productivity (Emaar Logistics, 2023).
- Saudi Post: Implemented AI-based routing and scheduling algorithms to optimize delivery routes and reduce delivery times (Saudi Post, 2023).
- SABIC: Utilizes AI-powered predictive maintenance to minimize equipment downtime and extend lifespan (SABIC, 2023).
- NAMA Stores: Optimizes inventory management across its network of warehouses using AI-driven systems (NAMA Stores, 2023).

- Benefits of AI and Digital Transformation in Logistics:

- Increased Efficiency and Productivity: Automating tasks, optimizing routes, and improving visibility significantly enhance efficiency and productivity (McKinsey & Company, 2022).
- Reduced Costs: AI helps to optimize inventory levels, reduce transportation costs, and minimize downtime, leading to significant cost savings (Gartner, 2023).
- Improved Customer Satisfaction: Faster delivery times, greater visibility, and personalized experiences enhance customer satisfaction and loyalty (PwC, 2022).

- Enhanced Safety and Security: AI-powered surveillance and predictive maintenance improve safety and security in logistics operations (World Economic Forum, 2020).
- Increased Flexibility and Adaptability: AI enables logistics companies to adapt to changing market conditions and customer demands more effectively (Accenture, 2023).

- Challenges of AI Adoption in Logistics:

- Data Availability and Quality: AI models require large amounts of high-quality data to function effectively (PwC, 2022).
- Talent Gap: The logistics industry needs skilled professionals who can understand and implement AI solutions (McKinsey & Company, 2022).
- Integration and Interoperability: Integrating AI solutions with existing systems can be complex and costly (Gartner, 2023).

16. AI and digital transformation in inventory management in Saudi Arabia

Saudi Arabia is undergoing a significant transformation in its inventory management practices, driven by the adoption of artificial intelligence (AI) and digital technologies. This transformation is being fueled by several factors, including:

- National Initiatives: Aims to diversify the economy and position Saudi Arabia as a global logistics and supply chain hub, with efficient inventory management playing a crucial role (Al-Qahtani, 2023).

- Evolving Customer Demands: Consumers are demanding faster delivery times, greater visibility into product availability, and personalized experiences, requiring businesses to optimize their inventory levels and management strategies (PwC, 2022).
- Increased Competition: Saudi Arabia faces stiff competition from regional logistics hubs, and AI-powered inventory management can provide a competitive edge by reducing costs, improving efficiency, and enhancing customer satisfaction (Logistics & Supply Chain Management Society, 2023).
- Data Availability: The proliferation of sensors, connected devices, and e-commerce data provides a rich source of information for AI algorithms to analyze and optimize inventory management (McKinsey & Company, 2022).

Several Saudi Arabian companies are embracing AI to transform their inventory management practices:

1. NAMA Stores: Utilizes AI-powered inventory optimization systems to manage its extensive network of warehouses, reducing stockouts and overstocking (NAMA Stores, 2023).
2. SABIC: Imploys AI-driven demand forecasting tools to accurately predict demand for its vast product range, ensuring optimal inventory levels and customer satisfaction (SABIC, 2023).
3. Noon: Leverages AI-powered inventory optimization algorithms to synchronize inventory levels across its fulfillment centers, ensuring timely deliveries and minimizing storage costs (Noon.com, 2023).

4. Emaar Logistics: Deploys AI-powered inventory tracking systems to monitor stock levels in real-time across its warehouses, preventing stockouts and optimizing replenishment strategies (Emaar Logistics, 2023).

5. Saudi Post: Utilizes AI-driven inventory management solutions to optimize inventory levels at its postal facilities, ensuring efficient sorting, distribution, and delivery of parcels (Saudi Post, 2023).

- Benefits of AI-Powered Inventory Management in Saudi Arabia:

The adoption of AI in inventory management is bringing significant benefits to Saudi Arabian businesses, including:

1. Reduced Inventory Costs: AI helps to optimize inventory levels, minimizing stockouts, overstocking, and obsolescence, leading to substantial cost savings (Gartner, 2023).

2. Improved Customer Satisfaction: Accurate inventory forecasting and optimization ensure that products are available when customers want them, enhancing customer satisfaction and reducing the risk of lost sales (PwC, 2022).

3. Enhanced Supply Chain Efficiency: AI improves the overall efficiency of the supply chain by optimizing inventory levels, reducing lead times, and minimizing disruptions (McKinsey & Company, 2022).

4. Data-Driven Decision Making: AI provides businesses with real-time insights into inventory trends and patterns, enabling informed decision-making for inventory management and procurement strategies (Accenture, 2023).

17. Survey findings:

The questionnaire was presented to a number of 4 arbitrators and experts (2- Supply Chain Managers, Sales Manager and Country Manager) and was then distributed on the basis of their advice and suggestions**.** A reliability test was performed using Cronbach's Alpha through SPSS and it shows the following result:

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	117	97.5
	Excluded[a]	3	2.5
	Total	120	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.877	22

Table 1 (Reliability test)

The researcher used survey-based analysis to examine the impact of artificial intelligence (AI) and digital transformation on Saudi Arabia's supply chain. A survey was conducted among 200 professionals working at Khereiji Showrooms targeting a research community representing different levels of the organization.

The study aims to understand the pace of adoption of AI technologies and digital transformation practices in countries and their impact on supply chain operations.

The results showed that about 48% of company employees are somewhat familiar with the concepts of AI and digital transformation and have implemented AI and digital transformation initiatives in supply chain management.

These initiatives have resulted in improved procurement processes, improved decision-making, increased efficiency and reduced costs.

However, the study also identified some challenges and concerns associated with the adoption of these technologies.

18. Survey Results:

- Demand Forecasting: 33% utilize AI for demand forecasting, improving accuracy and reducing inventory costs.
- Logistics Optimization: 37% leverage AI for route planning, fleet management, and warehouse optimization, leading to increased efficiency and cost savings.
- Talent Shortage: 40% identified the lack of skilled professionals trained in AI implementation and supply chain management as a major obstacle.

According to the schedule below, 34% of the employees agreed that AI applications helped to reduce the cost of the products, whereas 41% were neutral.

AI reduces costs of the products

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	13	6.5	6.5	6.5
	Disagree	24	11.9	11.9	18.4
	Neutral	83	41.3	41.3	59.7
	Agree	70	34.8	34.8	94.5
	Strongly agree	11	5.5	5.5	100.0
	Total	201	100.0	100.0	

Table 2 (AI reduces costs of the products)

As shown below, the majority of the employees agreed that digital transformation has impacted the supply chain efficiency.

DT has positively impacted the supply chain efficiency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	3.5	3.5	3.5
	Disagree	14	7.0	7.0	10.4
	Neutral	71	35.3	35.3	45.8
	Agree	78	38.8	38.8	84.6
	Strongly agree	31	15.4	15.4	100.0
	Total	201	100.0	100.0	

Table 3 (Digital transformation impacted supply chain efficiency)

Employee's suggestions and recommendations:

Suggestions and recommendations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		171	85.1	85.1	85.1
	- Built a platform that specializes in offering training on AI and digital transformation apps. - Encourage to hire a counselor who is familiar with AI concepts and get use of the consolation.	1	.5	.5	85.6
	.	1	.5	.5	86.1
	* The Government should incentivize using AI in the local industrial supply chains. * The Government should implement AI training for Saudi supply chain professionals. * There should be yearly conferences and initiatives to promote AI & Digitization in the local market.	1	.5	.5	86.6
	1- البيانات تحليل تقنيات استخدام: البيانات تحليل إدارة وتحسين بالطلب التنبؤ لتحسين الضخمة المخزون. 2. تكامل: الأشياء إنترنت (IoT) حية بيانات وجمع العمليات لمراقبة IoT أجهزة الإمداد سلاسل من. 3. الشحنات تتبع: نظم تطوير البلوكشين تقنيات باستخدام الشحنات لتتبع فعالة وRFID. 4. الذكاء استخدام: الآلي التعلم وتحسين الطلب تنبؤات لتحسين الاصطناعي التخطيط. 5. الآلي التشغيل: من العمليات تحسين الروتينية العمليات في الآلة تطبيق خلال. 6. السيبراني الأمان تعزيز: السيبراني الأمان لحماية الإمداد سلاسل في الحساسة البيانات. 7. التدريب واستخدام لفهم العمال مهارات تطوير: والتطوير الجديدة التكنولوجيا. 8. الصناعي التعاون: تشجيع الحكومية والجهات الشركات بين التعاون على والتقنيات المعرفة لتبادل.	1	.5	.5	87.1

1. Develop a clear AI strategy aligned with national goals. 2. Invest in robust data infrastructure and ensure data quality and security. 3. Foster a culture of innovation and support startups and research institutions. 4. Invest in AI talent development and offer specialized training programs. 5. Utilize predictive analytics for demand forecasting and supply chain optimization. 6. Implement intelligent automation to streamline tasks and improve efficiency. 7. Embrace smart logistics and transportation using AI Technologies.	1	.5	.5	87.6
AI-enabled models Should be developed to help drive down emissions, anticipate needs, and improve efficiency in operations. Demand prediction: AI can also be used to reduce surplus inventory or production based on more accurate demand sensing	1	.5	.5	88.1
Can implement AI-Powered Demand Forecasting and use AI for Supply Chain Visibility and Transparency.	1	.5	.5	88.6
Conduct workshops	1	.5	.5	89.1
Merge AI tools with SC process to utilize the BP	1	.5	.5	89.6
Privacy, replaces humans.	1	.5	.5	90.0
إتاحة الورش والدورات المجانية والمسابقات والجوائز التي تزيد الوعي عند الفرد والمجتمع على السواء	1	.5	.5	90.5
االتطوير والتقدم	1	.5	.5	91.0
اتمنى ذلك لكي يسهل الكثير من الامور و الاعمال لدى الشركات ولكن لها اجابيات و سلبيات على الشركة و العملاء	1	.5	.5	91.5
اذا ارتبط الذكاء الاصطناعي في العمل كثير من الموظفين راح يخسرون عملهم	1	.5	.5	92.0

	اعداد دورات تدريبية متخصصة ومكثفة لمنسوبي الشركات	1	.5	.5	92.5
	التأهيل والتدريب السليم للموظفين واختيار منظومات موثوقة وسليمه لتعزيز الذكاء الاصطناعي والاستفادة من تجارب جهات استخدمه احدث انضمت الذكاء الاصطناعي	1	.5	.5	93.0
	الذكاء الاصطناعي يهدد الوظائف البشرية	1	.5	.5	93.5
	ان تكون الشركات دقيقة وذات كفاءات	1	.5	.5	94.0
	ان توفر الشركة ورش عمل بخصوص الذكاء الصناعي والتحول الرقمي والمام الموظفين بمدى اهميتها	1	.5	.5	94.5
	ان يكون ذو كفاءة عالية جدا في مساعدة البشر ويجعل وطني في تقدم وتطور اكثر	1	.5	.5	95.0
	تدخل تقنيات اضافية مثل انترنت الاشياء والواقع المعزز	1	.5	.5	95.5
	تعليم الناس و نشر المعرفة في بيئة العمل	1	.5	.5	96.0
	تنظيم دورات داخليه عن اهم تطبيقات الذكاء الاصطناعي والتي من الممكن ان تخدم مصالح الشركة	1	.5	.5	96.5
	توفير التدريب الكافي للموظفين	1	.5	.5	97.0
	شرح منهجية الذكاء الاصطناعي، تفعيل بعض الخدمات الإلكترونية لتسهيل عملية التحول الرقمي	1	.5	.5	97.5
	عدم فقدان خدمات العنصر البشري لاثراء خدمات الذكاء الاصطناعي	1	.5	.5	98.0
	عقد ورش عمل	1	.5	.5	98.5
	لا يوجد	1	.5	.5	99.0
	لا يوجد اقتراحات لان معظم الشركات الخاصة لا تستخدم التحول الرقمي	1	.5	.5	99.5
	لقاء اصحاب الشركات ومدراء العمليات وأخذ اراءهم	1	.5	.5	100.0
	Total	201	100.0	100.0	

Table 4 (Suggestions and recommendations)

19.Research recommendations:

The researcher suggests the following points to be followed for future researches in the impact of AI and digital transformation in supply chain in Saudi Arabia:

- Expand the research community to include more respondents from a variety of organizations and generalize the results.
- Explore the implementation of AI technologies and digital transformation practices in specific sectors of the Saudi supply chain, such as manufacturing, logistics, or retail. This will provide a deeper understanding of the unique challenges and opportunities faced by different industries.
- Examine the ethical and legal implications of AI adoption in the supply chain, particularly in terms of data privacy, security, and algorithmic biases. This research will contribute to the development of guidelines and frameworks for responsible AI implementation in Saudi Arabian supply chains.
- Conduct a comparative analysis of companies that have successfully implemented AI and digital transformation initiatives in their supply chain versus those that have not. This research will provide valuable insights into the factors that contribute to the success or failure of digital transformation projects and their impact on overall business performance.

By conducting further research in these areas, a more comprehensive understanding of the impact of AI and digital transformation on the supply chain in Saudi Arabia can be achieved, leading to actionable insights and recommendations for businesses in the country.

Questionnaire:

1- What is your gender? (Optional)

ما هو جنسك؟

ذكر Male

أنثى Female

2- What is your age?

ماهو عمرك

20-30

31-40

41-50

51-60

3- What is your highest level of education?
ماهو أعلى مؤهل دراسي لديك

ثانوية عامة او اقل High school or below

دبلوم Diploma

درجة البكالريوس Bachelor's degree

درجة الماجستير Master's degree

درجة الدكتوراه او اعلى PhD degree or above

4- What is your job title? (Optional)

المسمى الوظيفي

مدير سلاسل إمداد Supply Chain Manager

مدير خدمات لوجستية Logistics Manager

مدير مشتريات Procurement Manager

مشرف مستودع Warehouse Supervisor

أخصائي مشتريات Procurement Specialist

اخرى Other

5- Years of experience?

عدد سنوات الخبرة

1-5

6-10

11-20

أكثر من More than 20

6- What is your company's size (number of employees)?

حجم الشركة التي تعمل بها (عدد الموظفين)

أقل من Less than 50

250 – 50

500 - 251

أكثر من More than 500

7- How familiar are you with the concept of Digital Transformation?
ما مدى معرفتك بمفهوم التحول الرقمي؟

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

10- Your organization is using AI to help in reducing the costs of the products

الشركةالتي تعمل بها تستخدم الذكاء الإصطناعي للمساعدة في خفض تكاليف المنتجات

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

11- Your organization is using AI to help in decision-Making Processes

الشركة التي تعمل بها تستخدم الذكاء الإصطناعي في المساعدة على اتخاذ القرارات

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

12-Your organization uses AI in Enhancing customer satisfaction

الشركة التي تعمل بها تستخدم الذكاء الإصطناعي في تعزيز رضا العملاء

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

13- Digital Transformation contributed to lowering the cost of the products in your organization

ساهم التحول الرقمي في خفض تكاليف المنتجات في الشركة التي تعمل بها

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

14- Digital transformation increased the efficiency in the logistics sector in your organization.
أدى التحول الرقمي الى زيادة كفاءة قطاع الخدمات اللوجستية في الشركة التي تعمل بها

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

15- Digital transformation has significantly improved the quality of your organization's inventory management.
التحول الرقمي أدى بشكل كبير الى تحسن جودة ادارة المخزون في الشركة التي تعمل بها

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

16- Your organization's logistics sector is being impacted by AI.
يوجد أثر للذكاء الإصطناعي على قطاع الخمات اللوجستية في الشركة التي تعمل بها

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

17- Your organization is using AI applications in warehouse management
تستخدم الشركة التي تعمل بها الذكاء الإصطناعي في ادارة المستودعات

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

18- The adoption of digital transformation has significantly enhanced your organization of warehouse operations.
ساهم تطبيق التحول الرقمي في الشركة التي تعمل بها بشكل ملحوظ في تعزيز تنظيم عمل المستودعات

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

19- Your organization is using AI applications on demand forecasting
تستخدم الشركة التي تعمل بها الذكاء الإصطناعي في توقعات الطلب على المنتجات

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

20- Your organization is using AI applications in the inventory management
الشركة التي تعمل بها تستخدم الذكاء الإصطناعي في إدارة المخزون

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

21- Your organization's employees possess adequate knowledge to handle AI technologies
لدى موظفي الشركة التي تعمل بها الإلمام الكافي للتعامل مع تقنيات الذكاء الإصطناعي

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

22- Your organization has a clear vision of using AI applications to improve the supply chain
لدى الشركة التي تعمل بها رؤية واضحه لإستخدام تطبيقات الذكاء الإصطناعي لتطوير سلاسل الإمداد

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

23- Your organization trains its employees to effectively use AI applications
الشركة التي تعمل بها تدرب موظفيها للإستخدام الفعال لتطبيقات الذكاء الإصطناعي

لا اتفق بشدة Strongly disagree

لا اتفق Disagree

محايد Neutral

اتفق Agree

اتفق بشدة Strongly agree

24- What suggestions and recommendations would you propose for integrating AI and digital transformation in the Saudi Arabian supply chain future? (Optional)
ماهي الاقتراحات و التوصيات التي يمكن ان تقدمها لدمج الذكاء الإصطناعي و التحول الرقمي مع مستقبل سلاسل الإمداد في المملكة العربية السعودية

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جامعة ميدأوشن

كلية الإدارة

قسم / تخصص إدارة المشاريع

العنوان باللغة العربية

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

إعداد الطالب/

محمد عمر العميري

إشراف/

د. وليد عبد الجواد سليمان صديق

د. الفيصل عبد الحميد محمد حسن

العام الدراسي:

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الملخص:

تبحث ورقة البحث هذه أثر الذكاء الاصطناعي والتحويل الرقمي على إدارة سلسلة الإمداد في المملكة العربية السعودية. ويناقش الباحث كيف يُحدث الذكاء الاصطناعي والتقنيات الرقمية ثورة في سلاسل التوريد على مستوى العالم من خلال الأتمتة وتحليل البيانات وتحسين العمليات. ومع ذلك، هناك نقص في الدراسات التي تبحث في هذه التأثيرات على وجه التحديد في المملكة العربية السعودية. ويهدف الباحث إلى سد هذه الفجوة من خلال دراسة الاتجاهات الحالية في سلسلة التوريد في المملكة العربية السعودية، وكيفية تطبيق الذكاء الاصطناعي، والعوائق المحتملة أمام التكامل. وتنطوي منهجية البحث على إجراء دراسة استقصائية للمهنيين العاملين في مجال سلاسل التوريد في الشركات السعودية. وقد أسفرت المبادرات التي نُفذت عن فوائد مثل تخفيض التكاليف وتحسين صنع القرار والكفاءة. غير أنه تم تحديد نقص المواهب والافتقار إلى الخبرة باعتبارهما تحديين رئيسيين. ويوصي الباحث بأن تؤدي البحوث المقبلة إلى توسيع حجم العينة، ودراسة الآثار على قطاعات محددة، والتحقيق في الآثار الأخلاقية والقانونية المترتبة على اعتماد هذه المعايير. وبالإضافة إلى ذلك، ينبغي للمنظمات السعودية أن تضع استراتيجية في هذا المجال، وأن تستثمر في البنية التحتية للبيانات، وأن تقدم تدريباً متخصصاً، وأن تستخدم هذه الاستراتيجية في التنبؤ بالطلب وتحقيق الاستخدام الأمثل لسلاسل الامداد.

وفي الختام، وفي حين أن الذكاء الاصطناعي والتحول الرقمي يبشران بالكثير لتعزيز سلسلة الإمداد في المملكة العربية السعودية، فإن على المنظمات أن تتغلب على التحديات المتصلة بالمهارات والبيانات والتكامل من أجل تحقيق فوائد هذه التكنولوجيات بالكامل. ويمكن للمنظمة، من خلال الاستراتيجيات والأطر الصحيحة، أن تساعد الشركات السعودية على تحسين القدرة التنافسية والكفاءة ودفع عجلة النمو الاقتصادي وفقاً لأهداف رؤية عام 2030.