

Challenges of Successful Implementation of Artificial Intelligence in Logistics Project Management at Saudi Telecom Company

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Received:

15/11/2024

Revised:

30/11/2024

Accepted:

08/12/2024

Published:

30/03/2025

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Citation: Al-Subaie, N. A.

(2025). Challenges of Successful

Implementation of Artificial Intelligence in Logistics Project Management at Saudi Telecom Company.

Journal of Economic, Administrative and Legal Sciences, 9(35), 114 –125. <https://doi.org/10.26389/AJSRP.B181124>

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Abstract: The emergence of artificial intelligence (AI) technology has the capability to drastically change logistics and supply chain management across various business and industrial sectors. Logistic project management, a crucial sector in the supply chain management of companies, is regarded as a domain where AI will play a key role in enhancing efficiency, precision, and the speed of service delivery. Saudi Arabia's Vision 2030 aims to improve connectivity with other nations both regionally and globally by refining logistics services, streamlining trade exchanges, and incorporating digital technology into these processes. The aim of this study is to identify the challenges faced when implementing AI technologies in logistics project management at Saudi Telecom Company (STC). This research employs a qualitative approach that features a literature review on the topic. The findings revealed several challenges impeding the global implementation of AI in logistics project management, which can be classified into organizational, technological, economic, data, environmental, social, and ethical issues. In the Saudi context, within the STC, four key challenges of implementing AI in logistics project management were recognized: data privacy and security, hardware infrastructure needs, insufficient employee skills and adaptability, and social acceptance. Based on the findings of this study, it can be concluded that implementing AI technology in logistics project management, when executed correctly, could reveal significant opportunities at the STC. Further experimental studies are suggested to gain a better understanding of the challenges that restrict the application of AI technology in logistics project management.

Keywords: Artificial intelligence, Logistics, Project Management, Challenges, Saudi Arabia, Saudi Telecom Company.

تحديات نجاح تطبيق الذكاء الاصطناعي في إدارة المشاريع اللوجستية في شركة الاتصالات السعودية

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المملكة العربية السعودية

المستخلص: لظهور تكنولوجيا الذكاء الاصطناعي (AI) القدرة على تغيير الخدمات اللوجستية وإدارة سلسلة التوريد بشكل جذري عبر مختلف القطاعات التجارية والصناعية. تعتبر إدارة المشاريع اللوجستية، وهي قطاع حاسم في إدارة سلسلة التوريد للشركات، مجالاً سيلعب فيه الذكاء الاصطناعي دوراً رئيسياً في تعزيز الكفاءة والدقة وسرعة تقديم الخدمات. تهدف رؤية المملكة العربية السعودية 2030 إلى تحسين الاتصال مع الدول الأخرى على المستوى الإقليمي والعالمي من خلال تحسين الخدمات اللوجستية وتبسيط التبادلات التجارية ودمج التكنولوجيا الرقمية في هذه العمليات. يهدف هذا البحث إلى تحديد التحديات التي تواجهها عند تنفيذ تقنيات الذكاء الاصطناعي في إدارة المشاريع اللوجستية في شركة الاتصالات السعودية (STC). يستخدم هذا البحث نهجاً نوعياً يتميز بمراجعة الأدبيات حول هذا الموضوع. كشفت النتائج عن العديد من التحديات التي تعيق تنفيذ الذكاء الاصطناعي في إدارة المشاريع اللوجستية عالمياً، والتي يمكن تصنيفها إلى قضايا تنظيمية وتكنولوجية واقتصادية وبيانات وبيئية واجتماعية وأخلاقية. في السياق السعودي، ودخل شركة الاتصالات السعودية، تم التعرف على أربعة تحديات رئيسية لتطبيق الذكاء الاصطناعي في إدارة المشاريع اللوجستية وهي: خصوصية البيانات والأمان، واحتياجات البنية التحتية للأجهزة، وعدم كفاية مهارات الموظفين والقدرة على التكيف، والقبول الاجتماعي. بناءً على نتائج هذه الدراسة، يمكن أن نستنتج أن تطبيق تكنولوجيا الذكاء الاصطناعي في إدارة المشاريع اللوجستية، عند تنفيذه بشكل صحيح، يمكن أن يكشف عن فرص كبيرة في شركة الاتصالات السعودية. نقترح إجراء المزيد من الدراسات التجريبية للحصول على فهم أفضل للتحديات التي تحد من تطبيق تكنولوجيا الذكاء الاصطناعي في إدارة المشاريع اللوجستية.

الكلمات المفتاحية: الذكاء الاصطناعي، اللوجستيات، إدارة المشاريع، التحديات، المملكة العربية السعودية، شركة الاتصالات السعودية.

Introduction

The emergence of Artificial Intelligence (AI) has significantly influenced different industries, especially logistics and project management, rendering them major beneficiaries of its implementation (Richey Jr et al., 2023). The power of AI is found in its ability to process and analyze large data sets, resulting in more efficient operations, improved resource distribution, and better decision-making skills. These advancements are crucial for enhancing productivity and efficiency, as they clarify AI's capability to extract actionable insights from intricate data landscapes, signaling a new age of operational excellence (Alqublan, 2021).

Within the logistics industry, AI is recognized as a key facilitator for initiatives related to smart logistics and supply chains that can enhance end-to-end visibility, optimize logistics transportation, warehousing, distribution processing, information services, minimize emissions and environmental impact, and can aid in achieving time and cost efficiencies (Song et al., 2020). Major corporations in the industry are integrating AI and machine learning as crucial components to boost real-time decision-making concerning competitiveness, performance, costs, inventory, asset management, and workforce. Additionally, it can assist these firms in advancing resource planning systems into more sophisticated AI frameworks and analytics, both semi-autonomous and fully automated (El Makhoulfi, 2023). A significant application of these advancements is seen in warehouse and distribution activities, where automation powered by AI and big data is growing more prevalent. In recent years, automation has become more popular because of its use in different phases of supply chain management. It has been applied in predicting demand, optimizing price recommendations, tailoring product suggestions, and forecasting sales, thus enhancing profit margins and inventory control in warehouses and for logistics planners (Nimmagadda, 2021). Even with these encouraging developments, companies face major difficulties in effectively incorporating AI into logistics operations (Al Suwaidi et al., 2023).

Project management is an essential foundation for guaranteeing the success of any project, as it significantly contributes to utilizing the right knowledge, skills, and tools to meet project requirements efficiently and effectively (Al-Tahtah, 2024). Project management demands that project managers juggle multiple factors, including scope, time, cost, and quality, while prioritizing the needs and expectations of those involved in or impacted by the project. It also aids in the efficient utilization of resources to accomplish transparent and comprehensible results for all stakeholders, thereby improving the degree of collaboration and coordination (Savio & Ali, 2023). By explicitly outlining the roles and responsibilities of each person involved in different phases of the project, management helps guarantee that work advances smoothly and effectively. Furthermore, project management serves as a crucial mechanism for aligning the particular goals of the project with the overall strategic aims of the organization, thereby increasing the likelihood of attaining long-term success. It similarly aids in establishing the implementation timeline, defining performance monitoring strategies, and addressing possible risks, which guarantees the delivery of exceptional outcomes that fulfill expectations (Shang et al., 2023). Although it has great potential, AI in project management faces challenges and limitations (Shoushtari et al., 2024).

In Saudi Arabia, firms are progressively embracing AI technologies to improve operational effectiveness in a rapidly changing economic environment (Al-Ghamdi & Al-Dharman, 2022), an exemplary case is the Saudi Telecom Company (STC). STC's implementation of AI for inventory control and demand forecasting demonstrates how such technologies can generate significant operational advantages, enhancing efficiency and responsiveness across supply chain operations (STC, 2024). The Saudi 'Vision 2030' strategy recognizes the impact of the telecom sector in enhancing living standards and driving economic development (KSA, 2016). This vision initiated the National Industrial Development and Logistics Program in 2019, which seeks to evolve the Kingdom into a prominent global contender in the energy, mining, logistics, and industrial sectors. These rapidly expanding sectors are broadening Saudi Arabia's economy, generating quality employment and ensuring sustainable growth for future generations (Vision2030, 2019).

Even though digital technology, including AI, is increasingly crucial for companies to integrate into business and industrial processes like logistics in the telecommunications sector, and despite the Saudi government's attempts to stay abreast of swift technological advancements to meet Vision 2030 objectives, there is a deficiency of local research on the application of AI in logistics project management for Saudi firms, particularly STC. Consequently, this study seeks to explore the challenges of applying AI in logistics project management at STC in Saudi Arabia.

Statement of the Problem

AI applications in telecommunications and logistics could greatly lower network deployment and operational expenses, boost performance, improve customer service, and aid in creating and launching new services (Marr, 2017). Efficient logistics project

management is essential for telecommunications firms to improve their services and deliver the optimal experience for their clients (Alojai et al., 2019).

Saudi Arabia boasts a unique strategic location connecting three continents, acting as a trade center and rich in natural resources. The Kingdom's journey to becoming a major industrial powerhouse and global logistics hub has only just begun (Vision2030, 2019). STC Group acts as the driving force for digital transformation in the Gulf region, offering advanced solutions and significantly contributing to the digitization initiatives. The organization provides a wide array of services, including digital infrastructure, cloud solutions, cybersecurity, Internet of Things (IoT), AI, digital payments, digital media, and digital entertainment. The organization comprises over 14 subsidiaries across the Kingdom of Saudi Arabia and the regions of North and Middle Africa, along with Europe. STC has focused on AI applications in logistics, underscored by groundbreaking solutions such as "Smart Tally," which revolutionizes the logistics industry with smart cameras and AI that analyze images to identify containers and truck labels, and "Smart Surveillance & Analytics," which includes a 5G camera paired with AI that analyzes real-time video to deliver instant business insights (STC, 2024).

Although numerous research efforts have explored the enhancement of administrative systems for managing logistics projects—both in the Arab region and globally—there remains a deficit of studies that focus on the difficulties of integrating AI into logistics management in telecommunications companies. There is an urgent need to explore this topic further to remain in sync with the technological and managerial transformations occurring in all industrial sectors, especially in telecommunications.

Therefore, this study seeks to answer the following main question: What challenges do the successful implementation of AI in managing logistics projects face at the Saudi Telecom Company? The following sub-questions branch out from this main question:

- 1- What are the challenges of successfully applying AI in managing logistics projects at Saudi Telecom Company?
- 2- What are the effects of applying AI at Saudi Telecom Company?
- 3- To what extent can the application of AI contribute to managing logistics projects at Saudi Telecom Company?

Study Purpose

The study aims to identify and analyze the challenges hindering the effective implementation of AI in logistics project management at Saudi Telecom Company.

Study Importance

This research provides a significant addition to the broader understanding of AI application in the logistics industry, in particular logistics project management. A thorough grasp of the challenges linked to AI implementation is essential for stakeholders and decision-makers in STC and similar organizations. Through identifying and analyzing these challenges, the research provides stakeholders with the insights needed to formulate informed strategies designed to alleviate difficulties and enhance the advantages of AI technologies. This strategic understanding can result in better operational efficiencies, lowered costs, and improved service delivery, all of which are essential for sustaining a competitive advantage in the rapidly evolving business landscape today. Moreover, the results of this study can provide a groundwork for additional scholarly investigation into the use of AI in logistics, especially in the context of the Middle East.

Definition of Terms

- Artificial Intelligence (AI)

Artificial intelligence is a branch of computer science that aims to develop systems that can simulate human intelligence through learning and decision-making (Davenport & Ronanki, 2018). In this context, AI is a technology that enables machines to learn and perform tasks that normally require human intelligence. These tasks include analyzing data, recognizing patterns, and making decisions based on available information (Davenport & Ronanki, 2018; Russell & Norvig, 2016). AI continues to evolve at a rapid pace, becoming an essential part of our daily lives. AI has enormous potential to improve and make our lives easier, provided it is used properly. However, we must bear in mind that this enormous potential comes with complex challenges, from privacy breaches and security risks to concerns about exacerbating inequality and its effects on the labor market. AI also raises questions about ethics and potential social impacts, requiring caution and deep thought about how to use this technology responsibly and safely (Ertel, 2024).

- Project

It is a successive and interconnected series of procedures, tasks and activities that have specific objectives according to timetables for completion, in light of specific standards and specifications. These activities are based on different sources of funding and include equipment and labor (Hindi et al., 2017).

- Project Management

It is a set of principles, methods, rules and foundations used to plan and monitor the project implementation and completion process, as well as providing the necessary resources for the project and make the necessary decisions to achieve the project objectives effectively (Al-Shahri et al., 2023).

- Logistics Project Management

Logistics Project Management pertains to the organized planning, execution, and oversight necessary to efficiently manage logistics activities within the framework of a particular project. This field seeks to guarantee the effective movement and storage of products, combining different logistical operations like inventory control, warehousing, and distribution (Coyle et al., 2021). Efficient management of logistics projects is essential for maximizing resource utilization, reducing expenses, and improving overall project results (Mangan & Lalwani, 2016).

Literature Review

- AI in Logistics Project Management

AI has become a disruptive force, reshaping industries and revolutionizing commercial operations. Among the areas greatly affected, project management possesses. The integration of AI offers smart automation, decisions based on data, and predictive features, tackling issues found in conventional project management methods. Effective AI applications have transformed project management, enhancing forecasting, resource distribution, and risk evaluation (Savio & Ali, 2023).

The benefits of AI regarding productivity, efficiency, and worldwide economic expansion are notable and are expected to generate progressive global economic activity in the years ahead (Dwivedi et al., 2021). Project management is an intricate procedure that demands thorough planning, implementation, and oversight. Conventional techniques frequently face difficulties with extensive data sets, unexpected obstacles, and repetitive duties. In this scenario, AI provides a revolutionary method, improving multiple facets of project management (Shoushtari et al., 2024). Logistic operations and the associated project management, which represent a crucial aspect of supply chain management within organizations, are perceived as a domain where AI will play a key role in enhancing efficiency, accuracy, and service delivery speed (Dubey et al., 2020). AI, possessing the ability for intricate pattern recognition, predictive analysis, and optimization, stands out as a viable approach for tackling the diverse issues inherent in modern supply chain management (Nimmagadda, 2021). It is also anticipated that AI can serve as a tool to streamline operations and enhance management strategies amidst the growing complexity of interconnectivity (Modgil et al., 2022).

In this context, the utilization of AI technology is classified into multiple categories, which consist of smart operation rule management, smart warehouse positioning, smart decision-making support, image identification, and smart scheduling (Al Suwaidi et al., 2023). In the logistics sector, AI technology emphasizes areas such as intelligent search, reasoning planning, and smart robotics (Dubey et al., 2020). Companies that utilize AI extensively are thought to be gaining significant benefits, including reduced downtime, enhanced efficiency, and greater customer satisfaction (El Makhoulfi, 2023). There are many instances and options for utilizing robots in logistics, including smart robots for gathering, picking, and categorizing items; robots designed for unloading containers (Chung, 2021).

AI in logistics can deliver the best solutions for vehicle routing, thereby lowering costs, ensuring accurate demand forecasting, speeding up decision-making, and enhancing customer satisfaction by personalizing logistics services (Klumpp, 2018). Nonetheless, despite the significant advantages of AI, its adoption and implementation in logistics operations are still in their early stages (Kaplan & Haenlein, 2020; Woschank et al., 2020). Thus, gaining a deeper insight into obstacles and difficulties is crucial for effectively leveraging the possible advantages from existing resources to enhance returns. It is worth noting that the ongoing documentation of machine configurations, operational statuses, quality parameter adjustments, predictive maintenance strategies, decision support systems, sophisticated scheduling, planning, and control methods in research domains such as inventory management, flow shop issues, conventional job shop scheduling dilemmas, production optimization, and enhancements in logistics operations, like identification and tracking methods, is regarded as a promising area within the Smart Logistics paradigm (Woschank et al., 2020).

- Review of previous studies

The existing recent studies on the challenges of AI use in logistics project management in companies and organizations were reviewed and summarized in Table 1. Most previous studies have conducted detailed analyses of the challenges that face the implementation of AI in logistics operations in various countries including Arabic ones "UAE" (Al Suwaidi et al., 2023), these studies adopted a qualitative approach through a literature review (Al Suwaidi et al., 2023; El Makhoulfi, 2023; Erturk & Koseoglu, 2024; Nimmagadda, 2021; Richey Jr et al., 2023). Other studies have focused on studying the reality of using AI in project management in different sectors in Saudi Arabia (Al-Shahri et al., 2023; Savio & Ali, 2023) and in other countries such as Singapore (Shang et al., 2023), where these three studies analyzed the challenges facing the successful implementation of AI in project management in general. Al-Shahri et al. (2023) and (Shang et al., 2023) adopted a quantitative approach through questionnaires, while (Savio & Ali, 2023) used secondary data. One study adopted a case study approach (Klump, 2018). In addition, (Dwivedi et al., 2021) used both literature review and interview with experts' approaches in their study.

The authors mentioned the benefits of using AI in logistics business and project management in different sectors. Furthermore, the challenges facing the successful implementation of AI in logistics were highlighted. However, only two studies focused on the challenges facing the use of AI in project management in Saudi Arabia (Al-Shahri et al., 2023; Savio & Ali, 2023). While no previous Saudi studies dealt with the challenges facing the implementation of AI in logistics project management, and more specifically in telecommunication sector. Therefore, the current study focuses on identifying the challenges militating against the implementation of AI in logistics at the Saudi STC. Studying a country such as KSA, in the context of economic development and digital transformation, will help analyze specific AI activities and provide specific implications applicable to STC and the technology sector in general. Moreover, this ongoing study intends to offer additional benchmarking for logistics managers in decision-making within supply chain management.

Table 1. Summary of previous studies.

Author	Country/ Language	Topic	Aim/Method	Results
(<u>Erturk & Koseoglu, 2024</u>)	Turkey/English	Adaptation of Artificial Intelligence Technologies to Logistics Businesses	Describing the adaptation process of the logistics sector to AI technologies/Literature Review	Challenges include: IT infrastructure, investments in data collection (IoT), transition to cloud technology, software license investments, facility restructuring investments, investments in robots, etc.
(<u>Hegedus, 2024</u>)	Hungary/English	The logistics of artificial intelligence	Exploring the new challenges regarding the hardware requirements of AI applications in the context of global supply chains/ Literature review	Challenges include hardware infrastructure requirements, cost (Energy consumption), skilled workforce, cybersecurity, and the need of continuous development and maintenance.
(<u>Al Suwaidi et al., 2023</u>)	United Arab Emirates/English	Investigating Barriers and Challenges to Artificial Intelligence (AI) Implementation in Logistic Operations: A Systematic	Investigating challenges associated with AI implementation in the logistics operations/A systematic literature review process	7 major categories of barriers and challenges of AI adoption and implementation in the logistic are identified:(organizational and managerial challenges, technological challenges, economic challenges, data challenges, environmental challenges, social challenges, political, legal, and ethical

Author	Country/ Language	Topic	Aim/Method	Results
		Review of Literature		challenges). Similarly, 16 specific challenges such as lack of top management support, internal requirement-organizational strategy, real-time response, disconnected systems, technology complexity, skill and expertise, high investment, operational costs, AI infrastructure, data standardization, scalability factors, data privacy and security, and insufficient operational warehouse space were identified.
(El Makhoulfi, 2023)	Netherlands/English	AI Application in Transport and Logistics Opportunities and Challenges (An Exploratory Study)	Investigating the opportunities and challenges of implementing AI technologies in the transport and logistics sectors/Literature study, and interviews with experts and companies active in the AI world	The challenges associated with adopting AI and automation in transportation and logistics sectors: high capital investments, organization change, high costs associated with using data in the AI system, organizational maturity and cultural readiness, and appropriate intelligent information technology infrastructure, cybersecurity risks, accountability (including, liability and insurance practices), legal issues (regulation, law/order, etc.), technology mistrust, and the displacement of human workers.
(Richey Jr et al., 2023)	USA/English	Artificial intelligence in logistics and supply chain management: A primer and roadmap for research	Synthesizing the potential applications of AI within the logistics and supply chain management/A qualitative literature review	Challenges include ethical considerations, data privacy, transparency, and visibility, copyright issues, the lack of regulatory templates, and workforce adaptability.
(Al-Shahri et al., 2023)	Saudi Arabia/ Arabic	The Reality of Artificial Intelligence on Project Management in the Government	Identifying the reality of AI in project management in the government sector in the Kingdom of Saudi Arabia, by identifying	Challenges facing the AI implementation in project management in governmental sectors are: cost of modern artificial intelligence technologies, differences in the

Author	Country/ Language	Topic	Aim/Method	Results
		Sector in the Kingdom of Saudi Arabia.	the reality of the awareness of project management workers in the Saudi sectors of the importance of artificial intelligence in the stages of project management, the extent of its contribution to it, and its importance in improving project management, in addition to the most important administrative and technical requirements to simplify the use of artificial intelligence in the government sector, and the obstacles to its use./Descriptive analytical approach through questionnaire	administrative work mechanism between different government departments, lack of financial incentives for AI workers, poor effectiveness of electronic infrastructure, lack of AI workforce efficiency and skills, resistance to the use of artificial intelligence.
(Shang et al., 2023)	Singapore/ English	Prospects, drivers of and barriers to artificial intelligence adoption in project management.	Identifying the drivers and barriers to adopting AI in project management within Singapore's construction and environment sectors/Both quantitative and qualitative approaches	Key barriers include high costs, lack of support, and insufficient skilled personnel trained in AI technologies.
(Savio & Ali, 2023)	Saudi Arabia/English	Artificial Intelligence in Project Management & Its Future	Examining the current applications of AI in project management and its future/Collecting secondary data from various reputable and scholarly sources.	Successful AI implementations in project management face some challenges: data quality, investment uncertainties, workforce readiness, and change management.
(Nimmagadda, 2021)	USA/English	Artificial Intelligence for Real-Time	Conducting a rigorous investigation into the application of AI	The integration of AI within supply chain management is fraught with challenges: the

Author	Country/ Language	Topic	Aim/Method	Results
		Logistics and Transportation Optimization in Retail Supply Chains: Techniques, Models, and Applications	techniques for optimizing logistics and transportation operations in the dynamic environment of retail supply chains/A literature review	complex interplay of data quality and availability, the scarcity of AI talent and the resistance to change within organizations, and ethical considerations and bias in AI Algorithms (data privacy).
(Dwivedi et al., 2021)	UK/English	Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy	Investigating the opportunities and challenges related to the emergence of AI within a number of domains/ Literature review and interviews with leading expert contributors	Different challenges identified: Social, economic, technological, data, ethical, political/legal/policy, and organizational/managerial.
(Klumpp, 2018)	Germany/English	Automation and artificial intelligence in business logistics systems: human reactions and collaboration requirements	Developing a framework for distinguishing between more or less performing human–artificial collaboration systems in logistics/ A comprehensive case study regarding automated truck driving in logistics.	Challenges include Lack of top management support, lack of employees skills, and ethical considerations.

Methodology

This study utilizes a qualitative approach, employing a literature review method to examine the challenges of implementing artificial intelligence in logistics project management at STC. The study focuses on literature relevant to the topic, and data were gathered from various sources, including scientific journals and digital libraries, in both Arabic and English. The sample is not restricted to a specific number; instead, it is selectively chosen from pertinent literature. Data analysis involves the collection and interpretation of findings from the reviewed literature.

Results and discussion

In a global context, including the Saudi one (Al-Shahri et al., 2023; Savio & Ali, 2023), the analysis of the literature revealed different challenges facing the AI adoption in logistics project management. These challenges can be classified into seven categories, namely, organizational/ managerial, technological, economic, data, environmental, social, and political/legal/ethical challenges (Al Suwaidi et al., 2023).

- Organizational and managerial challenges

This category includes challenges such as lack of top management support (Klumpp, 2018; Shang et al., 2023), Internal Requirement-Organizational strategy (Dwivedi et al., 2021; El Makhoulfi, 2023; Richey Jr et al., 2023; Savio & Ali, 2023).

- Technological challenges

This includes technology mistrust (El Makhoulfi, 2023), real-time response, disconnected systems, technology complexity (Al Suwaidi et al., 2023; Dwivedi et al., 2021), and lack of skilled personnel in AI technology (Al-Shahri et al., 2023; Klumpp, 2018; Shang et al., 2023).

- Economic challenges

Implementing AI in logistics project management demands expenditures on technology infrastructure, data collection investments (IoT), cloud technology development, software licensing expenditures, facility reconfiguration investments, robot investments, etc. (Al-Shahri et al., 2023; El Makhoulfi, 2023; Erturk & Koseoglu, 2024; Hegedus, 2024). Moreover, the effective functioning of AI applications typically necessitates advanced hardware infrastructure. An additional important factor is the expenses associated with energy usage, AI technology creation, and upkeep (Al-Shahri et al., 2023; El Makhoulfi, 2023; Hegedus, 2024).

- Data challenges

There is a demand for innovative and effective technologies to manage the extensive volume, diversity, and speed of big data, while also addressing quality, privacy, and security concerns in the realm of AI applications in logistics project management (Al Suwaidi et al., 2023; Dwivedi et al., 2021; El Makhoulfi, 2023; Nimmagadda, 2021; Richey Jr et al., 2023; Savio & Ali, 2023).

- Environmental challenges

This category encompasses elements associated with warehousing, where the limitation of operational space for AI technology emerges as a barrier to its adoption and implementation. From a warehouse viewpoint, the implementation of AI technology certainly brings transformative alterations to the operational structure and framework of the warehouse. Consequently, this necessitates a suitable warehouse framework to support AI technologies for picking and ordering processes, which is a key emphasis of warehouse operations (Al Suwaidi et al., 2023).

- Social challenges

This category encompasses particular difficulties like insufficient employee collaboration, employee training, and joblessness (Al Suwaidi et al., 2023). Workers' opposition to altering their conventional work methods hinders AI sectors (Al-Shahri et al., 2023; Nimmagadda, 2021; Savio & Ali, 2023; Shang et al., 2023). Implementing AI necessitates the distribution of resources and extensive training for employees to adjust to new job responsibilities (Richey Jr et al., 2023). Advanced technological expertise is essential for AI since a vast quantity of data is necessary. This will also contribute to the demand for training, which could be economically unviable for numerous logistics companies (Hegedus, 2024; Klumpp, 2018).

- Political, legal, and ethical challenges

Categories of political, legal, and ethical challenges include elements like the absence of regulations regarding ethics and liability that govern AI technology (Dwivedi et al., 2021; Klumpp, 2018). The absence of targeted laws and regulations that foster motivation is viewed as a significant obstacle to AI implementation (El Makhoulfi, 2023).

- Challenges of using AI in logistics project management at STC

In Saudi Arabia, the establishment of the Saudi Data & AI Authority (SDAIA) aims to promote the nation's Data & AI efforts. To maximize the benefits of Data & AI for the economic and social development of the Kingdom, SDAIA developed the National Strategy for Data & AI (NSDAI, 2020) in collaboration with all stakeholders. The National Strategy for Data & AI aims to achieve the objectives of Vision 2030 by increasing the use of Data & AI and creating a strong foundation for a thriving local economy. Additionally, there are numerous initiatives established to assist with the implementation of the National Strategy for Data & AI. These encompass "Skills Initiatives" designed to enhance the nation's workforce by educating individuals in Data & AI, "Policy and Regulation Initiatives" as part of the national legislative transformation of KSA, creating the most favorable legal framework for Data & AI enterprises and talent, "Investment Initiatives" that bolster asset growth and enable KSA's economy by drawing local and international investors to discover and finance Data & AI opportunities in KSA, and "Ecosystem Initiatives" focused on promoting Data & AI integration throughout Giga-projects and major urban areas, boosting productivity, service quality, and overall wellbeing (NSDAI, 2020).

According to the National Strategy for Data & AI report from 2020, data and AI are currently transforming multiple industries and will increasingly be a crucial element in economic growth. AI solutions offer numerous opportunities (such as disaster management, road safety, and energy consumption management); however, several challenges are also arising (including data protection, automation, and cybersecurity) (NSDAI, 2020). The recently identified challenges of AI application across various sectors and work environments in Saudi Arabia align with our findings from existing research on the hurdles encountered in AI implementation within logistics project management. Various studies have highlighted the issue of data protection and privacy (Al Suwaidi et al., 2023; Dwivedi et al., 2021; El Makhoulfi, 2023; Nimmagadda, 2021; Richey Jr et al., 2023; Savio & Ali, 2023). Automation powered by AI necessitates significant financial investment in AI infrastructure (Al-Shahri et al., 2023; El Makhoulfi, 2023; Erturk & Koseoglu, 2024). A significant challenge in the utilization of AI technology, highlighted in the National Strategy for Data & AI report, is cybersecurity (Al Suwaidi et al., 2023; El Makhoulfi, 2023; Hegedus, 2024), prompting collective efforts to enhance the system's security.

STC, along with its partners, has become the center for digital products and services in the Middle East and North Africa, serving as the national facilitator in KSA for the government's Vision 2030 – a groundbreaking change aimed at reducing oil dependency by enhancing and diversifying the economy. New technologies like 5G, AI, and augmented reality are currently utilized in cutting-edge STC products and services, while emerging solutions like IoT and cloud technology are showing to enhance progress towards sustainability objectives (Alwetaid, 2022). In transportation and logistics, STC offers two primary services: the first is the "Shuttle Bus Service (IoT)," which serves as an all-encompassing solution for the shuttle bus industry, facilitating fleet scheduling, routing, and tracking while offering real-time information for both operators and riders. The second is the "Fleet Control Service (IoT)," designed to monitor the transportation process executed by fleets in a detailed manner (STC, 2024). In addition, as previously noted, STC provides intelligent solutions for logistics and industry, including "Automated Cranes," "Automated Gate Management," and "Container Track & Trace," among others (STC, 2024). STC facilitates the swift adoption and enhancement of 5G technology in the logistics industry by entering into various agreements, including one with the General Authority of Ports aimed at converting to automated smart ports. This initiative embraces the technologies of the Fourth Industrial Revolution along with its innovative applications, leveraging technologies such as the Internet of Things, 5G, cloud computing, cybersecurity, and application services and platforms (TeleTimesInternational, 2022). Recently, One Network Enterprises (ONE), a premier global supplier of intelligent control towers and the Digital Supply Chain Network™, has entered into a Memorandum of Understanding with iot squared, a collaboration between STC Group and the Public Investment Fund of Saudi Arabia. This partnership aims to investigate the capabilities of digital supply chain networks across various sectors and implement technologies like data analytics and AI to enhance supply chain operations in the Kingdom of Saudi Arabia and the broader Middle East area. Through this partnership agreement, ONE and iot squared will work together to deploy a cohesive digital supply chain platform aimed at improving visibility, traceability, and efficiency throughout the entire logistics supply chain (OneNetWork, 2024).

Based on the above findings and related discussion, as well as considering the National Strategy for Data & AI report of 2020, and the activities of the STC in logistics sector in the Kingdom, four main challenges can be identified that hinder the successful implementation of AI technology in logistics projects management at the STC, namely, data challenges (security, privacy and quality), AI hardware infrastructure requirements, necessity of employees training for their adaption to new work responsibilities towards AI technology use in logistics, and social acceptance at both inside and outside STC.

Conclusion, Recommendations and limitations

Conclusion

The investigation of AI and its incorporation into different sectors has revealed a complicated terrain of challenges and opportunities for logistics project management and development. This research has explored the various challenges encountered in the application of AI within logistics project management across various countries and industries, emphasizing the Saudi context and specifically examining the challenges associated with AI use in logistics project management at Saudi Telecom Company. Utilizing a qualitative method alongside a literature review has uncovered four primary obstacles to effectively implementing AI in logistics project management at the STC, which include data issues, the need for AI hardware infrastructure, employee training, and societal acceptance.

In summary, as AI ushers in a new age, this study provides essential understanding of the challenges AI poses to logistics project management at the STC. By implementing strategic, adaptable, and ethical approaches, STC can effectively address the challenges of AI

integration, leveraging its capability to transform logistics for the overall benefit of the workforce and society. Leveraging AI technology in overseeing human cap logistics project management can create unforeseen opportunities when executed properly. This will guarantee that STC stays at the leading edge of technological advancement both in Saudi Arabia and globally.

Recommendations

Saudi Arabia's unique geopolitical location offers significant prospects for the logistics industry. As STC is interested in incorporating AI into its logistics and project management systems. We suggest that the study's continuation involves carrying out semi-structured interviews with the logistics top management at STC, categorized by activities, to uncover success factors and challenges at different activity levels. Based on the insights obtained, a prioritization of logistics activities should be established.

Study Limitations

This research is constrained by its qualitative theoretical framework and the particular context of AI application in logistics project management within the telecommunications industry in Saudi Arabia. Moreover, the rapid pace of technological progress may render the collected data outdated, necessitating ongoing research.

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