

Midocean University

College of Management

Graduation Project



The Impact of Artificial Intelligence on Logistics in Saudi Arabia Operations at NAQEL Express

Prepared by:

Yazan Mowafaq Saad Alnowaisir 233001377

Ahmed Sameer Mohammed Aleraqi 233001419

Supervised by:

Dr. Alfaisal Abd elhameed Mohamed

Dr. Fayez Ali Jrad

2023 - 2024

Table of contents:

Abstract:	5
Introduction.....	7
Study Problem	8
Research Importance	8
Study Objectives	9
Research Questions	10
Hypotheses	10
Theoretical premises of the study.....	10
Introduction.....	13
Previous studies	14
Theoretical framework.....	17
Artificial Intelligence.....	17
Logistics Operations.....	25
Introduction.....	30
Study Methodology:	30
Research Methods:.....	30
Study population and sample:.....	30
Research Tools:	34
The validity and reliability of the study tool:	34
Statistical processing used:	35
Limitations of the study.....	36
Findings of the Study	38
Results.....	49
Conclusions	50
Recommendations	51
References	53
Questionnaire	57
الملخص العربي	61

List of tables:

Table 1: Frequencies and percentages of the research sample by gender	31
Table 2: Frequencies and percentages of the research sample by education.....	32
Table 3: Frequencies and percentages of the research sample by Years of experience in the company	33
Table 4: Values of Internal Consistency Coefficients Using Cronbach Alpha Test	35
Table 5: The arithmetic means and standard deviations of the responses of the study sample members for the paragraphs of the axis (application of smart technology) are arranged in descending order.	38
Table 6: The arithmetic means and standard deviations of the responses of the study sample members for the paragraphs of the axis (The efficiency of logistics operations) are arranged in descending order.	40
Table 7: The arithmetic means and standard deviations of the responses of the study sample members for the paragraphs of the axis (Customer satisfaction) are arranged in descending order.....	42
Table 8: The arithmetic means and standard deviations of the responses of the study sample members for the paragraphs of the axis (Operating costs) are arranged in descending order.	44
Table 9: Results of simple regression analysis to test the first hypothesis of the study	46
Table 10: Results of simple regression analysis to test the second hypothesis of the study	46
Table 11: Results of simple regression analysis to test the third hypothesis of the study	47

Index of shapes:

Figure 1: Percentages of the research sample by gender.....	31
Figure 2: Percentages of the research sample by education	32
Figure 3: Percentages of the research sample by Years of experience in the company	33

Abstract:

This study aimed to analyze the impact of artificial intelligence on logistics operations at Naqel Express in Saudi Arabia. To achieve the study's objectives, the researchers designed a questionnaire consisting of 24 items to collect primary information from a sample of 144 individuals. Accordingly, data was collected, analyzed, and hypotheses were tested using the Statistical Package for the Social Sciences (SPSS). Various statistical methods, including simple regression analysis, were employed to achieve the study's goals. After analyzing the study's data and hypotheses, the study reached several key findings, including:

1. A noticeable reduction in operational costs was observed with the application of smart technology.
2. There is a positive and statistically significant relationship between technology application and operational efficiency.
3. A positive and statistically significant impact of smart technology application on customer satisfaction.
4. A reduction in operational costs accompanies the application of smart technology.

The study recommended the following:

1. Continuing investment in advanced smart technologies such as artificial intelligence and the Internet of Things to improve logistics efficiency and reduce costs.
2. Implementing comprehensive training programs to effectively equip employees with new technology.
3. Focusing on improving service quality by regularly collecting customer feedback.

Chapter One

Introduction

In today's rapidly changing business environment, integrating modern technologies such as artificial intelligence has become essential across various industries, especially in logistics. Logistics companies face the ongoing challenge of managing complex global supply chains while striving to reduce costs and enhance customer satisfaction. Adopting artificial intelligence offers a strategic pathway for these companies to effectively achieve these goals (Hofmann & Rüscher, 2017).

Artificial intelligence is a system that enables companies to analyze data and make decisions more accurately and efficiently. This system includes applications such as predictive analytics, inventory management, and logistics planning. In logistics, artificial intelligence is a vital tool for improving operational efficiency, reducing operational costs, and expanding access to new markets. The adoption of artificial intelligence enhances companies' ability to deliver faster and more accurate services by optimizing logistics management and providing immediate solutions to problems. The artificial intelligence system at NAQEL Express allows for tracking shipments and optimizing delivery schedules, thereby increasing operational efficiency and enhancing customer satisfaction. (Wang, *et al.*, 2016).

Logistics operations are a key indicator of a company's efficiency and success in managing its supply chain. Improving logistics operations refers to a company's ability to deliver goods faster and at a lower cost, as well as increasing customer satisfaction. In the context of NAQEL Express, the efficiency of logistics operations can be measured by reducing delivery times, improving inventory management, and minimizing errors in shipping processes. The application of artificial intelligence can lead to tangible improvements in these operations by providing more effective means of data management and decision-making.

This research aims to study the relationship between the use of artificial intelligence and the improvement of logistics operations at NAQEL Express. It will explore how artificial intelligence is applied in the company and how it impacts the efficiency of logistics operations, improves inventory management, and speeds up delivery processes.

Study Problem

The research problem revolves around the significant challenges faced by logistics companies, especially NAQEL Express in Saudi Arabia, in their efforts to improve operational efficiency and enhance supply chain performance using artificial intelligence. These challenges include the increasing complexities of global supply chain management, the need to achieve high levels of operational efficiency, the integration of different technological systems, and the need to balance operational performance with environmental sustainability goals.

Research Importance

1. Theoretical Importance:

- **Operational Efficiency Analysis:** The research helps understand and analyze the factors affecting operational efficiency in logistics companies, contributing to the development of new theories or the improvement of existing theories on logistics operations management.
- **Case Studies of Specific Companies:** The research provides a detailed case study of NAQEL Saudi Arabia, which can be used as a model to analyze the performance of similar logistics companies in the region.
- **Advanced Technology in Logistics:** The research contributes to expanding theoretical knowledge on how to integrate advanced technology into logistics operations and the expected benefits from this integration.

- **Sustainability in Logistics:** The research helps develop a theoretical framework on how to enhance sustainability in supply chains and logistics services, supporting global trends towards sustainable development.

2. Practical Importance:

- **Improving Operational Efficiency:** Logistics companies like NAQEL can use the findings and recommendations to improve their operational efficiency, leading to cost reduction and increased profitability.

- **Enhancing Supply Chain Performance:** The results provide practical tools and strategies to improve performance in supply chains, ensuring smoother and more efficient product and service flow.

- **Integrating Advanced Technology:** Companies can use the findings to identify the best ways to integrate advanced technologies such as artificial intelligence and robotics into their operations, enhancing productivity and accuracy.

- **Enhancing Sustainability:** The findings offer practical solutions to enhance sustainability, such as reducing carbon emissions and improving resource management, positively impacting the environment and society.

Study Objectives

- Analyze the challenges in logistics operations faced by NAQEL Express in Saudi Arabia.
- Evaluate the impact of artificial intelligence on enhancing efficiency and performance in logistics services at NAQEL Express in Saudi Arabia.
- Explore strategies for integrating artificial intelligence into logistics processes to improve effectiveness.
- Assess the role of artificial intelligence in optimizing supply chain management and logistics operations.

- Provide actionable recommendations for NAQEL Express in Saudi Arabia to effectively leverage artificial intelligence for sustainable growth and competitive advantage.

Research Questions

1. How does artificial intelligence (AI) improve efficiency and performance in logistics operations at NAQEL Express?
2. What are the key challenges NAQEL Express faces in integrating AI into its logistics processes?
3. What strategies can NAQEL Express adopt to effectively leverage AI for optimizing supply chain management?

Hypotheses

1. There is a positive and significant relationship between the application of smart technology in logistics operations and its efficiency.
2. There is a positive and significant impact of the application of smart technology on customer satisfaction with logistics services.
3. The application of smart technology in logistics operations is accompanied by a reduction in the operational costs of the company.

Theoretical premises of the study

1. Resource Theory Existing (RBV): The Resource-Based View (RBV) is a theory that posits that a company's unique and valuable resources can provide it with a competitive advantage. According to Barney (1991), resources that are valuable, rare, inimitable, and non-substitutable can enable a company to achieve and sustain superior performance. In the context of NAQEL Express, AI is considered a valuable resource that can enhance various aspects of logistics operations. By leveraging AI, NAQEL Express can improve process efficiency, optimize routes, enhance predictive maintenance, and ultimately

increase customer satisfaction. This theory helps to understand how NAQEL Express can use its AI capabilities to gain a competitive edge in the logistics industry.

2. Technology Acceptance Model (TAM): The Technology Acceptance Model (TAM) was developed by Davis (1989) to explain how users come to accept and use a technology. TAM suggests that two main factors influence technology acceptance: perceived usefulness and perceived ease of use. Perceived usefulness is the degree to which a person believes that using a particular system would enhance their job performance, while perceived ease of use refers to the degree to which a person believes that using the system would be free of effort. In the case of NAQEL Express, TAM is used to analyze how employees and managers perceive the application of AI in their logistics operations. Understanding these perceptions can help NAQEL Express address any concerns, improve training programs, and ensure a smoother integration of AI technologies into their workflows.

3. Systems Theory: Systems Theory, introduced by Bertalanffy (1968), emphasizes the interdependence and interaction of various subsystems within an organization. According to this theory, an organization can be viewed as a complex system composed of interconnected subsystems, each of which plays a crucial role in the overall functionality and success of the organization. When applying Systems Theory to NAQEL Express, the focus is on how the integration of AI impacts different components of logistics operations, such as inventory management, transportation, and customer service. By viewing NAQEL Express as a system, the study can examine how AI integration affects the entire logistics network, identify potential synergies, and address any disruptions that may arise during the implementation process. Systems Theory helps in understanding the holistic impact of AI on NAQEL Express's logistics operations, ensuring that the integration enhances overall organizational efficiency and effectiveness.

Chapter Two

Previous studies

Introduction

Previous studies are a fundamental component of scientific research, providing the theoretical foundation and background knowledge essential for understanding the topic under investigation. In this chapter, we will review the literature related to the impact of artificial intelligence on logistics operations, with a specific focus on NAQEL Express in Saudi Arabia.

The advancement of artificial intelligence (AI) in recent years has revolutionized various sectors, including logistics. Therefore, it is crucial to understand how AI applications influence logistics operations and the potential benefits that companies like NAQEL Express can derive from this technology. In this chapter, we will analyze previous research that explores the impact of AI on logistics operations, examining the methodologies and findings of these studies and how they align with the objectives of our research.

Additionally, we will address any research gaps identified in the existing literature and discuss how our study can contribute to filling these gaps. Through this review, we aim to provide a comprehensive understanding based on scientific foundations, which will help illuminate the effects of AI on logistics operations at NAQEL Express specifically, and in the logistics sector more broadly.

Previous studies

(Faccenda, 2022) conducted a study titled "Measuring the Sustainability Impact of Artificial Intelligence in Logistics: A Case Study Analysis". The objective of the study was to analyze methods for assessing the sustainability impact of AI in logistics, focusing on environmental, social, and economic impacts. It aims to understand how AI solutions can contribute to reducing environmental and societal impacts while meeting the increasing demand for goods and services in logistics. The study analyzes the sustainability improvements brought about by AI in logistics through methods such as evaluating key performance indicators (KPIs) and conducting case study analyses. It explores how AI optimizes various aspects of logistics operations, including transportation, inventory management, warehouse management, and delivery. The research highlights that AI in logistics offers benefits such as vehicle routing optimization, improved truck utilization, real-time route adjustments, risk and hazard identification, and predictive maintenance. However, it also identifies barriers to measuring sustainability impacts, such as the lack of integrated systems, advanced technologies and analytics, data governance frameworks, organizational changes, and limited financial incentives. Despite these challenges, evaluating the sustainability impacts of AI solutions is crucial for fostering more sustainable and responsible business practices in logistics.

(Balfaqih, 2023) conducted a study titled "Artificial Intelligence and Smart Logistics Systems in Industry". The aim of this study is to analyze the variables influencing smart logistics and to evaluate the effectiveness of artificial intelligence (AI) applications in enhancing smart logistics within the context of Industry 4.0. The study seeks to explore the technological applications of AI and examine the factors that drive the adoption of AI in smart logistics. The study employs a comprehensive analysis to investigate the impact of AI on

smart logistics. It examines variables affecting the adoption of AI technologies and integrates findings from technology and AI studies relevant to smart logistics. The research assesses the efficiency of AI applications by integrating various technologies such as big data, Internet of Things (IoT), and cloud computing. The findings indicate that AI applications significantly impact industrial organizations and businesses through enhanced communication and information technology in large-scale smart logistics systems. AI facilitates technological advancements in supply chain logistics by integrating capabilities in big data management, IoT integration, and cloud computing services.

(Alheadary, 2024, p. 161-168) conducted a study titled "The impacts of the internet of things and artificial intelligence on logistics in supply chain management". The objective of this study is to introduce and analyze a new approach called IoT-AI-SCM, which integrates the Internet of Things (IoT) and artificial intelligence (AI) for supply chain management. This approach aims to address the current gap in academic literature where the combination of IoT and AI is often overlooked in strategies and structures for overseeing the movement and storage of goods. The study employs the design science method to develop and implement the IoT-AI-SCM approach. This method involves five key steps: 1) utilizing sensors and devices enabled by IoT, 2) gathering and connecting data, 3) storing and processing data using cloud technology, 4) applying AI, and 5) analyzing and predicting outcomes, and 6) smart planning and improvement. The research indicates that implementing this approach can significantly transform supply chain and logistics management. By leveraging the essential features of IoT and AI, companies can enhance their capabilities in data collection, processing, and analysis, leading to improved decision-making and efficiency. The study outlines how this approach enables a reimagined supply chain management system that integrates advanced technologies to optimize operations and predict outcomes more accurately.

(Louis & Hubert, 2024) conducted a study entitled "The Impact of Artificial Intelligence on Logistics Decision Making". In this study, the aim was to explore how advancements in artificial intelligence (AI) impact decision-making processes in logistics, highlighting their profound effects, challenges, and opportunities. The research discusses how AI technologies such as machine learning, predictive analytics, and natural language processing empower logistics professionals with advanced tools to enhance decision-making efficiency and accuracy. It also addresses the optimization of resource allocation, predictive maintenance, and risk management in supply chain operations using AI algorithms. AI technologies such as machine learning, predictive analytics, and natural language processing have revolutionized logistics decision making by enhancing efficiency, accuracy, and agility. They optimize resource allocation by analyzing transportation costs, inventory levels, and demand patterns, thereby improving cost-effectiveness and minimizing environmental impact. The study indicated that AI enables predictive maintenance to reduce downtime and optimize asset utilization, while AI-driven risk management systems identify and mitigate supply chain disruptions proactively. Despite these benefits, challenges like data privacy concerns and the need for workforce upskilling remain, necessitating regulatory frameworks and ethical guidelines for responsible AI deployment in logistics.

(Villanueva-Eslava, *et al.*, 2024) conducted a study titled "Artificial intelligence and logistics services: a systematic literature review". The objective of the study was to identify the artificial intelligence tools utilized and their impact on logistics services, achieved through a systematic review of scientific literature. Fifteen articles were selected from the Proquest and Scopus databases using terms such as artificial intelligence AND Logistics AND contracts OR provision OR services. The study found utilization of technologies including Blockchain, IoT, smart contracts, deep learning, and computer software in

logistics services. It was concluded that digitization involves integrating artificial intelligence into logistics services, with IoT prominently featured, while deep learning is less common in this context compared to other technologies. Artificial intelligence tools were found to impact logistics services by optimizing supply chains, enhancing product identification and tracking, and improving efficiency in contracting and transportation processes. The study recommends that logistics service providers in Latin America adopt artificial intelligence tools to improve the services they offer, considering the growing trends of AI adoption in logistics services observed in Europe, Asia, and North America.

Theoretical framework

Artificial Intelligence

Since its inception in 2012, AI has seen both development and collapse due to several factors. The last two decades have seen a resurgence in the interest and uses of AI across several industries because of the increased flow of data and complexity that has evolved in business scenarios (Scholten, *et al.*, 2014). The potential of AI in many business functions is being explored considering current needs and future goals. AI helps with business system design thinking and learns from data to gain insights without human input. With the help of AI, organizations can pinpoint the weak points in their supply chain management and allocate resources accordingly (FossoWamba & Akter, 2019). By rapidly extracting client expectations, sensing the market, utilizing failure modes, optimizing internal and external supply chains, and encouraging a more creative workforce through the automation of routine tasks, AI has the potential to help businesses build the best possible goods (Jabbour, *et al.*, 2020).

Artificial Intelligence is a great research field, which has affected almost all fields of modern life with its flexible, effective, and efficient mathematically logically structured solutions. Day by day, this field gains more popularity and becomes more advanced with the support of developments within other remarkable fields/technologies like computers, electronics, and communication (McCarthy, *et al.* 2006). When the field of Artificial Intelligence is examined in detail, it is also divided into some specific sub-research areas like Machine Learning and Swarm Intelligence. Artificial Intelligence is a complex field that is applied in shipping and logistics companies. To eliminate the lack of standardization seen in supply chains and transportation vehicles, advanced web-based, information-based, and mobile technologies are used in transportation and logistics. AI usage areas in logistics include advanced technologies for solving problems, resource analysis, optimization of traditional mathematical solutions, modeling and simulation techniques, and intelligent systems in traffic and transportation (Abdullayeva. 2019).

- **Definition of Artificial Intelligence (AI)**

The initial concept of artificial intelligence emerged in the 1940s and has evolved to its current state due to several factors. Among these are the availability of vast amounts of big data from diverse sources, which has enabled AI capabilities that were not possible in the past due to a lack of data. Additionally, the presence of open-source communities on social media platforms, which develop and share AI tools and applications, has facilitated the advancement of many aspects of AI (Wirth, 2018).

Artificial intelligence can be defined as a branch of computer science concerned with how machines can simulate human behavior. This science relies on developing hardware and software capable of thinking in the same way the human brain does, learning as we learn, making decisions as we decide, and acting as we act. Thus, artificial intelligence is the process of simulating human

intelligence through computer systems. This process involves studying human behavior by conducting experiments on their actions, placing them in certain situations, observing their reactions, thinking patterns, and how they deal with these situations. Afterward, attempts are made to mimic human thinking through complex computer systems (Russell & Norvig. 2021).

Artificial Intelligence (AI): Refers to the simulation of human intelligence by computer systems, including tasks such as learning, reasoning, problem-solving, and decision-making. AI technologies may include machine learning, natural language processing, and computer vision.

AI is defined as a network of computers that can simulate human intellect while making decisions on how to approach a business problem (Huang & Rust, 2018).

- **Benefits of Artificial Intelligence**

First, incorporating artificial intelligence into logistics systems enhances planning and decision-making. Machine learning algorithms and neural networks enable the analysis of large data sets and the identification of patterns, which improves the understanding of production and logistics processes. This, in turn, facilitates better demand forecasting, allowing for optimal order placements and faster delivery processes.

Second, with the rapid advancement of technology in the warehouse sector, automated warehouses are becoming increasingly prevalent. It is projected that by 2026, the warehouse automation market will grow at an annual rate of 14%. Additionally, it is anticipated that 60% of warehouses will adopt AI to automate their processes.

Warehouse automation helps companies save time and resources previously dedicated to routine and labor-intensive tasks. AI technology in

warehouses streamlines operations such as data collection, demand forecasting, order modifications, and the redirection of goods in transit (Stefanini, 2021).

These automated processes not only execute tasks more quickly but also eliminate routine logistical activities that can impede efficiency.

In addition to enhancing speed and efficiency, automated warehouses offer complete operational transparency and increased accountability for every step of the process. Optimized inventory management ensures that products are organized based on their popularity, which minimizes errors and prevents incorrect placement of goods. These improvements in process optimization and a safer, more accessible work environment led to higher revenue and overall operational efficiency.

Artificial intelligence also plays a crucial role in mitigating risks within the logistics chain, such as schedule constraints, changes in transportation conditions, and various delivery strategies. AI can swiftly adapt to these changes using predefined algorithms, optimizing delivery processes by reorganizing planning and utilizing appropriate resources. This boosts delivery reliability, attracts more customers, and enhances brand loyalty.

Additionally, various innovative methods improve logistics processes. For instance, voice picking in warehouses represents a significant advancement in logistics and warehousing. This system optimizes order picking and shipping processes, reduces task completion times, and minimizes errors. With voice picking, warehouse workers receive real-time instructions through a software assistant, facilitating easy navigation and accurate product retrieval. This technology is especially beneficial for large warehouses with extensive inventories, transforming warehouse operations by enhancing efficiency, safety, and accuracy in order fulfillment.

One of the most significant advantages of AI is its ability to process data in real-time. This capability enables logistics personnel to make quicker decisions, streamline delivery processes, and improve customer service quality, thereby increasing customer loyalty. AI also aids in warehouse management by overseeing loading and unloading, tracking product types and quantities, and monitoring warehouse staff actions. Moreover, automatic quality control powered by AI allows for prompt responses to production and quality issues.

AI can further enhance manufacturing processes. For example, computer vision technology optimizes raw material usage by providing precise calculations of required materials. It can also predict potential production issues, allowing companies to address problems before they become critical. This results in increased production efficiency, improved product quality, and fewer defects, which is crucial for maintaining the company's reputation and boosting profits.

AI also offers scalability in logistics. It manages and performs tasks across various levels of the transport chain, from production to end-user delivery. This comprehensive management enhances convenience and provides additional services for customers.

Fujitsu's AI model significantly improves the detection of damaged components on assembly lines and in transportation systems. This technology not only saves time and money but also reduces the number of rejections and refunds, thereby increasing customer satisfaction. Fujitsu continues to advance its AI technologies to help businesses enhance process efficiency and achieve greater success in the global market.

Furthermore, the use of drones accelerates the delivery process. Their safety and reliability make them suitable for delivering pharmaceuticals and other resources efficiently (Datamites, 2023).

- **AI Technologies Empowering Logistics Decision-Making**

In this section, we will explore three key AI technologies that are transforming logistics decision-making: machine learning algorithms, predictive analytics, and natural language processing (Louis& Hubert, 2024).

A. Machine Learning Algorithms:

Machine learning algorithms are a branch of artificial intelligence that allow computers to learn from data and make predictions or decisions without explicit programming. In logistics, these algorithms analyze large datasets to uncover patterns, trends, and correlations that support decision-making.

Machine learning can be applied across various logistics functions, including demand forecasting, transportation optimization, and route planning. For instance, in demand forecasting, machine learning algorithms evaluate historical sales data, market trends, and external factors to predict future demand. This enables logistics managers to optimize inventory levels, schedule production, and ensure timely deliveries.

B. Predictive Analytics:

Predictive analytics utilizes statistical models and machine learning techniques to analyze historical and real-time data, predicting future events or outcomes. In logistics, predictive analytics provides valuable insights that facilitate proactive decision-making.

For example, predictive analytics can forecast equipment failures, maintenance needs, and supply chain disruptions. By examining sensor data, maintenance records, and historical performance data, logistics managers can anticipate when equipment might fail and schedule maintenance proactively. This reduces downtime and enhances operational efficiency.

C. Natural Language Processing (NLP):

Natural language processing is an AI technology that focuses on the interaction between computers and human language. It enables computers to understand, interpret, and generate human language, including text and speech. In logistics decision-making, NLP can extract valuable insights from unstructured data sources such as customer feedback, emails, and social media posts.

NLP algorithms can analyze text to perform sentiment analysis, identify key insights, and categorize information. For instance, in customer service, NLP can process customer feedback to reveal patterns or trends in satisfaction or complaints. This helps logistics managers pinpoint areas for improvement and make data-driven decisions to enhance customer experience.

By harnessing these AI technologies, logistics professionals can derive valuable insights, automate routine tasks, optimize processes, and make more accurate and informed decisions. However, successful implementation requires high-quality data, robust infrastructure, and specialized expertise. Organizations must also consider ethical implications and ensure transparency and accountability in the application of these technologies.

- **Risks of Artificial Intelligence**

Demands for AI technologies in logistics have recently increased, allowing companies and organizations to improve their productivity, reduce costs, and ensure more efficient performance. However, as with any new technology, the use of AI carries some risks.

One of the main risks of using AI in logistics is the possibility of the system being compromised. Hackers and cybercrime are constantly seeking new ways to hack, which could lead to data theft and leakage. Any errors in the AI code can lead to crashes and unexpected repercussions. For example, if the inventory

management system doesn't work properly, it can result in customers losing the need to increase production or filling up warehouses.

The software used in AI systems may be imperfect or contain errors that may lead to malfunctions or malfunctions in the system. When AI systems stop working properly, it can lead to significant supply chain shortages, such as increased order processing time, lost orders, or even lost customers. For example, a financial company experienced errors in its system that led to its inability to detect problems in trading due to a lack of clarity of data Consumers in System Data (Cheatham, *et al.*, 2019).

Another risk of using AI in logistics is the large volume of data that the system processes. This can lead to challenges in managing and processing data, resulting in some data being missed. It can also make data more vulnerable to cyberattacks and fraud.

Additionally, the development and implementation of AI systems can be very costly. Developing and testing an AI-based system can require substantial investment, and integrating AI into logistics operations may necessitate further investments in training and equipment.

Another concern is the potential loss of control over processes. It can be difficult for companies to understand how AI operates and to monitor its decision-making processes. This could lead to a loss of control over operations and a decrease in service quality. Furthermore, such systems might avoid task distribution among assets, potentially leading to inefficiencies in the organization's actions.

In the logistics industry, where processes are typically complex, issues may arise when using AI. This could be due to challenges in developing effective machine learning algorithms and considering all relevant factors. For instance, while AI might provide an optimal solution for cargo routing, it may

not account for local detours or truck size restrictions. Although new technologies can enhance a company's competitiveness, they might also lead to over-reliance on AI, reducing human involvement in critical decision-making. This could negatively impact the company's ability to adapt to variables not modeled in software solutions.

Perhaps the most significant risk is the reduction of jobs in logistics. Since AI can operate around the clock and more efficiently than humans, companies might decide to reduce their workforce and replace human workers with automated systems. This could negatively affect the quality of life for individuals working in the logistics sector.

Logistics Operations

- **The Logistics Market in Saudi Arabia**

Saudi Arabia is a significant logistics hub with immense growth potential. Within the MENA region, Saudi Arabia boasted the largest transportation and logistics market, valued at USD 27.6 billion in 2020. The country's top export partners include China, Japan, India, South Korea, and the UAE, while its primary imports come from the US, China, Germany, Japan, and the UAE.

Saudi Arabia has a well-developed freight infrastructure, featuring high-quality roads, seaports, and air transport facilities. Key players are present across various logistics functions, from freight forwarding and transportation to warehousing and last-mile delivery. The transportation and freight forwarding markets are highly fragmented, with many companies offering these services. Al Majdouie is a well-established player alongside DB Schenker and Kuehne Nagel, while SMSA, Aramex, and Naqel dominate the last-mile delivery segment.

The Kingdom's logistics sector holds significant growth opportunities due to its untapped potential. Saudi Arabia's strategic location has consistently attracted logistics and supply chain companies. Companies investing in the Kingdom gain unparalleled regional and global exposure to three continents. This strategic advantage is bolstered by a well-established infrastructure, providing a solid foundation for potential investors. Saudi ports are strategically situated at a pivotal intersection between East and West. The infrastructure is further enhanced by the integration of ten major ports with rail, road, and air networks, offering Saudi Arabia several natural advantages. Additionally, the Kingdom has economic zones that further extend these advantages, making it a robust base for strategic opportunities (YCP Solidiance, 2021).

- **Definition of Logistic Operations**

Logistic operations encompass the planning, implementation, and control of the efficient movement and storage of goods, services, and information from the point of origin to the point of consumption. These operations are designed to meet customer requirements and typically involve activities such as transportation, warehousing, inventory management, order fulfillment, material handling, packaging, and distribution. The goal of logistic operations is to ensure that the right products are delivered to the right place, at the right time, in the right condition, and at the right cost (Bowersox, *et al.*, 2013).

Encompasses all activities involved in the management and movement of goods and resources from point of origin to consumption. This includes transportation, warehousing, inventory management, and distribution (Chopra & Meindl, 2021).

- **Logistic Activities**

According to Gran *et al.* (2006), the logistic activities as defined by the European Organization for Transport and Logistics Services are divided into the following categories:

1. Logistic Activities Related to the Purchasing Process:

- Demand forecasting.
- Selection of supply sources.
- Determining purchase quantities and times.
- Deciding on the method and type of packaging.
- Determining delivery locations.

2. Logistic Activities Related to Transportation:

- Deciding on the type, methods, and equipment for transportation.
- Determining transport routes, loads, and transport prices.
- Identifying storage locations and determining storage points.

3. Logistic Activities Related to Storage:

- Determining the number and size of storage locations.
- Setting policies for storing raw materials or finished products and determining the inventory format.
- Defining storage space.
- Establishing methods for organizing and arranging warehouses, designing packages for storage purposes, and handling returns.

4. Logistic Activities Related to Handling:

- Choosing equipment.
- Defining order preparation procedures.

- **Key Challenges Faced by The Logistics Sector in The Kingdom**

Saudi Arabia's rapid growth in trends, tourism, and population presents several challenges. The Kingdom must respond swiftly to prevent disruptions in overall growth (Clausen, *et al.*, 2015).

- **Customer-Centric Logistics**

Logistics fulfillment has become more customer-centric, prioritizing delivery time and data visibility. During the COVID-19 lockdowns, e-commerce client registration surged, significantly increasing the demand for shipments. These registered clients are now dispersed across a wide area in KSA. However, the number of shipping companies is insufficient to meet this demand.

- **Addressing the Shipping Shortage**

To address the shortage, new shipping companies are emerging, and more trucks are being deployed. This lack of integration and cooperation is straining the current infrastructure and limiting the transportation process due to delays in maintaining and constructing new roads.

- **Expertise and Awareness Issues**

Business owners also face significant challenges due to the scarcity of suitable expertise in the region and the lack of awareness about logistics. Insufficient digital innovation in this era is hindering the industry's growth and advancement. Given that KSA focuses on the Saudization policy, it is essential to support and raise awareness among Saudi nationals to lead in terms of innovation.

Chapter Three

Study Methodology

Introduction

The research methodology serves as the foundation of scientific inquiry, outlining the methods and procedures for data collection and analysis to ensure the accuracy and reliability of the results. In this chapter, we will present the methodology employed in our study on "The Impact of Artificial Intelligence on Logistics Operations at NAQEL Express in Saudi Arabia."

This chapter will cover the research design, sampling, data collection tools, and analysis methods. We will explain the rationale behind the chosen methods and how they contribute to the validity and reliability of the findings.

Study Methodology:

The study follows the descriptive-analytical approach aimed at describing and analyzing the impact of artificial intelligence on logistics operations at NAQEL Express. The descriptive-analytical approach allows for understanding the relationship between independent and dependent variables and evaluating how smart technology applications can improve operational efficiency, customer satisfaction, and reduce operational costs.

Research Methods:

- 1. Data Sources:** Primary Data: Data collected from employees and managers at NAQEL Express through questionnaires.
- 2. Secondary Data:** Annual reports, company documents, and relevant academic articles were used.

Study population and sample:

The study population consists of all employees of NAQEL Express - Saudi Arabia

As for the study sample, 144 employees were selected, and (150) electronic forms were sent via e-mails for all company employees, and (144) responses were obtained and analyzed statistically, and the following table shows the demographic distribution of the study sample according to their personal data:

Analysis of the characteristics of the sample members:

1. Gender

Table 1: Frequencies and percentages of the research sample by gender

Gender	Number of Respondents	Percentage
Male	109	75.7%
Female	35	24.3%
Total	144	100.0%

The previous table shows that the percentage of males participating in the questionnaire (75.7 %) is more than females (24.3 %). These data are represented in the following graph as follows: -

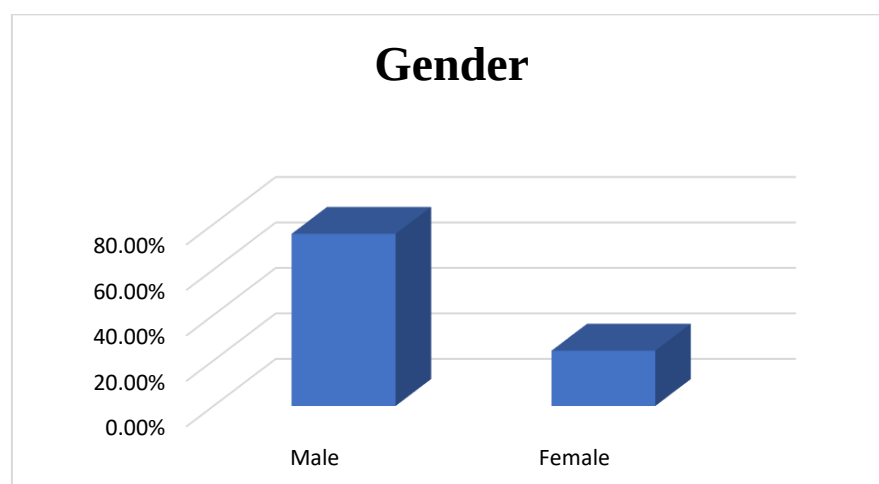


Figure 1: Percentages of the research sample by gender

2. Education

Table 2: Frequencies and percentages of the research sample by education

Education	Number of Respondents	Percentage
Academic	88	61.1%
Postgraduate	13	9.0%
Master	29	20.1%
Doctorate	14	9.7%
Total	144	100.0%

It is clear from the previous table that the largest percentage was university graduates, where their value was 61.1% of the total percentage of the study sample, after which those who obtained a master's degree and their percentage was 20.1%, while the holders of a doctorate degree were 9.7%, and the least of them were postgraduate students and their percentage was 9%.

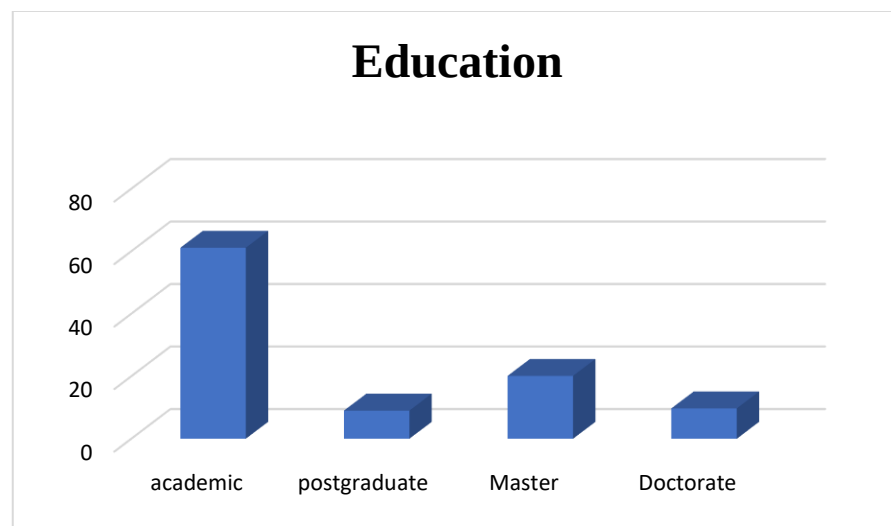


Figure 2: Percentages of the research sample by education

2. Years of experience in the company

Table 3: Frequencies and percentages of the research sample by Years of experience in the company

Years of experience	Number of Respondents	Percentage
Less than a year	16	11.1
1-3 years	13	9.0
More than 3 years	115	79.9
Total	144	100.0

By analyzing the respondents' responses, it was found that the most experienced of them working within NAQEL Express were more than 3 years (79.9%), followed by years of experience of less than one year (11.1%) and the least experience of 1-3 years (9%).

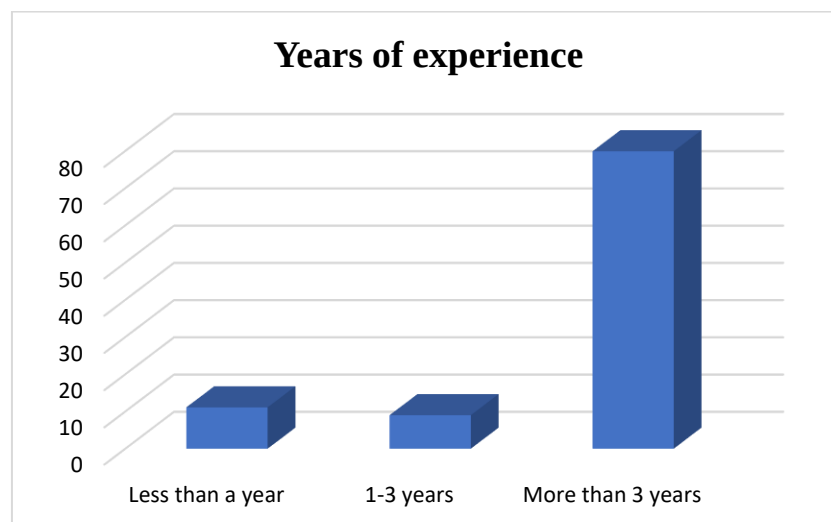


Figure 3: Percentages of the research sample by Years of experience in the company

Research Tools:

Questionnaire:

A questionnaire divided into several sections to cover different aspects of the study (smart technology applications, logistical operational efficiency, customer satisfaction, and operational costs). In addition to the general data of the study sample

- **The first section was: demographic information, which is represented in:** gender, educational level, number of years of experience within the company.
- **And the second section: the items that represent the variables of the study, namely:**
 1. Application of smart technology.
 2. Efficiency of logistics operations.
 3. Customer satisfaction.
 4. Operating costs.

The validity and reliability of the study tool:

The questionnaire was presented to a number of arbitrators from faculty members, to verify the sincerity of its paragraphs, and their opinions were taken, some paragraphs were redrafted, and the required amendments were made, in an accurate manner that achieves a balance between the contents of the questionnaire in its paragraphs, and in addition, the questionnaire was presented to a test sample of (20) employees from within the Naqel company under the current study, in order to identify the degree of respondents' response to the questionnaire, and they expressed their desire to interact with its paragraphs, which confirms the sincerity of Tool.

Reliability of the study tool:

To calculate the stability of the resolution, the internal consistency equation method was used using the Cronbach alpha test, where the values of Cronbach alpha for all study variables and for the questionnaire in general were higher than (80%), which is a very good percentage in research and studies, which indicates its high reliability, and the following table illustrates this.

Table 4: Values of Internal Consistency Coefficients Using Cronbach Alpha Test

Study variables	Statements	Alpha value
Smart Technology Application	1-6	0.921
Efficiency of logistics operations	7-12	0.918
Customer satisfaction	13-18	0.923
Operating costs	19-24	0.912
Total questionnaire	1-24	0.939

Statistical processing used:

To answer the questions of the study, descriptive and analytical statistics methods were used using the statistical package (SPSS), and to answer the study questions, arithmetic averages and standard deviations were used, as well as the Cronbach alpha test to ensure the reliability of the study tool, and the simple regression test to answer the hypotheses of the study.

The results of the descriptive statistical analysis of the data, which include the arithmetic averages and standard deviations of all items of the independent study and the paragraphs that make up each item, were relied upon, and it was considered that the Likert scale used in the study is graded as follows:

Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), Strongly Disagree (1). Based on the above, the values of the arithmetic averages reached by the study will be treated as follows: (3.67 or more = high), (2.34-3.66 = average), (2.33 or less = low). According to the following formula:

Highest value – The highest value of answer alternatives divided by the number of levels, i.e.:

$$5 - 1 \div 3 = 4 \div 3 = 1.33$$

This value is equal to the length of the class.

Limitations of the study

- **Temporal limits:** The study extends from the beginning of the use of intelligent technology in NAQEL Express operations to the present.
- **Spatial Research:** The study focuses on NAQEL Express's logistics operations in Saudi Arabia.
- **Objectivity:** The study includes assessing the effects of the use of artificial intelligence on the efficiency of operations and logistics performance.

Chapter Four

Results and Hypothesis Testing

Findings of the Study

The study was carried out by collecting information using a questionnaire carefully designed to meet the requirements of the study. The questionnaire was used as a tool for collecting information, and the descriptive analytical approach was adopted in the analysis. The descriptive approach focused on detailing the study problem and analyzing its variables based on data derived from previous relevant studies, various references and questionnaires prepared specifically for this research. For the analytical method, it was used to analyze the primary data collected from the study population. I sampled it, with the aim of verifying the validity of the study's hypotheses.

- **Analysis of the response of the sample members towards the variables of the study**

1. Application of smart technology

To describe the extent of the application of smart technology in NAQEL Logistics Services, the researcher resorted to the use of arithmetic averages and standard deviations, to verify the significance of the paragraph and its importance as shown in the table

Table 5: The arithmetic means and standard deviations of the responses of the study sample members for the paragraphs of the axis (application of smart technology) are arranged in descending order.

N	Statement	N	Mean	St.d	Level	Rank
1	I notice significant improvements in process efficiency after the implementation of smart technology	144	4.18	0.801	High	6
2	Applying smart technology helped improve data accuracy and demand forecasting	144	4.28	0.790	High	5
3	Smart technology has contributed to reducing human errors	144	4.30	0.761	High	3
4	We have a better system to monitor and track shipments thanks to smart technology	144	4.29	0.765	High	4

5	Smart technology has facilitated the improvement of the company's decision-making process	144	4.33	0.727	High	2
6	The application of smart technology has improved inventory management	144	4.46	0.635	High	1
Overall Mean		144	4.3	0.635	High	

It is clear from the previous table that the arithmetic averages of this item (Application of smart technology) have ranged between (4.18, 4.46), and the item has obtained a total arithmetic average (4.31), which is of the high level, and paragraph (6) has won the highest arithmetic average (4.46), and a standard deviation of (0.635), which is from the high level, as the paragraph stipulates (The application of smart technology has improved inventory management).. In the second place, paragraph No. (5) came with an arithmetic mean (4.33) and a standard deviation (0.727), which is of the high level, and it stipulated (Smart technology has facilitated the improvement of the company's decision-making process). In the third place, paragraph No. (3) came with an arithmetic mean (4.30) and a standard deviation (0.766), which is of the high level, and it stipulated (Smart technology has contributed to reducing human errors). In the fourth place, paragraph No. (4) came with an arithmetic mean (4.29) and a standard deviation (0.765), which is of the high level, and it stipulated (We have a better system to monitor and track shipments thanks to smart technology). In the fifth place, paragraph No. (2) came with an arithmetic mean (4.28) and a standard deviation (0.790), which is from the high level, and it stipulated (Applying smart technology helped improve data accuracy and demand forecasting). In the last order, paragraph No. (1) came with an arithmetic average (4.18) and a standard deviation (0.801), which is of the high level, and has stipulated (I notice significant improvements in process efficiency after the

implementation of smart technology). This explains that the application of smart technology at NAQEL Express is of a high standard.

2. Efficiency of logistics operations

To describe the extent of the efficiency of logistics operations in NAQEL Logistics Services, the researcher resorted to the use of arithmetic averages and standard deviations, to verify the significance of the paragraph and its importance as shown in the table

Table 6: The arithmetic means and standard deviations of the responses of the study sample members for the paragraphs of the axis (The efficiency of logistics operations) are arranged in descending order.

N	Statement	N	Mean	St.d	Level	Rank
1	Shipment delivery speed improved after the implementation of smart technology	144	4.20	0.756	High	6
2	Operations have become more organized and streamlined after the application of smart technology	144	4.22	0.763	High	5
3	Smart technology has reduced the time spent on each logistics process	144	4.27	0.723	High	4
4	Smart technology has improved the ability to handle larger volumes of cargo	144	4.30	0.712	High	3
5	We have a better risk management system thanks to smart technology	144	4.31	0.704	High	2
6	Smart technology has improved coordination between the various departments of the company	144	4.34	0.758	High	1
Overall Mean		144	4.27	0.756	High	

It is clear from the previous table that the arithmetic averages of this item (The efficiency of logistics operations) have ranged between (4.20, 4.34), and the item has obtained a total arithmetic average (4.20), which is of the high level, and paragraph (6) has won the highest arithmetic average (4.34), and a

standard deviation of (0.758), which is from the high level, as the paragraph stipulates (Smart technology has improved coordination between the various departments of the company). In the second place, paragraph No. (5) came with an arithmetic mean (4.31) and a standard deviation (0.704), which is of the high level, and it stipulated (We have a better risk management system thanks to smart technology). In the third place, paragraph No. (4) came with an arithmetic mean (4.30) and a standard deviation (0.712), which is of the high level, and it stipulated (Smart technology has improved the ability to handle larger volumes of cargo). In the fourth place, paragraph No. (3) came with an arithmetic mean (4.27) and a standard deviation (0.723), which is of the high level, and it stipulated (Smart technology has reduced the time spent on each logistics process). In the fifth place, paragraph No. (2) came with an arithmetic mean (4.22) and a standard deviation (0.763), which is from the high level, and it stipulated (Operations have become more organized and streamlined after the application of smart technology). In the last order, paragraph No. (1) came with an arithmetic average (4.20) and a standard deviation (0.756), which is of the high level, and has stipulated (Shipment delivery speed improved after the implementation of smart technology). This means that NAQEL customers enjoy a high level of satisfaction with their dealings with it.

3. Customer satisfaction

To describe the extent of the customer satisfaction in NAQEL Logistics Services, the researcher resorted to the use of arithmetic averages and standard deviations, to verify the significance of the paragraph and its importance as shown in the table

Table 7: The arithmetic means and standard deviations of the responses of the study sample members for the paragraphs of the axis (Customer satisfaction) are arranged in descending order.

N	Statement	N	Mean	St.d	Level	Rank
1	I notice an improvement in customer satisfaction after the implementation of smart technology	144	4.11	0.820	High	5
2	Providing customer service became more effective after the application of smart technology	144	4.11	0.901	High	6
3	Positive feedback from customers about the service increases after the implementation of smart technology	144	4.21	0.767	High	4
4	The process of handling customer complaints has become more efficient after the implementation of smart technology	144	4.22	0.808	High	3
5	Communication with customers made smoother thanks to smart technology	144	4.25	0.799	High	2
6	Smart technology has helped provide customized services to customer needs	144	4.29	0.746	High	1
Overall Mean		144	4.20	0.686	High	

It is clear from the previous table that the arithmetic averages of this item (Customer satisfaction) have ranged between (4.11, 4.29), and the item has obtained a total arithmetic average (4.20), which is of the high level, and paragraph (6) has won the highest arithmetic average (4.29), and a standard

deviation of (0.746), which is from the high level, as the paragraph stipulates (Smart technology has helped provide customized services to customer needs). In the second place, paragraph No. (5) came with an arithmetic mean (4.25) and a standard deviation (0.799), which is of the high level, and it stipulated (Communication with customers made smoother thanks to smart technology). In the third place, paragraph No. (4) came with an arithmetic mean (4.22) and a standard deviation (0.808), which is of the high level, and it stipulated (The process of handling customer complaints has become more efficient after the implementation of smart technology). In the fourth place, paragraph No. (3) came with an arithmetic mean (4.21) and a standard deviation (0.767), which is of the high level, and it stipulated (Positive feedback from customers about the service increases after the implementation of smart technology). In the fifth place, paragraph No. (1) came with an arithmetic mean (4.11) and a standard deviation (0.820), which is from the high level, and it stipulated (I notice an improvement in customer satisfaction after the implementation of smart technology). In the last order, paragraph No. (2) came with an arithmetic average (4.11) and a standard deviation (0.901), which is of the high level, and has stipulated (Providing customer service became more effective after the application of smart technology). This means that NAQEL customers enjoy a high level of satisfaction with their dealings with it.

4. Operating costs

To describe the extent of operating costs in NAQEL Logistics Services, the researcher resorted to the use of arithmetic averages and standard deviations, to verify the significance of the statement and its importance as shown in the table

Table 8: The arithmetic means and standard deviations of the responses of the study sample members for the paragraphs of the axis (Operating costs) are arranged in descending order.

N	Statement	N	Mean	St.d	Level	Rank
1	The company was able to reduce operating costs after the application of smart technology	144	4.11	0.873	High	6
2	Smart technology has contributed to improved resource utilization and reduced waste	144	4.15	0.833	High	5
3	Smart technology has reduced costs associated with maintenance and repairs	144	4.18	0.747	High	4
4	Smart technology has reduced the need for manual labor	144	4.20	0.744	High	3
5	We have a more effective system for tracking and evaluating costs thanks to smart technology	144	4.22	0.676	High	2
6	Smart technology has helped improve the company's overall operational efficiency	144	4.25	0.743	High	1
Overall Mean		144	4.19	0.683	High	

It is clear from the previous table that the arithmetic averages of this item (Operating costs) have ranged between (4.11, 4.25), and the item has obtained a total arithmetic average (4.19), which is of the high level, and statement (6) has won the highest arithmetic average (4.25), and a standard deviation of (0.743), which is from the high level, as the statement stipulates (Smart technology has helped improve the company's overall operational efficiency).

In the second place, statement No. (5) came with an arithmetic mean (4.22) and a standard deviation (0.676), which is of the high level, and it stipulated (We have a more effective system for tracking and evaluating costs thanks to smart technology). In the third place, statement No. (4) came with an arithmetic mean (4.20) and a standard deviation (0.744), which is of the high level, and it stipulated (Smart technology has reduced the need for manual labor). In the fourth place, statement No. (3) came with an arithmetic mean (4.18) and a standard deviation (0.747), which is of the high level, and it stipulated (Smart technology has reduced costs associated with maintenance and repairs). In the fifth place, statement No. (2) came with an arithmetic mean (4.15) and a standard deviation (0.833), which is from the high level, and it stipulated (Smart technology has contributed to improved resource utilization and reduced waste). In the last order, statement No. (1) came with an arithmetic average (4.11) and a standard deviation (0.873), which is of the high level, and has stipulated (The company was able to reduce operating costs after the application of smart technology). This explains why the application of technology in NAQEL has reduced operating costs at a high level.

- **Third: Testing the hypotheses of the study**

This section deals with testing the hypotheses of the study through the use of a simple regression analysis test, as follows.

First hypothesis H0₁:

There is a positive and significant relationship between the application of smart technology in logistics operations and its efficiency at significance level (0.05).

To test the first hypothesis, a simple linear regression test was used to test the relationship between the application of smart technology (independent

variable) and the efficiency of logistics operations (dependent variable) and the following table shows these results.

Table 9: Results of simple regression analysis to test the first hypothesis of the study

R	Beta	R²	F	Sig
0.854	0.854	0.729	382.250	0.000

* Statistically significant at the level of ($\alpha \leq 0.05$)

It is clear from the table that the value of the statistician (F) (382.250) with a level of significance less than (0.05), which indicates the acceptance of the hypothesis, and that there is a positive and statistically significant relationship between the application of smart technology in logistics operations and its efficiency at a significant level (0.05). Where the value of correlation (R) (0.854) with a coefficient of determination (R²) (0.729), that the impact of the application of smart technology on the efficiency of logistics operations within the company affects by (72.9%).

- **Second hypothesis H0₂:**

There is a positive and significant impact of the application of smart technology on customer satisfaction with logistics services.

Table 10: Results of simple regression analysis to test the second hypothesis of the study

R	Beta	R²	F	Sig
0.801	0.801	0.642	254.934	0.000

* Statistically significant at the level of ($\alpha \leq 0.05$)

"The results of a simple regression analysis indicate that the application of smart technology has a positive and statistically significant effect on customer satisfaction in logistics, where the correlation value (R) (0.801) was reported with a determination coefficient of R² (0.642), i.e. the impact of smart technology application on the level of customer satisfaction is 64.2%. The

value of the model ($F = 254.934$, $P < 0.001$) and the coefficient of determination ($R\text{-squared} = 0.64$) support the strength and impact of the model."

- **Third hypothesis H0r:**

The application of smart technology in logistics operations is accompanied by a reduction in the operational costs of the company.

Table 11: Results of simple regression analysis to test the third hypothesis of the study

R	Beta	R²	F	Sig
0.735	0.801	0.540	166.990	0.000

The results of a simple regression analysis indicate that the application of smart technology has a positive and statistically significant effect on operational costs of the company, where the correlation value (R) (0.735) was reported with a determination coefficient of R² (0.540), i.e. the impact of smart technology application on the level of operational costs of the company is 54 %. The value of the model ($F = 166.990$, $P < 0.001$) and the coefficient of determination ($R\text{-squared} = 0.64$) support the strength and impact of the model.

Chapter five

Conclusions and recommendations

Results

1. The level of application of smart technology within NAQEL Logistics in Saudi Arabia from the point of view of the study sample was found to be high.
2. The efficiency of logistics operations within NAQEL Logistics in Saudi Arabia from the point of view of the study sample was found to be high.
3. It was found that the level of quality of service provided in NAQEL Logistics in Saudi Arabia from the point of view of the study sample was high and this is reflected in customer satisfaction.
4. It was found that the operating costs of NAQEL Logistics in Saudi Arabia from the point of view of the study sample are reduced at a high level with the application of technology.
5. There is a positive and significant relationship between the application of smart technology in logistics operations and its efficiency at significance level (0.05).
6. There is a positive and significant impact of the application of smart technology on customer satisfaction with logistics services.
7. The application of smart technology in logistics operations is accompanied by a reduction in the operational costs of the company.

Conclusions

1. High Level of Smart Technology Application: The study found that the level of smart technology application within NAQEL Logistics is high from the perspective of the study sample.
2. High Efficiency of Logistics Operations: The efficiency of logistics operations within NAQEL Logistics is perceived to be high by the study participants.
3. High Service Quality and Customer Satisfaction: The level of service quality provided by NAQEL Logistics is high, which positively reflects on customer satisfaction.
4. Reduction in Operational Costs: The study indicated that the operational costs at NAQEL Logistics are significantly reduced with the application of smart technology.
5. Positive Relationship Between Technology and Efficiency: There is a positive and significant relationship between the application of smart technology and the efficiency of logistics operations at a significance level of 0.05.
6. Impact on Customer Satisfaction: The application of smart technology has a positive and significant impact on customer satisfaction with logistics services.
7. Reduction in Operational Costs: The application of smart technology in logistics operations is accompanied by a reduction in the operational costs of the company.

Recommendations

1. **Continued Investment in Smart Technology:** NAQEL Logistics should continue to invest in advanced smart technologies such as artificial intelligence (AI) and the Internet of Things (IoT) to further enhance logistics efficiency and reduce operational costs.
2. **Employee Training and Development:** Implement comprehensive training programs to ensure employees are well-equipped to handle new technologies effectively, thus improving overall company performance.
3. **Enhance Customer Experience:** Focus on continuously improving service quality by collecting regular feedback from customers to enhance their satisfaction.
4. **Periodic Performance Analysis:** Conduct regular performance and cost analyses using smart technologies to ensure maximum efficiency and optimal resource utilization.
5. **Expand Technological Scope:** Explore the application of additional smart technological solutions across various logistics operations to improve overall efficiency and effectiveness.
6. **Collaborate with Technology Partners:** Strengthen partnerships with technology firms to gain access to the latest logistics technologies and advanced solutions.

By implementing these recommendations, NAQEL Logistics can continue to improve its operations, enhance customer satisfaction, and maintain its competitive edge in the logistics industry.

References

References

- 1- Abdullayeva, A., (2019). **Impact of Artificial Intelligence on Agricultural, Healthcare and Logistics Industries**. Annals of Spiru Haret University. Economic Series, 19(2), 167-175.
<https://doi.org/10.26458/1929>.
- 2- Alheadary, W. G. (2024). **The impacts of the internet of things and artificial intelligence on logistics in supply chain management**. *International Journal of Advanced and Applied Sciences*, 11(1), P: 161-168.
- 3- Balfaqih, H. (2023). **Artificial Intelligence and Smart Logistics Systems in Industry**. Proceedings of the International Conference on Industrial Engineering and Operations Management Manila, Philippines.
- 4- Barney, J. (1991). **Firm resources and sustained competitive advantage**. *Journal of Management*, 17(1), 99-120.
- 5- Bertalanffy, L. (1968). **General System Theory: Foundations, Development, Applications**. George Braziller.
- 6- Bowersox, D. J., Closs, D. J., & Cooper, M. B. (2013). **Supply Chain Logistics Management (4th Edition)**. McGraw-Hill Education.
- 7- Cheatham, B., Javanmardian, K. & Samandari, H. (2019). **Confronting the risks of artificial intelligence**. Retrieved on 17 September 2019. Available: <https://www.mckinsey.com/capabilities/quantumblack/our-insights/confronting-the-risks-ofartificial-intelligence>
- 8- Chopra, S., & Meindl, P. (2021). **Supply Chain Management: Strategy, Planning, and Operation (8th ed.)**. Pearson.
- 9- Clausen, U., De Bock, J. & Lu, M. (2015). Sustainable Logistics and Supply Chains: Logistics Trends, Challenges, and Needs for Further Research and Innovation. Pp; 1-13.

- 10- Datamites Team. (2023). **Artificial Intelligence in Logistics Industries**. Retrieved on 13 January 2022. Available at: <https://datamites.com/blog/artificial-intelligence-in-logisticsindustries/>
- 11- Davis, F. D. (1989). **Perceived usefulness, perceived ease of use, and user acceptance of information technology**. *MIS Quarterly*, 13(3), 319-340.
- 12- Faccenda, G. (2022). **Measuring the Sustainability Impact of Artificial Intelligence in Logistics: A Case Study Analysis**. Tesi Di Laurea Magistrale in Management Engineering. POLITECNICO, MILANO 1863.
- 13- FossoWamba, S., & Akter, S. (2019). **Understanding Supply Chain Analytics Capabilities and Agility for Data-Rich Environments**. *International Journal of Operations & Production Management*, 39, 887-912. <https://doi.org/10.1108/IJOPM-01-2019-0025>
- 14- Gran D., Lambert. M., Stock. R. & Ellram. M. (2006). **"Fundamentals of logistics management"**. European edition.
- 15- Hofmann, E., & Rüsç, M. (2017). **Industry and the current status as well as future prospects on logistics**. *Computers in Industry*, 89, 23-34.
- 16- Huang, M., & Rust R. (2018). **Artificial Intelligence in Service**. *Journal of Service Research*, 21, 155-172. <https://doi.org/10.1177/1094670517752459>
- 17- Jabbour, C. J. C., Fiorini, P., D., Ndubisi, N., O., Queiroz, M., M., & Piatto E. L. (2020). **Digitally Enabled Sustainable Supply Chains in the 21st Century: A Review and a Research Agenda**. *Science of the Total Environment*, 725, Article ID: 138177. <https://doi.org/10.1016/j.scitotenv.2020.138177>
- 18- Louis F, Hubert K. (2024). **The Impact of Artificial Intelligence on Logistics Decision Making**. Available at: <https://www.researchgate.net/publication/380320025>

- 19- Mc Carthy, J.; Minsky, M.L.; Rochester, N.; Shannon, C. E. (2006). **A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence.** AI Mag. 27, 12–14,2006.
- 20- Montgomery, D. C., Peck, E. A., & Vining, G. G. (2012). **Introduction to Linear Regression Analysis (5th ed.).** Wiley.
- 21- Russell, S. J., & Norvig, P. (2021). **Artificial Intelligence: A Modern Approach (4th ed.).** Pearson. ISBN: 9780134610993.
- 22- Scholten, K., Sharkey Scott, P., & Fynes, B. (2014). **Mitigation Processes—Antecedents for Building Supply Chain Resilience.** Supply Chain Management, 19, 211-228. <https://doi.org/10.1108/SCM-06-2013-0191>
- 23- Stefanini group. (2021). **The Role of Artificial Intelligence in Logistics.** Retrieved on 16 November 2021. Available at: <https://stefanini.com/en/insights/articles/the-role-of-artificialintelligence-in-logistic>
- 24- Villanueva-Eslava, A., Riega-Virú, Y., Nilupu-Moreno, K., & Salas-Riega, J. L. (2024). **Artificial intelligence and logistics services: a systematic literature review.** DOI: 10.1109/ICALTER61411.2023.10372911
- 25- Wang, G., Gunasekaran, A., Ngai, E. W. T., & Papadopoulos, T. (2016). **Big data analytics in logistics and supply chain management: Certain investigations for research and applications.** *International Journal of Production Economics*, 176, 98-110.
- 26- Wirth, Norbert. (2018). **"Hello marketing, what can artificial intelligence help you with?"**. *International Journal of Market Research*, Vol. 6(5), pp435-438.
- 27- YCP Solidiance. (2021). Available at: <https://ycpsolidiance.com/>

الملاحق

Questionnaire

This questionnaire aims to collect the necessary data to study the impact of artificial intelligence on logistics operations at Naqel Express in Saudi Arabia as a graduation project in business administration, and you were selected to answer the statements contained therein.

Please read all paragraphs carefully and answer them objectively as this has a significant impact on the validity of the results of the study, noting that all data contained in this questionnaire will be treated with strict confidentiality and will only be used for scientific research purposes.

Thank you for your cooperation.....

Part I: Personal Data

1- Gender

- male
- female

2- Education level

- academic
- postgraduate
- Master
- Doctorate

3- Years of experience in the company

- Less than a year
- 1-3 years
- More than 3 years

Part Two: Questionnaire Questions

Please answer each of the following statements by placing an (x) in the box representing your opinion:

N	Statements	Answer alternatives				
		Strongly agree	Agree	neutral	Disagree	Strongly disagree
Smart Technology Application						
	I notice significant improvements in process efficiency after the implementation of smart technology					
	Applying smart technology helped improve data accuracy and demand forecasting					
	Smart technology has contributed to reducing human errors					
	We have a better system to monitor and track shipments thanks to smart technology					
	Smart technology has facilitated the improvement of the company's decision-making process					
	The application of smart technology has improved inventory management					
Efficiency of Logistics Operations						
	Shipment delivery speed improved after the implementation of smart technology					

	Operations have become more organized and streamlined after the application of smart technology					
	Smart technology has reduced the time spent on each logistics process					
	Smart technology has improved the ability to handle larger volumes of cargo					
	We have a better risk management system thanks to smart technology					
	Smart technology has improved coordination between the various departments of the company					
Customer Satisfaction						
	I notice an improvement in customer satisfaction after the implementation of smart technology					
	Providing customer service became more effective after the application of smart technology					
	Positive feedback from customers about the service increases after the implementation of smart technology					
	The process of handling customer complaints has become more efficient after the implementation of smart technology					
	Communication with customers made smoother thanks to smart technology					
	Smart technology has helped provide customized services to customer needs					

Operating Costs						
	The company was able to reduce operating costs after the application of smart technology					
	Smart technology has contributed to improved resource utilization and reduced waste					
	Smart technology has reduced costs associated with maintenance and repairs					
	Smart technology has reduced the need for manual labor					
	We have a more effective system for tracking and evaluating costs thanks to smart technology					
	Smart technology has helped improve the company's overall operational efficiency					

الملخص العربي

هدفت هذه الدراسة إلى تحليل تأثير الذكاء الاصطناعي على عمليات اللوجستيات في شركة ناقل إكسبريس في المملكة العربية السعودية.

ولتحقيق أهداف الدراسة، قاما الباحثان بتصميم استبانة شملت (٢٤) فقرة لجمع المعلومات الأولية من عينة الدراسة المكونة من ١٤٤ مفردة. وفي ضوء ذلك تم جمع وتحليل البيانات واختبار الفرضيات باستخدام الحزمة الإحصائية للعلوم الاجتماعية SPSS وتم استخدام الأساليب الإحصائية لتحقيق أهداف الدراسة، منها تحليل الانحدار البسيط. وبعد إجراء عملية التحليل لبيانات الدراسة وفرضياتها توصلت الدراسة إلى عدد من النتائج أبرزها:

١. تخفيض التكاليف التشغيلية كان ملحوظاً مع تطبيق التكنولوجيا الذكية.
٢. هناك علاقة إيجابية وذات دلالة إحصائية بين تطبيق التكنولوجيا وكفاءة العمليات.
٣. تأثير إيجابي وذو دلالة إحصائية لتطبيق التكنولوجيا الذكية على رضا العملاء.
٤. تخفيض التكاليف التشغيلية يصاحب تطبيق التكنولوجيا الذكية.

وقد أوصت الدراسة بما يلي:

١. الاستمرار في الاستثمار في التكنولوجيا الذكية المتقدمة مثل الذكاء الاصطناعي وإنترنت الأشياء لتحسين كفاءة اللوجستيات وتقليل التكاليف.
٢. تنفيذ برامج تدريب شاملة لتجهيز الموظفين بالتكنولوجيا الجديدة بشكل فعال.
٣. التركيز على تحسين جودة الخدمة من خلال جمع تغذية راجعة منتظمة من العملاء.
٤. إجراء تحليلات دورية للأداء والتكاليف باستخدام التكنولوجيا الذكية لضمان الكفاءة

القصى.

تأثير الذكاء الاصطناعي على العمليات اللوجستية في ناقل إكسبريس
في المملكة العربية السعودية

إعداد الطالب/

يزن موفق سعد النويصر ٢٣٣٠٠١٣٧٧

أحمد سمير محمد العراقي ٢٣٣٠٠١٤١٩

إشراف/

د. الفيصل عبد الحميد محمد

د. فايز علي جراد

٢٠٢٣ - ٢٠٢٤