The Role of Artificial Intelligence in Optimizing Logistics Management: A Case Study of VS Cargo Limited in Ndola

***[1]Joseph Nyirenda., [2]Fr. Mathew Lungu**

[1]School of Business and Information Technology, Cavendish University Zambia

[2]Corner of Great North and Washama Road, Villa Elizabeth, P.O. Box. 34625, Lusaka, Zambia

DOI: https://dx.doi.org/10.47772/IJRISS.2025.907000284

Received: 08 July 2025; Accepted: 14 July 2025; Published: 13 August 2025

ABSTRACT

This study investigates the role of Artificial Intelligence (AI) in optimizing logistics management, using VS Cargo Limited in Ndola, Zambia as a case study. Despite the global rise of artificial intelligence in streamlining operations, many logistics firms in developing economies, including VS Cargo, face difficulties in adoption due to infrastructure challenges, limited expertise, and resistance to change. The research aims to assess current artificial intelligence usage, identify benefits, explore implementation strategies, and examine challenges that affect the adoption. A positivism research philosophy employed, guided by a deductive approach. The quantitative nature of this philosophy allowed for a comprehensive analysis of AI adoption, its benefits, and challenges faced within a dynamic, technology-driven logistics environment. Quantitative data collected through semi-structured questionnaires administered to 35 employees and 6 managers in VS Cargo's logistics department was analyzed using frequency distribution and Pearson correlation. The findings revealed that real-time tracking and warehouse automation are the primary AI technologies in use at VS Cargo. These tools contribute significantly to route optimization, improved decision-making, enhanced customer satisfaction, and reduced operational costs. However, the company still faces notable challenges, including limited digital infrastructure, lack of skilled personnel, and poor interdepartmental coordination. The correlation analysis indicated strong relationships between AI adoption and logistics performance indicators, with route optimization showing the highest positive correlation ($r = 0.877$). The study recommends continuous training for staff, leadership sensitization, infrastructure upgrades, and stronger data management practices. It also advocates for employee engagement, structured AI roadmaps, collaboration with experts, and adequate funding. Addressing these areas will support sustainable AI integration and enhance logistics efficiency.

Keywords: Artificial Intelligence, Logistics Management, Real-Time Tracking, Warehouse Automation, Operation Efficiency

Date of Submission: 17th July, 2025

INTRODUCTION AND BACKGROUND

The world over the years has evolved, transforming the business environment into a global market where companies across the globe trade beyond their regional boundaries. This has increased pressure among industries to become competitive beyond their local markets. Therefore, to ensure competitiveness, optimization of efficiency in operations, and reductions in costs have resulted in many businesses turning to advanced technologies. The logistics industry has also not been left behind and is among the key drivers of global trade and commerce by ensuring the smooth flow of goods and services. As this industry expands, inefficiencies in the flow of goods and services and operational challenges also increase, drawing the attention of many businesses in this sector to turn to advanced technologies such as Artificial Intelligence (AI).

According to Russel & Norvig (2020), AI refers to the simulation of human intelligence by machines that are programmed to think, learn, and make decisions. Machine learning, natural language processing, and robotics are among the main technologies on which AI is built, making it possible for computers to process huge amounts

of data, provide insights, and identify patterns. The adoption of AI in logistics is at a fast rate, transforming the face of the industry, offering solutions to improve decision-making and routing, enhance real-time tracking, and inventory management. PwC (2020) states that logistics systems that are powered by AI have great potential to reduce costs while improving customer satisfaction, which is the core objective of every business in the 21st century. Businesses can deliver goods and services at a fast rate and reduce wastage of fuel, aligning with the global business sustainability goals. In addition, McKinsey & Company (2019) highlights the important role that AI plays in predictive analytics, improving demand forecasting, reducing errors in the supply chains, and increasing effectiveness in decision making.

While the integration of AI in the business world has demonstrated to be a game changer and has shown a lot of transformative potential. The adoption of the technology has faced a lot of challenges in developing economies like Zambia. Limited access to digital infrastructure, financial constraints, and a lack of expertise to work with AI-driven technologies are some of the barriers that hinder this adoption, posing a great impact on the growth and competitiveness of logistics companies that operate in such markets (www.techtrends.co.zm). DHL (2018) points out that the successful implementation of AI in logistics often depends on bridging the gap between cutting-edge technology and the readiness of companies to adopt it.

VS Cargo Limited, established in 1997, is one of the pioneers of the logistics sector in Zambia. Founded with a vision to transform the logistics business in the Copperbelt region of Zambia, particularly in Ndola, by offering rail and road logistics services. At inception, VS Cargo focused solely on moving cargo in and out of the Democratic Republic of Congo and other countries in the Sub-Saharan region, allowing the company to become a key player in the region's transit and transshipping hub market (VS Cargo Limited, n.d.). In 2006, VS Cargo expanded its operations and established its first bonded warehouse in Ndola to handle road and rail logistics. This move was a response to the demand for efficient cargo handling, like copper and cobalt concentrate, on the market. To solidify its industry leadership, the company further expanded its services in 2009 by becoming the first company in the region to integrate cargo security management into its services, providing customers with real-time tracking solutions and safety of high-value cargo during transit (VS Cargo Limited, n.d.).

Over the years, VS Cargo has expanded its operations, including the introduction of a range of services such as warehousing, freight forwarding, and ocean freight solutions. The mission of the company from inception has always been reliable delivery of cargo and tailoring logistics solutions to the needs of the customer from point of collection to point of delivery. Even though the company has seen this growth and has succeeded in offering traditional logistics management, the company has yet to fully integrate AI in its operations due to financial constraints, gaps in workforce expertise, and stakeholder resistance to transition from traditional to advanced technology-driven logistics systems. These challenges have affected VS Cargo's operational efficiency, contributing to higher delivery costs, delays, and inventory management inefficiencies. These challenges have impacted the company's ability to fully satisfy its customers and to remain competitive in an industry increasingly defined by technological innovation (VS Cargo Limited, n.d.).

This study aimed to investigate how AI can optimize logistics management, using VS Cargo Limited as a case study. It delved into specific AI applications, including route optimization, predictive analytics, real-time tracking, and warehouse automation, to identify practical strategies for integrating these technologies into VS Cargo's operations. The research highlights the tangible benefits of adopting AI, such as cost reduction, stimulating customer service, improving decision making and route optimization. Moreover, it provides actionable recommendations tailored to VS Cargo's uniquely faced challenges, serving as a roadmap for the company to leverage AI for competitiveness and sustained growth. Furthermore, by focusing on VS Cargo, the study not only contribute to understanding AI's role in logistics management in Zambia but also provide insights that could benefit other companies in similar contexts. It reinforces the importance of embracing technological innovation as a key driver for efficiency and growth in the logistics industry.

Problem Statement:

The logistics sector plays a vital role in meeting the rising demands of commerce and trade, where Artificial Intelligence (AI) has proven critical in optimizing delivery routes, enhancing efficiency, and ensuring timely services. Despite its transformative potential, VS Cargo Limited faces significant challenges in adopting AI,

including inadequate digital infrastructure, limited expertise in AI-driven logistics, and resistance from employees to transition from traditional methods (VS Cargo Limited, n.d,). These barriers have hindered the company's operational efficiency, affecting customer satisfaction and competitiveness. This study investigated the role of AI in optimizing logistics management at VS Cargo, highlighting its benefits and providing actionable recommendations to address these challenges and improve overall performance.

Research Objectives

i. To analyze the current state of AI adoption in logistics Management at VS Cargo Limited.

ii. To evaluate the strategies being used to integrate AI in logistics management at VS Cargo.

iii. To identify the benefits of utilizing AI in logistics management at VS Cargo.

iv. To examine the challenges hindering the full utilization of AI in logistics management at VS Cargo Limited.

v. To analyze how the challenges of AI utilization affect business performance.

LITERATURE REVIEW

Conceptual Framework

The Concept of Artificial Intelligence

Artificial intelligence has been defined in a number of ways, and according to Mancini et al. (2023), AI refers to autonomous, non-human agents capable of perceiving their environment, processing information, and taking actions that help them achieve specific goals. In other words, these technologies optimize certain tasks in a perceived intelligent manner. These intelligent agents need to have mastered machine learning as well as key aspects of predictive data analytics to perform tasks intelligently. AI is slowly becoming a game-changer in logistics management, reshaping the industry through enhanced efficiency, automated operations, and data-driven decision-making. In addition, AI is becoming an integral part of logistics, much like relational databases, transforming business operations (DHL & IBM, 2018). According to Burnham (2024), AI is helping logistics firms deal with challenges such as fragmented supply chains, market volatility, and operational inefficiencies through AI-powered tools like generated AI and operations research, improving carrier pricing, optimizing networks, and reducing inefficiencies.

Logistics Management

As defined by Richey et al. (2022), logistics management is simply a strategic process that involves acquiring, storing, and monitoring the movement of tangible items such as goods, materials, and equipment from one point to another. Logistics management can be seen in this regard as the process of planning, implementing and controlling the movement of goods and services as well as information. Key areas such as transportation, inventory control and material handling are encompassed in logistics management. For this study, logistics management is simply the movement of goods and services between the origin point and the final point, as well as the formulation of plans, management, and implementation processes that are related to the movement and storage of these goods and services. Optimizing logistics management is key in modern businesses as it helps to effectively coordinate the flow of goods and information from the source to the end user. It also helps companies like VS Cargo to streamline their operations as well as cut costs by moving goods in a timely and efficient manner.

Logistics management is a cardinal component of supply chain management, which is key in the efficient planning, implementation, and control of goods and services from the source to the consumer. It is critical in a firm like VS Cargo as it is key in various aspects of transportation, warehousing, as well as order fulfilment, leading to timely and cost-effective delivery of goods and services. In addition, for a firm like VS Cargo, efficient and effective logistics management helps enhance operational efficiency, improve customer satisfaction, and

reduce costs. Therefore, by integrating AI in logistics management, there can be a transformative opportunity for firms like VS Cargo to enhance their efficiency in operations (improved decision making, stimulate customer service, optimized routes, and reduced costs), and hence, reduce delivery time.

Graphical Representation of the Study

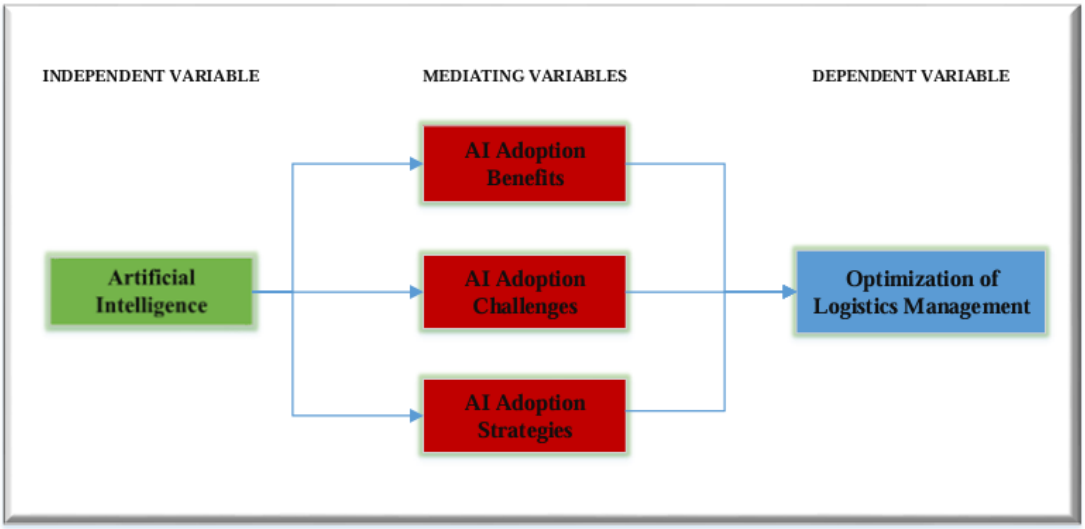

Figure 2.1 Graphical Representation of the Study

Empirical Literature

Current State of AI adoption in logistics Management

Recent literature reflects growing interest in the adoption of Artificial Intelligence (AI) across multiple sectors in Zambia, including logistics, healthcare, and education. Mumbi (2023), in an article published by Bongo Hive, outlines the evolution and expanding role of AI technologies from early concepts by Alan Turing to modern advancements in machine learning and predictive analytics, emphasizing their transformative impact on business processes, data analysis, and decision-making. While AI presents significant opportunities for economic growth, challenges such as data privacy, infrastructure deficits, and limited workforce preparedness remain prevalent.

Mumbi's (2023) study on Smart Logistics highlights the progress Zambia has made toward the Smart Zambia Transformation Agenda 2064 and its goal of becoming a regional logistics hub by 2028. However, infrastructure limitations continue to hinder widespread adoption of AI-driven logistics solutions, including inventory management, shipment tracking, and route optimization. Similarly, Kayembe et al. (2023) examine AI adoption within higher education, revealing parallel challenges such as low digital literacy, high costs, and inadequate policy frameworks. These barriers mirror those found in Zambia's logistics sector, reinforcing the call for coordinated investments in infrastructure, policy development, and AI education to promote sustainable and scalable adoption. This review concludes that while AI adoption in Zambia is gaining momentum, unlocking its full potential, especially in logistics, requires strategic planning

Strategies Being Used to Integrate AI in Logistics Management

In today's increasingly competitive and complex business environment, organizations like VS Cargo are adopting Artificial Intelligence (AI) as a strategic tool to enhance operational efficiency and gain a competitive edge in logistics management. As emphasized by Nicolletti (2025), AI represents not just a technological upgrade but a transformative strategic decision that requires careful planning and long-term sustainability. Successful integration demands a structured roadmap tailored to business goals, supported by quality data, continuous monitoring, and workforce training (Al Suwaidi et al., 2022; Atadoga et al., 2024).

Selection of appropriate AI technologies and models based on operational needs such as warehouse automation, route optimization, and forecasting, is essential for aligning solutions with logistical requirements (Brau et al.,

2023). Furthermore, developing a strong foundational culture of innovation and investing in AI education improves organizational readiness and long-term adaptability (Chen et al., 2024). Overall, effective AI implementation in logistics firms necessitates deliberate planning, strategic execution, and ongoing evaluation to optimize decision-making, boost operational performance, and drive innovation across the organization.

Key benefits of utilizing AI technologies in logistics Management and Operations

Artificial Intelligence (AI) is increasingly recognized as a transformative tool across global industries, especially logistics, where it supports enhanced route optimization, operational efficiency, and customer satisfaction. Lumisi (2023) highlights AI's capability to reduce delivery delays by leveraging real-time traffic data, while Liu (2023) stresses the role of machine learning in pattern recognition for proactive logistics management. Zhao et al. (2020) broaden the scope of AI's applications to include demand forecasting, warehouse automation, and dynamic cargo tracking, alongside AI-powered customer service automation. Liu Q. (2024) demonstrates the practical feasibility of AI and IoT integration in China's logistics sector, confirming improvements in route planning, cost efficiency, and real-time cargo visibility through machine learning and deep learning technologies.

Amponsah et al. (2024) reinforce AI's value in reducing costs and enhancing decision-making across supply chain domains, spanning transportation, inventory planning, finance, and customer service. A report by DHL and IBM (2018) echoes these findings, highlighting AI's shift from reactive logistics to predictive operations via automation, analytics, and robotics. Yet, they emphasize ongoing challenges, including cybersecurity risks, workforce adaptation, and integration complexities. Samuel's (2025) explores the evolution of supply chain management toward Industry 6.0, framing AI as both a technical tool and a collaborative interface between humans and machines (Industry 5.0). Using the PRISMA framework, the study underscores the need for resilient and sustainable adoption strategies grounded in real-time analytics and predictive forecasting.

Regionally, Africa is beginning to adopt global AI strategies, with firms testing machine learning for transport planning in complex environments (Africa Supply Chain Magazine, 2025). In Zambia, where the logistics sector supports mining and manufacturing, firms like VS Cargo stand to benefit significantly from AI adoption. Integrating real-time routing systems could help mitigate urban congestion and improve service reliability. Ultimately, as Liu (2023) emphasizes, AI enhances competitive advantage by offering faster, more accurate, and more sustainable logistics services. For companies such as VS Cargo, leveraging AI-driven data insights and automation represents an opportunity to overcome traditional challenges and meet the growing demand for efficient, customer-centric logistics solutions.

Challenges Hindering the Full Utilization of AI in Logistics Management

Chen et al. (2024) examined the role of Artificial Intelligence (AI) in optimizing logistics with sustainability criteria in Spain, highlighting emerging technologies such as real-time analytics, block chain, and autonomous systems as key enablers of efficiency and environmental impact reduction. The study emphasized challenges, including demand-supply uncertainties and collaboration complexities, while advocating for future research on hybrid AI models and scalable optimization frameworks. In contrast, the DHL and IBM (2018) report positions AI as a transformative tool in logistics, focusing on efficiency and predictive capabilities. However, Daios et al. (2015) presented a more cautious view, stressing adoption barriers such as organizational readiness, ethical concerns, and the importance of human-centered integration. Al Suwaid et al. (2022) conducted a system-level review in the UAE, identifying seven core categories of AI implementation barriers ranging from technological and economic to legal and social. Their study highlighted the need for firms to align AI adoption with strategic goals, regulatory compliance, and workforce capabilities to ensure scalability and security.

Regional perspectives from Sub-Saharan Africa provide a practical lens for understanding localized challenges. Kuteyi and Winkler (2022) identified infrastructure deficits, policy gaps, and fragmented supply chains as major constraints to AI adoption, while advocating for mobile and cloud-based solutions. Similarly, Atadoga et al. (2024) compared the rapid AI uptake in U.S. logistics with slower progress in Africa due to resource and infrastructure limitations. The study emphasized the value of cross-border collaboration and knowledge exchange to stimulate innovation. Finally, Samuels (2025) offered a global perspective on the evolution of AI in supply chains, framing its integration within Industry 5.0 and 6.0 paradigms. This theoretical overview

complements regional studies by showing that while AI holds transformative potential, its implementation must be adapted to diverse operational environments. Collectively, these studies underscore the need for tailored AI adoption strategies, accounting for technological readiness, regulatory frameworks, and socio-economic contexts to ensure sustainable impact across regions.

How the challenges of AI utilization affect the overall business performance?

Artificial Intelligence (AI) is reshaping logistics through automation, efficiency, and data-driven decision-making. However, its adoption introduces several operational and strategic challenges that impact business performance. Cui et al. (2023) emphasize computational limitations, where inadequate high-performance computing undermines real-time processing and operational accuracy. Workforce adaptation also poses challenges, as highlighted by Liu (2023), with employee resistance and skill shortages complicating AI deployment in traditional logistics environments.

Further concerns involve data management and integration. Brau et al. (2023) point out that poor data infrastructure and limited big data strategies weaken the effectiveness of AI models. Integration issues with legacy systems exacerbate implementation difficulties, often requiring costly downtimes and advanced technical support (Liu, 2023; Dwivedi et al., 2021). Dwivedi et al. also note that AI models learn through trial and error, demanding expertise in machine learning and system design resources that may be scarce in firms like VS Cargo.

Ethical considerations, strategic alignment, and risk management are also central to successful AI adoption. Daios et al. (2025) stress that resilience in supply chains and organizational readiness are critical, contrasting with the logistics-optimization focus of DHL and IBM (2018). Brau et al. (2023) further highlight cybersecurity concerns, advocating for strong data protection policies and cloud-based infrastructure to defend against threats. Overall, while AI holds transformative potential for logistics, its success depends on thoughtful implementation strategies, robust infrastructure, workforce readiness, and continuous adaptation.

Theoretical Review

Technological Acceptance Model (TAM)

The Technology Acceptance Model (TAM) explains how user perceptions, specifically perceived usefulness and ease of use affect the adoption of technologies like AI. In logistics firms such as VS Cargo, these perceptions shape whether AI is effectively embraced to improve efficiency, reduce costs, and support decision-making. As Pan and Nishant (2023) note, strong logistics capabilities are essential for national competitiveness, making TAM a helpful tool for understanding how AI can be strategically adopted in the logistics sector.

METHODOLOGY

Research Philosophy and Approach

This study employed a positivism research philosophy, guided by a deductive research approach, to explore the role of artificial intelligence (AI) in optimizing logistics management at VS Cargo Limited. The quantitative nature of this philosophy allowed for a comprehensive analysis of AI adoption, its benefits, and the challenges faced within a dynamic, technology-driven logistics environment (Saunders et al., 2012). The problem-solving focus of this philosophy enabled the development of strategic, evidence-based recommendations tailored to the firm's operational context, supporting informed decision-making and future AI integration.

Research Strategy

The study applied a case study strategy to examine AI's role in optimizing logistics at VS Cargo Limited, enabling a detailed and context-specific analysis. As noted by Pan et al. (2024), case studies are especially effective in supply chain research for uncovering insights into AI-driven efficiency, predictive analytics, and decision-making. This approach supported the identification of practical benefits and challenges of AI adoption

within a dynamic logistics environment, leading to tailored recommendations to improve operational performance and competitiveness in Zambia's logistics sector.

Sampling Frame

The researcher employed the probability sampling method to select each respondent from the population of interest, with emphasis on those from VS Cargo's logistics operations department. Aggarwal (2024) states that probability sampling minimizes bias and promotes fairness in model outcomes and has the ability to generalize conclusions. The researcher specifically used a simple random sampling technique to select a sample of management and employees within the company.

Population and Sample

Population:

The study focused on the logistics operations of VS Cargo Limited in Ndola, and the target population comprised all the employees (68) and management (11) in the logistics operations department of the company. The total population is 360 for VS Cargo Limited in Ndola.

Representative Sample

To determine the appropriate sample size for this study, the researcher employed the Fisher formula, a method used in similar studies like Atado et al. (2021) and Daios (2015). The formula is expressed as follows $n = (Z^2 \times P \times Q) / D^2$ where;

Z = Z-score corresponding to the desired Confidence Interval (e.g., 1.96 for 95% confidence),

P = estimated proportion of the population with the desired characteristics (e.g., 0.3),

D = Represents the margin of error (e.g., 0.05)

Q = 1 – P

Taking P = 0.3 (30% of the population) and Z = 1.96 at 5% confidence interval $n = (1.96^2 \times 0.3 \times 0.7) / 0.05^2$ $n = (3.84 \times 0.21) / 0.0025$ $n = 0.08064 / 0.0025$ $n = 32.3$

The sample size was therefore 32 respondents, and since there is a 10% non-response, the sample size used was 35 respondents. Those from management were six (6), and the employees were 29 respondents.

Data Collection Tools

Primary data was collected through semi-structured questionnaires, which were administered to each respondent (employees and management of VS Cargo) in the study to collect quantitative data, which provided insights into the challenges, barriers, and best practices for AI integration. Secondary data, on the other hand, such as industry reports, company performance records, and academic literature, were reviewed to provide context and support to the analysis.

Data Analysis Techniques

Quantitative Data Analysis

To analyze quantitative data collected using semi-structure questionnaires, this study adopted frequency distribution as a core descriptive statistical technique. Frequency distribution was used to systematically organize and summaries responses from both management and employees at VS Cargo, highlighting how frequent specific responses, and views appeared across the datasets. Correlation analysis was additionally used to identify

the patterns related to AI adoption, benefits, and challenges and to examine the relationship between the independent and dependent variables following the methodology used in a study by (Cui et al. 2023).

Ethical Considerations

The study ensured that research ethics were considered throughout the research process by informing the participants of the purpose of the study before engaging them. Participation was voluntary, and no participant was forced to participate. Respondents were also guaranteed confidentiality and anonymity, and it was maintained throughout the process. No recording of names or any personal identification during data collection was made. The researcher also obtained permission to conduct this research from the management of VS Cargo Limited.

RESULTS AND DISCUSSION

What is the current state of AI adoption in logistics Management at VS Cargo?

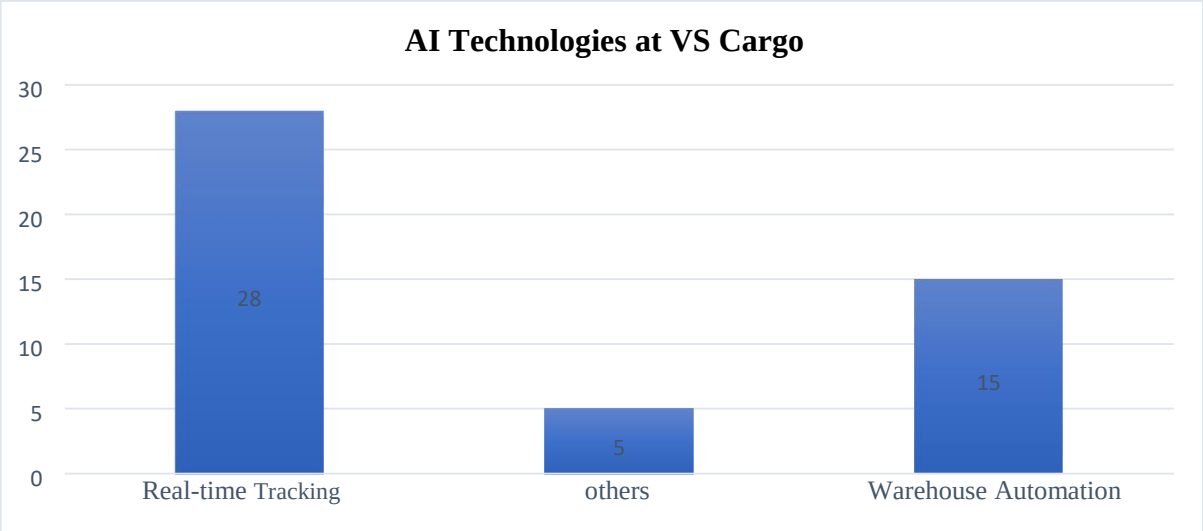

Figure 4.1 AI Technologies at VS Cargo

Real-time Tracking

The findings of this study align well with the theory used in this study. According to the Technology Acceptance Model (TAM), the adoption of a technology by an individual or an organization depends on the perception of its usefulness and ease of use (Davis, 1989). At VS Cargo Limited, while Artificial Intelligence (AI) is widely used through real-time tracking systems, its application remains confined to basic functionalities. Advanced tools, such as predictive analytics, are yet to be fully integrated. This limited utilization entails that employees and management may not perceive these tools as immediately beneficial or user-friendly, thereby slowing broader adoption of the technology.

A prominent example is the JT701 tracking device by JoinTech, which has gained wide acceptance across VS Cargo's operations. The device is valued for its reliable performance, particularly in identifying the exact location of cargo and updating customers in real time. From the perspective of TAM, the success of the JT701 device reflects a strong perception of usefulness and ease of use among employees and managers, resulting in its widespread adoption. This supports TAM's argument that when a technology meets practical needs with minimal complexity, users are more likely to embrace it.

The findings of this study also support the study by Mumbi (2023), who observed that in Zambia, the majority of logistics companies are aware of AI solutions but face challenges in implementation due to limited infrastructure and digital literacy. The use of the JT701 device highlights how even in constrained environments, technologies that align well with TAM's principles can be successfully adopted. However, both the literature

and this study point to the importance of long-term planning and investments that aim to improve digital capacity and provide targeted training to enhance user perceptions.

Warehouse Automation

Another notable finding from this study is the adoption of warehouse automation at VS Cargo which minimizes manual processes in managing inventory movements into, within and out of the storage facilities. Management respondents revealed that important warehouse operations had become more streamlined through the use of systems that automate tasks such as data entry, stock monitoring, and report generations. The integration of smart hardware like the Mettler Toledo scale and a digitally enabled inventory management system, linked with SAP Business One, supported this shift. Although SAP Business One is not fundamentally an AI solution, it is integrated with AI features such as document extraction and real-time stock visibility, which together reduce errors and support warehouse optimization, including space utilization and forecasting.

The level of technological integration reflects key elements in the Technology Acceptance Model (TAM). The positive perception of users towards the usefulness of this system, particularly in enhancing operational efficiency and decision-making, contributed to its greater acceptance. These perceptions explain to a greater extent why automated systems have gained traction within VS Cargo's warehouse operations. In addition, warehouse automation enhances VS Cargo's ability to manage increased cargo volumes, reduces human error, and improves the company's capacity to adapt to changing logistics demands. As such, these systems represent a tangible investment in operational flexibility and long-term competitiveness.

The findings also support those of Pan and Nishant (2023), who argue that digital tools in logistics contribute to greater visibility, transparency, and customer satisfaction. They emphasize in their study that AI-powered solutions help improve forecasting accuracy and streamline workflows, results which were also observed at VS Cargo through improved stock control and better resource allocation. Therefore, the integration of predictive analytics and data-driven warehouse controls reflects the alignment between theory and practice, confirming the broader role that AI can play in optimizing logistics efficiency when deployed strategically.

What strategies are being used to integrate AI in logistics management at VS Cargo?

Table 4.1 Strategies for AI Adoption

Sensitizing and educating employees	Raise awareness about AI benefits to reduce resistance and build support	100% (Mgmt) / 88.57% (Emp)
Investing in digital infrastructure	Upgrade systems, enable AI integration, and support smart logistics	97.14% (Emp)
Engaging AI experts	Facilitate collaboration between management and staff to guide implementation	83.33% (Mgmt)
Training, upskilling & workshops	Equip employees through structured training programs, both regular and adaptive	88.57% (Emp) / 66.7% (Mgmt)
AI-focused research	Identify best-fit technologies to meet logistics needs	77.14% (Emp)
Quick response to industry changes	Increase organizational agility to stay current with evolving AI trends	50% (Mgmt)
Supportive policies & secure data sharing	Strengthen governance, protect data, and promote inter-organizational alignment	71.43% (Emp)
Fostering an open mindset	Encourage adaptability and reduce resistance to technological changes	33.33% (Mgmt)

The researcher's second objective was to determine the strategies VS Cargo uses to integrate AI in its logistics operations in ways that align with its business goals. The findings of this study revealed that VS Cargo uses both technical and organizational strategies to support AI adoption in logistics management. The strategies that align with the literature reviewed in this study and reflect key principles of the Technology Acceptance Model (TAM), which emphasizes that technology adoption is driven by users' perceptions of usefulness and ease of use (Davis, 1989).

One of the most important strategies employed by the company was sensitizing and educating employees which was supported by all management respondents and 88.57% of employees. This approach is important because it helps reduce resistance to new technologies and improves user confidence. According to TAM, employees are more likely to adopt a technology when they believe it is useful and not difficult to use, which is also supported by Chen et al. (2024) and Nicolletti (2025), who argue that building a strong knowledge base and training culture is critical for the success of AI implementation.

Investing in digital infrastructure (97.14%) is another key strategy that employees identified. By ensuring systems such as real-time tracking and warehouse automation are supported by strong and reliable infrastructure, VS Cargo creates an environment where AI tools can be perceived as both functional and accessible. This aligns with TAM's assertion that perceived ease of use is influenced by system reliability and accessibility. Additionally, Al Suwaidi et al. (2022) also support this in their study by emphasizing the importance of establishing a clear implementation roadmap and preparing high-quality data systems before AI can be used effectively.

Furthermore, engaging AI experts (83.33%) was revealed by management to have helped VS Cargo access specialized knowledge and ensure proper alignment between AI tools and business needs. This strategic alignment enhances the level of perceived usefulness, as employees are more likely to adopt technologies that support their tasks and improve their performance, as supported by Atadoga et al. (2024), who stress that having skilled professionals in data science and logistics is key to successful digital transformation. Additionally, training and upskilling employees, highlighted by 88.57% of employees and 66.7% of management further supports the company's effort to build long-term capacity. Workshops and practical sessions which are conducted regularly by the company help employees learn how to interact with AI systems, reducing perceived complexity and increasing acceptance.

Other supportive actions include conducting AI-focused research (77.14%), promoting secure data sharing (71.43%), and encouraging a mindset that is open to change (33.33%). These strategies reflect the need for careful planning and innovation, as noted by Brau et al. (2023) and Chen et al. (2024), who argue that organizations must select the right AI models and match them to their goals, data environment, and resource capacity. Overall, the study shows that effective AI integration requires both technical readiness and human involvement. Without the right infrastructure, AI systems cannot function effectively. However, even the best systems will fail if employees lack the skills or motivation to use them. By combining strong leadership and with strong practical support and continuous learning, VS Cargo is building a foundation for sustainable AI adoption. This supports the idea by Nicolletti (2025) that AI is not just a tool, but a strategic shift that requires companies to rethink how they work, learn and grow.

What are the key benefits of utilizing AI technologies in logistics operations at VS Cargo?

Table 4.2 Benefits of utilizing AI technologies in logistics operations at VS Cargo

Enhanced Decision Making	91.43%	Data-driven insights, faster and more accurate strategic choices
Route Optimization	88.57%	Real-time tracking, reduced fuel usage, and timely deliveries
Stimulating Customer Satisfaction	82.86%	Personalized services, consistent delivery, and faster problem resolution
Demand Forecasting	80%	Better inventory planning, reduced stock outs or overstock

Reducing Operational Costs	80%	Process automation, efficiency gains, cost savings
Enhancing Visibility & Transparency	77.14%	Supply chain traceability, improved accountability, stakeholder trust

The third objective of this study was to determine the benefits that AI technologies have contributed to the operational efficiency and strategic performance of VS Cargo. The study revealed that Artificial Intelligence (AI) technologies have provided a wide range of benefits in the logistics operations of VS Cargo. Both management and employees shared that AI tools, especially real-time tracking and warehouse automation, have improved how the company operates in several important areas.

One of the major benefits, as revealed in this study, was improved decision-making, with 91.43% of respondents agreeing that AI systems help the company make faster and more accurate decisions. This revelation aligns with the Technology Acceptance Model (TAM), which states that people will use the technology when they find it useful and easy to use. Since AI tools offer real-time data and predictions, decision makers at VS Cargo are able to manage stock, determine efficient routes, and respond quickly to problems. This supports the findings of Boute and Udenio (2021), that AI tools increase the company's agility and help them make smarter decisions using large volumes of data.

Another important benefit revealed in the study is route optimization (88.57%), which helps the company reduce delivery times and fuel costs. AI systems allow VS Cargo to adjust routes based on real-time traffic conditions, a benefit that supports TAM's principle of perceived usefulness, as employees recognize the tangible impact of AI on operational efficiency. Similarly, Lumisi (2023) points out that AI tools that respond to traffic updates and expected delays make logistics more efficient in today's fast changing business environment. Customer satisfaction was also highlighted to be a major benefit by 82.85% of respondents. AI tools give customers more accurate delivery updates, allow personalized services, and help resolve issues faster. Positive outcomes that contribute to users' perception of usefulness and ease of use, central to TAM. In support of this is the DHL & IBM (2018) report and a study by Zhao et al. (2020), who states that AI improves communication, transparency, and trust in logistics processes.

Demand forecasting and cost reduction (80%) were also key benefits highlighted by the respondents. AI helps predict customer demand by analyzing past sales patterns and external data. This reduces waste and ensures that products are available when needed. It also minimizes manual, work and errors. Results that align with Liu (2023) and Amponsah et al. (2024), who explains that AI helps lower costs and supports smarter inventory planning by using machine learning to detect patterns and trends. Lastly, visibility and transparency in the supply chain (77.14%) were identified as crucial benefits. AI tracking systems provide VS Cargo with better control and monitoring of shipment, which users perceive as useful. In support of this is a study Samuels (2025) who explains how real-time analytics and AI forecasting tools are central to building more sustainable and reliable logistics systems.

Across all these areas, the use of AI at VS Cargo demonstrates that the company is shifting from manual and reactive processes to proactive and data-driven processes. Changes that are growing the global role of AI in logistics, as discussed in studies by Zhao et al. (2020) and Boute and Udenio (2021), highlighting the importance of integrating AI thoughtfully to improve overall logistics efficiency, competitiveness, and customer experience. These benefits also strongly align with TAM, as users' positive perceptions of AI's usefulness and ease of use have driven its acceptance and integration into logistics workflows.

What challenges hinder the full utilization of AI in logistics management at VS Cargo Limited?

Table 4.3 Challenges hindering full utilization of AI in logistics management at VS Cargo

Digital Infrastructure Limitations	Inadequate systems, connectivity gaps, outdated technologies	91.43% (Emp)
Integration Complexity	Technical difficulty in embedding AI into logistics operations	85.71% (Emp)

Lack of Skills and Expertise	Shortage of AI professionals; limited internal capabilities	77.14% (Emp) / 83.33% (Mgmt)
Financial Constraints	High implementation costs, limited investment capacity	74.29% (Emp)
Resistance to Change	Organizational reluctance, employee hesitancy toward tech transitions	71.43% (Emp) / 83.33% (Mgmt)
Strategic Gaps in Leadership	Lack of clear AI adoption strategy or vision	66.67% (Mgmt)
Privacy and Security Concerns	Fear of data breaches, regulatory uncertainty	66.67% (Mgmt)
Computational Resource Limitations	Insufficient processing power for largescale AI tasks	42.86% (Emp)
Training Deficiencies	Limited or irregular skill-building opportunities	33.33% (Mgmt)
Cultural and Engagement Barriers	Weak organizational support, low employee involvement, lack of AI awareness	28.5% (Emp)

From the fourth objective the study established that despite the substantial benefits of using AI in logistics as highlighted in the preceding subheading, VS Cargo still faces several key challenges that prevent full and effective adoption of AI in its logistics operations. These challenges were grouped in two main areas: management level challenges and employee level challenges. This aligns with the theory used in this study and the trends discussed in both global and African contexts.

The most critical challenge identified by employees is the lack of digital infrastructure (91.43%). Technologies that are outdated, poor system integration and limited connectivity make it difficult to support modern technologies like AI. This situation reflects the findings by Chen et al' (2024) and Kuteyi and Winkler (2022), who observed that poor infrastructure is a major challenge to AI-driven sustainability and logistics innovation especially in the Sub-Saharan Africa. Without reliable systems, users may perceive AI as difficult to use or ineffective, reducing its acceptance.

The complexity of integrating AI systems into daily logistics processes is another important challenge revealed by the findings of this study highlighted by 85.71% of the employees. Integrating AI with legacy systems often requires specialized technical knowledge and careful system redesigns. If users find these systems too complex or disruptive, their perception of ease of use declines, leading to resistance. This supports the concerns raised by Al Suwaidi et al. (2022), who emphasized that integration is not just a technical task but also demands strategic planning, compliance, and workforce adaptation.

Another concern is financial limitations highlighted by 74.29% of employees. AI systems often require large upfront investments in hardware, software, infrastructure, and training. This issue was also noted by Kuteyi and Winkler (2022) and AL Suwaidi et al. (2022), who stressed a point that African logistics firms often lack the capital required to adopt large-scale AI technologies. When users associate AI with financial constraints or limited support, its perceived usefulness may decline, affecting overall acceptance. In addition, resistance to change remains a challenge, especially among employees and some decision-makers. This was confirmed by 71.43% of employees and 83.33% of management. Employees may worry about losing their jobs, find the technology difficult to understand, or simply feel uncomfortable moving away from traditional processes. TAM explains that unless employees see how AI benefits their work and feel confident using it, they are unlikely to embrace it.

Furthermore, strategic and leadership-related challenges also affect AI adoption. 66.67% of management noted that there is no clear AI strategy and 66.67% pointed to privacy and security concerns. These findings reflect those from Daios et al. (2025) and Chen et al. (2024) who emphasized that without clear direction, strong leadership and solid security measures, AI systems may fail to deliver their full potential and further weaken user acceptance. Lastly, computational limitations and lack of continuous training identified by 42.86% of

employees and 33.33% of management respectively, show that even when AI is introduced, its success depends on ongoing support and training. TAM suggests that training improved perceived ease of use, while visible improvements in performance improves perceived usefulness. These findings reveal that the challenges hindering AI adoption as VS Cargo are deeply connected to user perceptions, making TAM a valuable framework for understanding and addressing these challenges.

How do the challenges of AI utilization affect the overall business performance?

Table 4.4 How the challenges of AU utilization affect the overall business performance

Data Privacy & Security Concerns	Delayed AI implementation, employee mistrust, manual workarounds, slow operations, risks to data integrity
Infrastructure & Integration Complexity	Increased costs and timelines, partial system integration, data silos, reduced process efficiency
Workforce Skill Gaps	Underutilization of AI tools, low ROI on training, fallback to manual processes, tech investment hesitancy
Leadership Awareness & Communication	Vague project goals, fragmented vision, employee resistance, unclear strategic direction
Limited Cross-Functional Collaboration	Poor data sharing, slow decision-making, disjointed operations, missed optimization opportunities

The last objective was to analyze how the challenges identified affect the overall business performance. The study revealed that several challenges to AI adoption were directly affecting business performance at VS Cargo. These challenges limit efficiency, delay operations, and reduce the return on investment in AI technologies. The findings also align with literature reviewed in this study and support the Technology Acceptance Model (TAM) used this study.

Workforce skill gap

While it is important to integrate technologies such as AI to enhance efficiency, there is need to ensure that there is no skill gap in utilizing these technologies among employees. Many VS Cargo employees lack the skills required to integrate AI technologies in their operations, analyze system outputs and troubleshoot automated workflows. Therefore, the company needs to address this skill gap which requires significant investment in hiring expertise like data scientists and contracting external trainers to retrain its workforce which aligns with a study by Liu (2023). Even if training is provided for employees, they are likely to go back to traditional logistics operations if they do not fully trust and understand the new tools. The underutilization of AI by employees not only reduces the return on investments spent on employee training, but also reduces management's confidence in investing in future technologies. From the perspective of the TAM, if employees find AI hard to use or are not confident in using it, they are unlikely to adopt it fully. This results in lower productivity and slower adaptation to AI-driven changes.

Infrastructure setup and integration complexity

VS Cargo uses legacy systems. Therefore, integrating AI tools in such systems and ensuring compatibility comes with a lot of complexities, which raises project costs and timelines because of the need for external expertise, such as developers and data scientists, as also highlighted in a study by Liu (2023) and Dwivedi et al. (2021). When these systems are partially implemented, they lead to data silos that hinder collaboration among functional departments of the organization and force employees to enter information twice and manually reconcile discrepancies. Such inefficiencies introduce errors into inventory counts and shipment tracking, preventing the company from realizing the full benefits of its AI investments. In addition, it creates delays, extra costs, and data errors. In the case of VS Cargo, these technical barriers slow down operations and cause some departments to

work in isolation, reducing collaboration. It also reduces employee trust and slows down organizational transformation.

Lack of strong data management systems

This was another challenge identified in both the findings of this study and the literature. As Brau et al. (2023) highlighted in their research, AI systems rely heavily on clean, organized and large volumes of data. The absence of effective data management processes at VS Cargo resulted in poor-quality insights which reduces the usefulness of AI and affect the company's ability to make quick, informed decisions. Overtime, this can create missed business opportunities and lower customer satisfaction.

Leadership awareness and communication

Lack of leadership awareness on technologies such as AI by management leads to broad or vague directives rather than clear and concrete project goals. Majority of senior managers at VS Cargo do not have hands-on-experience with AI which poses great concerns to the success of the organization because middle managers receive unclear priorities, thereby creating shifting timelines and unclear success metrics. This conforms with TAM, which emphasizes that leadership must actively guide organizational change, by clearly communicating AI benefits and strategic relevance, as Daios et al. (2025) highlighted, that successful AI implementation depends on strong strategy and risk management, not just putting the technology in place. In addition, when the vision of the company is not unified, employees often struggle to see the purpose behind the implementation of new systems, fostering their passive resistance. Therefore, it is essential that employees are motivated and resources are effectively aligned through clear and consistent communication of strategic benefits of AI.

Cross-functional collaboration and information flow

Effective integration of technologies such as AI requires that there is collaboration between all the functional departments, like IT, operations, finance, and customer service teams, yet every VS Cargo department uses its tools for reporting and performance metrics. This independence of departments creates information silos, which makes it difficult to validate AI model outputs and slows down corrective actions. Additionally, the lack of shared dashboards and regular cross-departmental meetings where different issues are discussed and lessons learnt in different areas of operation are shared for others to benefit. Therefore, companies like VS Cargo miss a chance to optimize their logistics processes.

Data Privacy and Security Concerns

Before AI is integrated into the logistics operations of VS Cargo, it is important that it secures customer and shipment data against unauthorized access, which requires strong encryption, secure servers, and compliance with data protection regulations of both local and international business environments. While it is important to implement these safeguards, they often delay the integration of AI because IT teams must validate each security layer before deployment. In addition, this concern aligns with the concern pointed out by Brau et al. (2023), that AI tools must be secure, regularly updated, and protected against cyber threats. Therefore, if the systems at VS Cargo are seen as unsafe or untrustworthy, employees may avoid using them fully. This again connects with TAM, where consistent and secure system performance is essential to build confidence among users.

Role of employees and policy makers

To have a clear understanding of the role of Artificial Intelligence in logistics management, the employees were asked what the role of policy makers was, and management was asked about the role that employees play in ensuring it is effectively adopted.

Role of employees in supporting AI adoption in logistics management

The findings of this study indicate that employees play a very important role in the adoption and implementation of Artificial Intelligence (AI) technologies at VS Cargo. This resonates with the Technology Acceptance Model (TAM, which states that a technology is more likely to be used by employees when they perceived it to be useful

and easy to use (Davis 1989). The framework helps explain why employee involvement is essential across multiple stages of AI integration.

Sample Variable	Response	Frequency	Valid Percentage
Role of Employees	Development IT-Related Infrastructure	6	100
	Accepting and Supporting the Change Process	5	83.33
	Providing feedback on AI related changes	2	33.33
	Identifying Areas for Change	5	83.33

100% of the respondents emphasized the importance of employee involvement in developing IT-related infrastructure that supports AI implementation, which includes assisting in setting up systems, managing technical components, and maintaining data inputs and connectivity. This resonates with TAM, as it directly influences how usable and effective the technology appears to end users. VS Cargo employees help the company respond to evolving logistics demands and strengthen its ability to implement AI tools effectively by contributing directly to infrastructure development, enhancing their perceived ease of use.

Additionally, 83.3% of respondents highlighted that employees play a key role in identifying areas where AI can be applied, such as shipment tracking, route optimization, and warehouse automation. This aligns with TAM's principle of perceived usefulness as employees are more likely to support technologies that improve performance in areas they understand and manage. Employees also have a role to play in accepting and supporting organizational changes, highlighted by 83.33% of the respondents. Employees who embrace new workflows and actively engage in innovation initiatives help create a culture of openness and readiness. This reduces resistance and VS Cargo and strengthens TAM's conditions for adoption, as users begin to associate AI with practical benefits and manageable learning curves.

Although only 33.3% of respondents emphasized the role of employees in providing customer feedback, it is still very significant. By sharing insights on customer preferences and satisfaction, VS Cargo employees help refine AI systems to better meet user expectations, reinforcing the perceived usefulness of these tools. This view is supported by Brau et al' (2023), who argue that frontline engagement is essential for building reliable and data-driven logistics systems. Furthermore, the findings align well with the findings from Liu (2023) and Al Suwaidi et al. (2023) who stress that employees are not just mere system users but also change agents because their involvement in infrastructure development, problem identification, and obtaining feedback contributes to the success of AI adoption and makes it more inclusive and sustainable. Without the involvement of employees, technical systems risk being underutilized and misaligned with VS Cargo's business needs.

It is therefore important to note that the role of employees in AI adoption goes beyond basic usage. They help the company develop infrastructure, foster positive attitudes toward change, and identify where AI tools can deliver value. Their contributions are very important in that they directly support the theoretical foundation of this study and reflect broader trends in AI-driven logistics innovation. Therefore, it is important for an organization like VS Cargo to empower employees, an essential element for maximizing the benefits of AI and achieving long-term transformation.

Role of policy makers in supporting AI adoption in logistics management

Policy makers, as revealed by the study, play an important role in creating an environment that enables successful AI integrations within logistics firms, particularly those in management positions as VS Cargo. Employees identified several key actions for promoting AI adoption.

Sample Variable	Response	Frequency	Valid Percentage
	Providing Proper Training	32	91.43

Role of Policy Makers	Employee Engagement	30	85.71
	Regular Dialogue with Developers	24	68.57
	Building Platforms for Reducing Resistance	29	82.86
	Setting Clear Regulations	31	88.57
	Allocating Resources	31	88.57

The major role highlighted in the findings of this study is the provision of proper training for employees (91.43%), reflecting the principle of the Technology Acceptance Model. Training employees in an organization regarding AI technologies helps build confidence, reduce resistance to change, and enhance the perceived value of AI tools among employees. This also contributes to improved user competence, increasing the likelihood of successful implementation. This perspective aligns well with the study by Liu (2023) and Dwivedi et al. (2021), who argue that building workforce capacity is critical for effective AI adoption, especially in traditional logistics environments where digital literacy may be low.

The employees also equally emphasized the role of setting clear regulations and adequate funding (88.57%), which indirectly supports TAM by ensuring employees work within well-defined systems supported by reliable resources, which strengthens trust and usability. Regulations are essential because they guide implementation by setting expectations and responsibilities, while funding ensures the availability of resources for infrastructure, acquisition of software, and ongoing system maintenance. Similarly, a study by Daios et al. (2025) and the DHL & IBM (2018) report also highlight that without policies and financial commitment, AI initiatives may struggle to achieve reliable outcomes of logistics operations. Therefore, when systems are properly supported, users are more likely to trust their reliability and efficiency.

Equally important is employee engagement, with 85.71% of respondents, indicating the need for inclusive and participatory change management practices. This finding strengthens TAM in that when employees are greatly involved, there is an increase in understanding, trust, and ownership of AI processes. Employees who feel part of the implementation process are more likely to contribute meaningfully to system refinement and usage. The approach which is highly supported by Atadoga et al. (2024), emphasizing that organizational culture must support participatory innovation to unlock the full potential of AI. Although fewer respondents (68.57%) indicated regular dialogue with developers, this role is very significant to the adoption of AI. When VS Cargo engages with developers, it allows them to adjust AI tools to their unique operational needs, maintain system relevance, and improve resilience. This is supported by Chen et al. (2024), who states that dialogue with developers fosters strategic agility and supports the customization of AI solutions in complex and evolving logistics environments.

These roles indicate that policy makers have a multi-dimensional role in AI adoption which ranges from leadership and resource allocation to employee empowerment and strategic collaboration. When these roles are effectively performed, they strengthen the organization's technical readiness, improve user acceptance, and build the capacity to adapt and innovate. A coordinated approach essential for sustainable AI integration in logistics firms like VS Cargo

CORRELATION

The main objective of this study was to investigate the Role of Artificial Intelligence (AI) in Optimizing Logistics Management: A case of VS Cargo Limited in Ndola. To support this, the researcher conducted a correlation test on some key roles that the respondents highlighted. The correlation test, as defined by Doyle et al. (2007), is the degree of relationship between two or more variables. The correlation test is denoted by the letter (r) and its values range from -1 (perfect negative) and +1 (perfect positive). A value of zero (0) is an indication that there is no relationship. This study utilized a Pearson Correlation Test, similar to Lumisi (2023), denoted as; $r = \frac{\text{covariance}(x, y)}{S_x \times S_y}$

Where x and y are variables with Sx and Sy being the standard deviations for x and y, respectively. Using SPSS for analysis, the correlation test results were as indicated in Table 4.16 below as follows;

Table 4.5 Correlation Test Results

		Role of AI	**Reducing Operational Costs**	**Improving Decision Making**	**Stimulating Customer Service**	**Route Optimization**
Role of AI	Pearson correlation	1	-0.624**	0.814**	0.795**	0.877**
	sig. (2 -tailed)	.000	.000	.000	.000	.000
	sum of squares and cross products	102.187	123.104	124.109	101.263	208.115
	Covariance	1.121	1.286	1.286	1.189	1.123

** Correlation is significant at 0.05 significance level.

We can infer from Table 4.16 above that all four (4) variables above were significant, with the most influence of AI seen on Route optimization (0.877), and this was followed by Improving decision making (0.814). For stimulating customer satisfaction, the correlation was 0.795, while a reduction in operation costs added a negative correlation of 0.624. With high correlations of over 60% on all four variables, it can be said that with the adoption of AI, there can be an increase in the performance and efficiency of VS Cargo logistics operations. It is therefore cardinal for VS Cargo and other logistics firms to effectively utilize various AI technologies in their operations so as to increase their performance in the industry.

RESULTS

Table 4. 1 Table of Results

Source	**SS**	**df**	**MS**
Model	13.123124	3	2.1421101
Residual	2.13241288	32	.01211212
Total	21.1214220	35	214324254

Number of Observations

F (3, 32)

Prob > F = 0.000

$R^2 = 0.875$

Adjusted $R^2 = 0.778$

Root MSE = .12547

It can be inferred from the table of results above that the above variables were significant (Prob > F = 0.000) with three (3) degrees of freedom. The $R^{2,}$ which measures the variations in the dependent variable being explained by the independent variables, was 0.875, an indication that there are other roles that AI can play in

logistics management. The R^2 of 0.875 further implies that the roles highlighted above are just 87.5% and that there are other roles it can play.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The purpose of this study was to investigate the Role of Artificial Intelligence (AI) in Optimizing Logistics Management: A case of VS Cargo Limited in Ndola. The researcher learnt that the two main AI Technologies used at VS Cargo were real-time tracking and warehouse automation, which play key roles in logistics management at the firm. Real-time tracking was found to be key in logistics management as it helped VS Cargo identify with accuracy the position of goods, stimulate route optimization, and inform customers well in advance, which led to customer satisfaction, especially those in industrial logistics management. For Warehouse automation, it was found to play a key role in managing and executing of tasks related to storage, and movement of goods.

Despite these and other benefits, the study revealed a number of challenges associated with AI adoption at VS Cargo. The first being concerns over privacy and security requiring proper protocols such as encryption, strict access controls and regular security audits to safeguard customer and operational data. Integrating AI into the existing IT infrastructure is another challenge identified which demands significant investment in middleware applications, API development, and system testing to ensure communication between new and legacy systems is seamless and effective. The other major challenge identified is that of a lack of workforce with technical skills to configure, operate and interpret AI tools, and VS Cargo faces budgetary constraints that limit support for comprehensive training and infrastructure upgrade.

In order to overcome these challenges, the study revealed the need to implement a structured monitoring and evaluation framework that tracks AI performance metrics and feeds insights back into system improvements; developing targeted training programs that combines in-house workshops, online courses and vendor led trainings to ensure that the skill gap in workforce is bridged; fostering a culture of continuous learning and establishing a formal vendor-selection process that evaluates potential solutions against VS Cargo's strategic objectives, logistical challenges, ensuring that the platforms being integrated in its operations can address the operational needs.

Recommendations

This study shows that integrating AI technologies in companies like VS Cargo can improve logistics efficiency, customer service, and route planning. However, several challenges and key areas of improvement were identified, leading to the following recommendations:

Continuous Training and Development of Skills

The findings revealed a lack of technical knowledge and confidence in using AI systems as one of the major challenges to AI adoption. Therefore, there is a need for VS Cargo to provide continuous training and skill development for employees. Training programs such as workshops, mentorship initiatives, and guided hands-on sessions can help build competence and reduce resistance to change among the employees. This recommendation aligns with the TAM because when employees are trained and find AI systems to be beneficial to their work and easy to use, they are likely to adopt them into their operations. Building digital literacy across all levels of staff at VS Cargo will ensure AI tools are used effectively, and it will maximize the value of both human and technological resources.

Leadership awareness and communication

Equally important to continuous training and development of skills is strengthening leadership awareness and communication around AI adoption. This study highlighted that a lack of strategic vision from top management leads to unclear directives and uncertainty among employees. To address this, top managers at VS Cargo must

be equipped with basic AI knowledge and regularly communicate with subordinates the purpose, benefits, and expected outcomes of integrating AI technologies into operations. When employees understand the strategic reasoning behind changes, they are more likely to support them. Effective leadership is essential for the growth of VS Cargo because it will not only increase trust but also drive a culture of innovation and readiness for technological transformation.

Infrastructure Improvement

VS Cargo operates legacy systems that are incompatible with many modern AI tools. This creates delays, data silos, and additional operational costs. The study therefore recommends upgrading digital systems and investing in scalable infrastructure that can support real-time data processing, system integration, and analytics. A robust IT environment enhances the ease of system usage and increases employee confidence in the technology. In addition to improving employee perception on AI's usefulness and overall performance, management of VS Cargo should ensure systems are reliable, which supports the core principle of TAM.

Data Management Practices

AI tools rely on clean, well-structured data to provide accurate data outputs and actionable insights like those provided through real-time tracking. Poor data quality leads to inaccurate outputs and reduces trust in the system among the employees. Therefore, the research recommends developing centralized data policies, including protocols for access, accuracy, and security. This would improve the value of insights generated by AI and increase the technology's perceived usefulness, essential for encouraging user acceptance and consistent usage among VS Cargo employees.

Employee Engagement

The study emphasizes the importance of employee engagement in AI-related processes. Respondents noted that employees should not be treated as passive system users but as active contributors to AI design, implementation, and improvement. Therefore, by involving employees in areas for AI application, testing features, and providing feedback, VS Cargo can ensure better alignment between systems and the actual needs of the organization. When employees are engaged, they are more likely to trust and accept AI technologies.

Developing a clear and structured AI roadmap

For strategic planning, the study recommends developing a clear and structured AI roadmap, outlining specific goals, timelines, roles, and evaluation metrics to guide implementation. A clear and structured AI roadmap will help VS Cargo coordinate efforts across departments and ensure that AI adoption aligns with the company's broader business objectives. Management should make regular reviews and updates to the roadmap to keep the adoption agile and responsive to changing logistics needs.

Collaboration with AI experts and developers

It should be stressed that the logistics industry has specific needs and challenges; hence, generic AI solutions cannot be the solution. It is therefore cardinal for VS Cargo managers to seek the right AI partners with experience (proven) in developing and implementing AI systems tailored to VS Cargo's operational needs. Engaging with experts not only improves system design but also promotes strategic agility and innovation. As some employees may face challenges using complex tools, the support of developers and other specialists ensure technical solutions remain practical and relevant.

Improving Cross-Functional Coordination

The research revealed that departments at VS Cargo operate in isolation, using separate systems and reporting tools. This creates data silos and complicates the validation process of AI outputs, as data comes from independent departments. The study therefore recommends introducing shared dashboards, holding interdepartmental meetings, and creating unified reporting protocols to improve collaboration. This coordination among departments enhances data flow, strengthens trust in AI tools, and improves their overall effectiveness.

Proper Funding

Proper funding is necessary to sustain AI adoption. Without dedicated financial resources, it is difficult for VS Cargo to invest in the hardware, software, training, and infrastructure required for effective implementation. Allocating a clear budget for AI initiatives demonstrates VS Cargo's commitment and helps ensure projects are not abandoned due to cost-related delays or underperformance.

Privacy and Data Security

Lastly, concerns related to privacy and data security must be addressed. Employees are less likely to engage with AI systems if they fear that sensitive data could be exposed or misused. The study recommends investing in secure servers, encryption protocols, and compliance measures to protect customer and shipment data. Ensuring consistent and safe system performance boosts user trust and directly supports TAM's principle of perceived ease of use.

REFERENCES

1. Al Suwaidi, J., Aydin, R., & Rashid, H. (2022). Investigating barriers and challenges to artificial intelligence (AI) implementation in logistic operations: A systematic review of literature. Proceedings of the 5th European International Conference on Industrial Engineering and Operations Management, 1600–1616. https://ieomsociety.org/proceedings/2022rome/308.pdf
2. Amponsah, B. K., Asamoah, P. B., & Frimpong, M. (2024). The impact of artificial intelligence in logistics and supply chain in the USA—Focusing on leading industries in the 21st century. International Journal of Research and Scientific Innovation, 11(11), 22–30. https://doi.org/10.51244/IJRSI.2024.1111003
3. Atadoga, A., Obi, O. C., Osasona, F., Onwusinkwue, S., Daraojimba, A. I., & Dawodu, S. O. (2024). AI in supply chain optimization: A comparative review of USA and African trends. International Journal of Science and Research Archive, 11(1), 896–903. https://doi.org/10.30574/ijsra.2024.11.1.0156
4. Brau, R. I., Sanders, N. R., Aloysius, J., & Williams, D. (2023). Utilizing people, analytics, and AI for digitalized retail supply chain decision-making. Journal of Business Logistics. https://doi.org/10.1111/jbl.12355
5. Chen, W., Men, Y., Noelia, F., Osorio, C., & Juan, A. J. (2024). Artificial intelligence in logistics optimization with sustainable criteria. Sustainability, 16(21), 9145. https://doi.org/10.3390/su16219145
6. Cui, H. X., Qiu, J. L., Cao, J. D., Guo, M., Chen, X. Y., & Gorbachev, S. (2023). Route optimization in township logistics distribution considering customer satisfaction based on adaptive genetic algorithm. Mathematics and Computers in Simulation, 204, 28–42. https://doi.org/10.1016/j.matcom.2022.05.020
7. Daios, A., Kladovasilakis, N., Kelemis, A., & Kostavelis, I. (2025). AI applications in supply chain management: A survey. Applied Sciences, 15(5), 2775. https://www.mdpi.com/2076-3417/15/5/2775
8. DHL & IBM. (2018). Artificial intelligence in logistics. DHL Trend Research. https://www.dhl.com/content/dam/dhl/global/core/documents/pdf/glo-core-artificialintelligence-trend-report.pdf
9. Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Duan, Y., Dwivedi, R., Edwards, J., Eirug, A., Galanos, V., Ilavarasan, P. V., Janssen, M., Jones, P., Kar, A. K., Kizgin, H., Kronemann, B., Lal, B., Lucini, B., ... Williams, M. D. (2021). Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. International Journal of Information Management, 57, 101994 https://doi.org/10.1016/j.ijinfomgt.2020.101994
10. Gavrilov, L. A., & Gavrilov, N. S. (2001). The reliability theory of aging and longevity. Journal of Theoretical Biology, 213(4), 527–545. https://doi.org/10.1006/jtbi.2001.2430
11. Jointech. (2024). AI camera – JOINTECH – Your trusted solutions provider beyond security. https://jointech.com.vn/products/ai-camera/
12. Kuteyi, D., & Winkler, H. (2022). Logistics challenges in Sub-Saharan Africa and opportunities for digitalization. Sustainability, 14(4), 2399. https://doi.org/10.3390/su14042399
13. Lazonick, W. (2013). Apple's business model: What should the world's richest company do with profits? Accounting Forum, 37(4), 249–267. https://doi.org/10.1016/j.accfor.2013.01.001

14. Liu, W. (2020). Route optimization for last-mile distribution of rural e-commerce logistics based on ant colony optimization. IEEE Access, 8, 12179–12187. https://doi.org/10.1109/ACCESS.2020.2964328
15. Liu, Q. (2024). Logistics distribution route optimization in artificial intelligence and Internet of Things environment. Decision Making Applications in Management and Engineering, 7(2), 221–239. https://doi.org/10.31181/dmame7220241072
16. Lumisi, M. (2023). An assessment of the adoption of artificial intelligence (AI) in the South African construction industry. North-West University, South Africa.
17. McKinsey & Company. (2019). AI in logistics: The next frontier of competitive advantage. https://www.mckinsey.com
18. Mumbi, L. (2023, July 12). Artificial intelligence (AI) in Zambia. BongoHive. https://bongohive.co.zm/artificial-intelligence-ai-in-zambia/
19. Pan, S. L., & Nishant, R. (2023). Artificial intelligence for digital sustainability: An insight into domain-specific research and future directions. International Journal of Information Management, 72, 102668. https://doi.org/10.1016/j.ijinfomgt.2022.102668
20. PwC. (2020). The potential of AI in the logistics industry. https://www.pwc.com
21. Richey, R. G., Roath, A. S., Adams, F. G., & Wieland, A. (2022). A responsiveness view of logistics and supply chain management. Journal of Business Logistics, 43(1), 62–91. https://doi.org/10.1111/jbl.12290
22. Russell, S., & Norvig, P. (2021). Artificial intelligence: A modern approach (4th ed.). Pearson.
23. Samuels, A. (2025). Examining the integration of artificial intelligence in supply chain management from Industry 4.0 to 6.0: A systematic literature review. Frontiers in Artificial Intelligence, 7, Article 1477044. https://doi.org/10.3389/frai.2024.1477044
24. Teece, D. J., & Pisano, G. (1994). The dynamic capabilities of a firm: An introduction. Industrial and Corporate Change, 3(3), 193–224. https://doi.org/10.1093/icc/3.3.193
25. VS Cargo Limited. (n.d.). Company overview. https://www.vscargo.com
26. Zhao, Z. X., Li, X. M., & Zhou, X. C. (2020). Distribution route optimization for electric vehicles in urban cold chain logistics for fresh products under time-varying traffic conditions. Mathematical Problems in Engineering, 2020, Article ID 9864935. https://doi.org/10.1155/2020/9864935
27. Tech Trends. (n.d.). Zambian government endorses AI global summit event. https://www.techtrends.co.zm/zambian-government-endorses-ai-global-summit-event-seen-as-key-step-towards-adoption-of-national-aistrategy/