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AI-Driven Supply Chain: Investigating the Impact of Artificial Intelligence on Supply Chain Operations for the Egyptian Retail and E-commerce Market

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Abstract

Purpose: *This research aims to examine the impact of artificial intelligence capabilities on supply chain operations, in particular demand forecasting and inventory management, in the Egyptian retail and e-commerce industry. In a modern supply chain, digitalization plays a vital role in integrating advanced technologies into supply chain processes. The use of digital technologies allows organizations to achieve better operational efficiency, monitor supply chain practices, make data-based decisions, and respond rapidly to market fluctuations.*

Design/Methodology/Approach: *The research design employed mixed methods; a qualitative research design was conducted through seven semi-structured interviews with people holding managerial and operational roles in selected retail companies that have incorporated artificial intelligence applications into their supply chain operations. A quantitative research design was conducted using online surveys sent to employees of retail firms that were currently using AI in their supply chains.*

Findings: *The findings of this study indicate that artificial intelligence capabilities have a significantly positive impact on supply chain operations, which leads to better demand forecasting and inventory management. The results also imply improvements in decision-making and supply chain visibility, minimization of forecast errors, and optimization of inventory. The findings of the interviews align with this conclusion because industry experts stated that applying artificial intelligence improved supply chain performance.*

Research implications/limitations: *This study addresses the limited empirical evidence on AI in Egypt's retail and e-commerce sector by examining the relationship between AI capabilities and supply chain operations. Using a mixed-methods approach, the study combines quantitative evidence with industry insights to provide a contextual perspective on AI capabilities in the supply chain. It motivates further academic investigation into AI integration across supply chain processes and lays the groundwork for exploring its technological, operational, and strategic implications. The study builds on the Resource-Based View (RBV) by defining AI capabilities as organizational capabilities that help firms effectively use data, analytics, and technology to improve supply chain performance.*

Practical implications/limitations: *The results show that the capabilities of AI can help retail and e-commerce companies in enhancing demand forecasting and inventory management. To get the benefit of these capabilities, companies need to enhance data-driven decision-making, system integration, data quality, and organizational capabilities. The findings are context-specific and driven by organizational capability and AI adoption levels.*

Originality: *Based on Resource-Based View (RBV) theory, the study frames AI adoption in the Egyptian retail market. The paper bridges a critical literature gap by providing empirical, mixed-method evidence on how AI resource deployment operates within the unique constraints and volatility of an emerging market (Egypt). The paper addresses the low adoption rate of AI in the region, positioning AI capabilities as rare, non-substitutable resources that drive superior performance in demand forecasting and inventory optimization within emerging markets. Rather than treating AI merely as an IT tool, the research frames AI as an organizational resource that reconfigures supply chain capabilities—enabling real-time decision-making, adaptive forecasting, and dynamic inventory control.*

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Keywords: *Artificial Intelligence, Demand Forecasting, Egyptian Retail Sector, Inventory Management, Operational Efficiency, Supply Chain Management.*

1. Introduction

Modern global supply chains require businesses to sustain supply chain operations through flexible systems that need to respond quickly and achieve integrated operational plans. Both global market expansion and growing competitive pressures force companies to improve operational effectiveness (Sujatmiko *et al*., 2024). Demand forecasting and inventory management are considered necessary essentials of supply chain operations because of cost efficiency, service quality, and overall organizational performance. However, accurate forecasting and actual inventory control have become increasingly challenging because of market instability and changes in consumer needs, which highlights the need to move forward with complex technical and data-driven solutions.

There have been various inefficiencies in traditional supply chains, including inefficient resource utilization, slow decision-making, and imbalanced inventory due to changes in demand levels, supply chain disruptions, and over-reliance on static historical data (Guo *et al*., 2025). The challenges have also been heightened by globalization, increased customer expectations, and organizations' inability to address these trends through technological means (Delbufalo, 2022). To increase resilience and agility in the industry, there has been a move towards Smart Supply Chains (SSC), which are digitally integrated processes using AI, IoT, and Big Data Analytics (Teixeira *et al*., 2025). The digitalization of the process is a key transformation from historical planning to dynamic and real-time optimization through advanced data-driven technology (Yang *et al*., 2024). Through this, companies can increase their forecasting accuracy, optimize inventory, reduce disruptions, minimize manual errors, and create a foundation for future AI adoption (Nazara *et al*., 2024).

Organizations today are using advanced technologies such as Artificial Intelligence (AI) as the main technology solution (Pricopoaia *et al*., 2025). AI technologies enable companies to process large data sets, which helps in identifying complex patterns and enhancing the decision-making process (Macron, 2025). AI improves demand forecasting accuracy and enhances inventory management in retail and e-commerce businesses, which have unpredictable demand trends and complicated operational systems (Chidozie *et al*., 2024).

Despite the growing body of academic research on AI applications in supply chain management, most studies have focused on developed economies or general operational improvements. Limited attention has been given to the detailed impact of AI on supply chain operations, specifically in demand forecasting and inventory management in emerging markets, particularly within the Egyptian retail sector. Addressing this crucial gap is not just academically important but also essential from a practical perspective of supporting Egypt's retail and e-commerce sector with the objectives of Egypt's digital transformation targets set by such national strategies as Egypt Vision 2030. This highlights an important research gap and the need for an empirical study within this context.

Therefore, this study aims to investigate how AI capabilities impact supply chain operations, specifically in the Egyptian retail and e-commerce industry. The study seeks to identify the benefits derived from the deployment of AI-driven technologies across supply chain operations in the Egyptian retail and e-commerce sector. The study seeks to identify the benefits derived from the deployment of AI-driven technologies across supply chain operations in the Egyptian retail and e-commerce sector. Moreover, the study aims not only to evaluate the results of AI-driven solutions on improving demand forecasting accuracy and inventory management efficiency in the retail sector but also seeks to create a strong conceptual framework describing the relationship between the usage of AI and supply chain performance measures in the Egyptian retail industry. Finally, recommendations are intended in this study to use artificial intelligence in supply chain operations to improve overall performance in the Egyptian retail and e-commerce industry.

Consequently, this study uniquely contributes new empirical evidence about the influence of artificial intelligence technologies on demand forecasting and inventory management in Egypt's retail and e-commerce industry. While most studies are conceptual in nature, this research shows the practical value of artificial intelligence through an analysis of the impact that it has on forecasting and inventory management performance. In addition, the results can be useful for making practical decisions concerning AI capabilities within e-commerce businesses in Egypt and help reach the goals of digital transformation of the country. The study thus bridges the gap between the theoretical perspective of AI and its practical effects for supply chain efficiency.

To pursue the above objectives, the study explores the use of AI in supply chain operations within the Egyptian retail industry. Research questions that will be answered in this study include: (1) How do AI capabilities impact demand forecasting and inventory management in the Egyptian retail and e-commerce sector? (2) To what extent does AI enhance overall supply chain performance? Through a mixed-method approach, empirical evidence on the relationship between AI

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capabilities and supply chain operations is clearly stated in this study. The findings from this research will contribute both academically and practically, providing guidelines on how AI can be used to improve supply chain performance.

2. Literature Review

2.1 The Impact of Artificial Intelligence on Supply Chain Operations

Artificial Intelligence (AI) refers to a highly advanced technology that uses computer programs and machine learning tools to perform complex tasks, analyze large data sets, and make predictions without relying on any input from a human being. (Mishra, 2024). AI has become more significant in different industries because it can automate complicated operations and make strategic decisions, which helps companies to reduce costs, optimize resource utilization, and increase service quality (Ali *et al*., 2024).

Among these industries, supply chain management (SCM) excels as a key area for AI implementation. Supply chain complexity is increasing, which leads humanity to use artificial intelligence as one of the key tools in enhancing the overall supply chain (Nweje & Taiwo, 2025). AI technology helps to automate repetitive tasks, reduces human error, and enables organizations to focus on additional areas, which include difficult activities where human involvement is essential. (Parise, 2024). AI manages these difficulties by evaluating complex patterns in customer behavior and market trends, which helps organizations to manage inventory, forecast accurately, and use resources efficiently as demand remains changing (Shahriar, 2025). AI enhances supply chain coordination by determining the connections through the value chain. As a result, organizations can effortlessly recognize early signals of disruptions and enable preventive decision-making (Luo, 2022). To recognize this operational impact, this research studies the impact of AI within two main supply chain operations, which are demand forecasting and inventory management.

Artificial intelligence in demand forecasting is a key element of supply chain management, as its accuracy allows companies to find a balance between supply and demand, cut costs, and increase the service level. As a result, organizations are now increasingly implementing AI-based forecasting techniques to improve prediction results and support decisions based on historical data (Chandran & Basir, 2024).

Traditional forecasting methods use historical data and fixed models, which limit the ability to forecast complicated demand trends and sudden demand shifts. These limitations cause forecasting errors, which result in inaccurate forecasts that lead to overstocking, stockouts, inefficient use of resources, and decreased customer satisfaction. Moreover, the lack of integration of real-time and various data sources results in lower responsiveness and inefficiencies such as the bullwhip effect (Tulli, 2020).

AI contributes to the accuracy of demand forecasting by analyzing structured and unstructured data and finding complex patterns that help get the most accurate forecast results. Organizations use AI models to track real-time data, market trends, and external factors to be able to respond faster to demand variations (González *et al*., 2025). AI-based forecasting systems lead to more accurate predictions while enhancing operational speed, which results in improved business performance (Riad *et al*., 2024). Researchers who have led numerous studies have examined how artificial intelligence helps to improve demand forecasting by resolving the difficulties that traditional forecasting methods face.

Table 1: Previous Studies on AI Capabilities and Demand Forecasting

Author(s) & Year	Challenges in Demand Forecasting	Benefits of AI
Sullivan & Fosso Wamba (2024)	Fluctuating demand, rapid market changes, lack of adaptive inputs, and difficulty selecting reliable variables.	Improved forecasting accuracy.
Kumar et al. (2024)	Traditional time-series models are limited by static data and the inability to integrate external variables.	Integration of diverse data, improved accuracy, enhanced variance detection, and optimized inventory levels.
Kavak & Rusu (2025)	Traditional models are unsuitable for nonlinear energy demand patterns.	Improved short-term forecasting accuracy in smart systems.
Emma (2025)	Data quality issues, integration barriers, and high implementation costs.	Enhanced responsiveness and supply chain adaptability.
Judijanto et al. (2024)	Traditional demand forecasting is limited in the textile manufacturing sector.	Demand forecasting accuracy improvements.
Choudhuri (2024)	Supply chain specialists regularly face forecasting errors.	Measurable improvement in forecasting accuracy through 250 specialists surveyed.
Karim (2025)	In the supermarket and online retail sector, forecasting rate mistakes are big.	Reduced forecasting errors by up to 70%.

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Previous studies in Table 1 consistently demonstrate that AI improves forecasting accuracy, enhances responsiveness, and supports better inventory decisions. Based on the empirical evidence from these previous studies, the following hypothesis is proposed:

H1: There is a statistically significant impact of AI capabilities on demand forecasting.

Artificial intelligence in inventory management is necessary to maintain optimal amounts of inventory, reducing costs and increasing the availability of products. Thanks to artificial intelligence, today's inventory management systems can leverage current data, enabling real-time tracking and prediction-based decision-making (Nweje & Taiwo, 2025).

Traditional inventory systems are described as having limited visibility, dependence on manual processes, and a lack of real-time data. This results in inefficiencies that include having too much stock and a shortage of products, costly storage, and poor operational efficiency (Shahriar, 2025). Companies face more challenges with demand fluctuations because manual data usage increases errors and limits the ability to respond effectively (Singh & Adhikari, 2023).

AI capabilities improve inventory management through demand forecasting, inventory optimization, and automated replenishment systems. Companies use AI-based solutions to access immediate information, which helps to create accurate predictions, improve resource management, and enhance operational performance (Verma, 2024). Furthermore, AI handles risk management processes, creates effective financial planning, and develops awareness of market changes, which results in better organizational performance (Massari *et al.*, 2025).

Table 2: Previous Studies on AI Capabilities and Inventory Management

Author(s) & Year	Challenges in Inventory Management	Benefits of AI
Singh & Adhikari (2023)	Inventory shortages, inefficient tracking, and revenue loss.	Smart systems for demand forecasting, theft prevention, and automation.
Çaylı & Oralhan (2024)	Limited understanding of customer behavior affects inventory decisions.	Optimized inventory levels and faster response times.
Ismaeil & Lalla (2024)	Price volatility and high inventory holding costs.	Risk reduction and profit maximization through option contracts.
Dosdoğru et al. (2020)	Lack of accurate lead time predictions.	Improved lead time estimation using AI and simulation.
Aishwarya Lakshmi et al. (2023)	Inventory management difficulties, deficient safety stock, and poor delivery time tracking.	Enhanced safety stock, improved restocking effectiveness, and better lead-time assessment.
Karim (2025)	Stock record deviations and inconsistencies in retail store inventories.	Increased inventory accuracy by up to 15%, reducing stock record deviations.

Evidence from previous studies in Table 2 highlights the efficiency of AI in optimizing inventory levels. Based on the empirical evidence from these previous studies, the following hypothesis is proposed:

H2: There is a statistically significant impact of AI capabilities on inventory management.

2.2 Resource-Based View (RBV) Theory

The Resource-Based View (RBV) is a theoretical framework that explains how companies create competitive advantage by leveraging valuable internal resources and capabilities. The theory can help an organization gain a sustainable competitive advantage by suggesting what resources are valuable, rare, inimitable, and non-substitutable (Barney, 1991). Therefore, the theory emphasizes that the utilization of strategic resources and capabilities can improve performance (Peteraf, 1993). In this research, RBV is the theoretical foundation used to validate the fact that the application of AI technology is an ability that could enable companies to improve supply chain operations.

According to the RBV theory, the implementation of AI technology is considered an application of technological tools in combination with organizational resources. The integration of AI technology, analytics, data, and IS/IT resources with organizational processes and routines develops capabilities crucial for decision-making and business process efficiency (Przegalińska *et al.*, 2025). The operative adoption of AI capabilities depends on a firm's ability to integrate these resources instead of having only the technology. Therefore, this theory is mainly applicable to supply chain operations, where AI capabilities can support handling information, making analytical decisions, and enhancing operational processes (Ashfaq *et al.*, 2025).

Concerning the RBV, resources and capabilities derived from AI can improve the performance of supply chain operations and performance with regard to improving the capability of firm decision-making (Callefi *et al.*, 2026). In demand forecasting, when technology-based tools, forecasting capabilities, and data analytic capabilities are efficiently organized and integrated within organizational processes, the accuracy, reliability, and quality of the forecast will be improved (Chandran

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& Khan, 2024). Likewise, in inventory management, technology, technical, and organizational resources can help to achieve better inventory management, whereas the use of AI technology can further improve the performance of inventory-related processes such as optimizing stock levels, reducing operational costs, and minimizing out-of-stock and overstock scenarios (Rashid *et al*., 2026). This study uses the RBV theory in AI and supply chain operations to strengthen the research framework, highlighting that AI capabilities are strategic resources that are used in decision-making areas like demand forecasting and inventory management.

AI can be viewed as an organizational and technological capability that allows companies to effectively use AI technologies in decision-making within supply chain operations. These capabilities will help improve demand forecasting and inventory management by allowing more accurate predictions and plans. Accordingly, RBV can be used as a theoretical foundation in studying the impact of AI capabilities on demand forecasting (H1) and the impact of AI capabilities on inventory management (H2) in the Egyptian retail and e-commerce sector.

Based on the Resource-Based View (RBV), the research classifies AI capabilities as the ability related to technology and organization, which supports companies in using AI technology to improve supply chain operations, specifically demand forecasting and inventory management. Based on the theoretical background and the review of existing literature, the research framework, as shown in Figure 1, recognizes the relationship between AI capabilities as an independent variable and demand forecasting and inventory management as dependent variables.

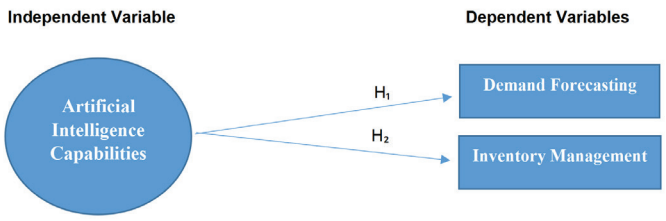


Figure 1: Research Framework and Hypothesis Model

2.2 Artificial Intelligence in E-commerce and Supply Chain Operations

Since the quick expansion of the digital economy and e-commerce is considered the main vehicle for doing business globally and providing rapid services, Artificial Intelligence (AI) has become a crucial factor in driving efficiency and competitiveness (Satija & Singla, 2025). According to Saleh & Zeebaree (2025) and Alam *et al*. (2025), using sophisticated tools of machine learning, natural language processing, computer vision, and predictive analytics derives valuable insights from enormous amounts of complex data, automates decision-making processes, improves knowledge about customers, and provides personalized experiences (Patil, 2024). The capability of conducting such an analysis on the fly allows for drastic improvements to fundamental supply chain processes, especially by building highly accurate models of dynamic demand forecasting that use structured and unstructured data and significantly reduce prediction errors amid the volatility of the markets (Riachy *et al*., 2025). Additionally, AI allows building fully automated inventory management systems that can track inventories in real time and detect products that move slowly, analyze risks, and conduct various scenario analyses (Amosu *et al*., 2024). However, realizing such operational efficiencies and maintaining the much-needed consumer trust poses several ethical dilemmas, among them algorithmic bias and the restrictions of data privacy (Kothapalli, 2022).

2.3 Artificial Intelligence in the Egyptian E-commerce Sector

In the context of the national development plan of Egypt Vision 2030, Artificial Intelligence (AI) is considered one of the cornerstone technologies necessary for achieving sustainable economic growth, social equality, and institutional capabilities (Elgohary, 2022). To actualize this vision, Egypt has developed an integrated strategy that links technological advances to sustainable development objectives in a manner of cooperation among government bodies, the private sector, and international organizations. Hence, Egypt's National AI Strategy allows the country to obtain competitive advantages and raise its economic development through three major pillars: human capital development, technology infrastructure development, and innovation (Hafez, 2022). According to the OECD (2021), the implementation of AI tools in industries such as healthcare, education, agriculture, and retail is expected to improve the effectiveness of each operation. In addition, the application of these AI technologies in the country is related to certain operational structures designed around issues of governance and ethics (National Council of Artificial Intelligence, 2023).

The e-commerce sector in Egypt gains benefits from such a structure, where industry growth has been achieved through building a digital structure on a countrywide scale, creating regulations aligned with national policies, and linking local networks to global networks (Elsafty & Hesham, 2025). The biggest push that this structural ecosystem ever got was during the coronavirus pandemic, where stringent lockdowns and social distancing fast-tracked the adoption of digitalization by consumers and businesses alike (Galal, 2023). At the same time, the government accelerated its digital transformation process through collaboration

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with various international institutions, such as UNCTAD, where information and communication technology (ICT), e-payments, e-procurement, and e-government were established as key elements for regional leadership in telecommunications (Galal, 2023). As a broad factor contributing to macroeconomic growth, e-commerce increases employment in high-value tech services and helps local commerce tap into global markets.

3. Research Methodology

This study adopts a mixed-method research design to investigate how AI impacts supply chain operations, particularly in demand forecasting and inventory management. A mixed-method approach is adopted since the study involves both qualitative data to gain in-depth insights into managerial operations and quantitative data to test relationships among variables. The qualitative part of the research includes semi-structured interviews conducted with retail companies to examine practical perceptions of how companies implement AI in supply chain operations. The quantitative part consists of the collection of primary data through a structured online questionnaire distributed to supply chain professionals in the retail sector.

Secondary data were collected by conducting a wide investigation of existing literature, which included journal articles, conference papers, and books. Academic databases, which included Google Scholar, Scopus, ResearchGate, Emerald Insight, and ScienceDirect, were used to find studies that examined AI applications in supply chain operations.

Primary data were collected through a mixed-method approach, which used both semi-structured interviews and a structured questionnaire to gather qualitative and quantitative data. According to the qualitative data, seven semi-structured interviews were conducted via Microsoft Teams with supply chain professionals from the Egyptian retail and e-commerce sectors: Carrefour, Amazon Egypt, Breadfast, Mantrac, Noon, Jumia Egypt, and Talabat. This study's targeted population involves supply chain experts employed in retail organizations in Egypt. To select the right sample of supply chain professionals, the purposive sampling technique was used to ensure they have the essential knowledge and experience in AI supply chain management. The core questions of the interview were as follows: first, the interview questions considered technology acceptance, focusing on the current state of AI tool adoption and the challenges companies face during AI integration in the supply chain. Second, the interview examined operational impacts, exploring how automated data systems change real-time demand forecasting accuracy and inventory management metrics. Third, the interviews explored strategic considerations, including how local market conditions, digital transformation, and organizational factors influence the effectiveness of AI-enabled supply chain operations in Egypt. Once the interviews were conducted, the collected data were analyzed and sorted based on the major themes of the research. Thematic analysis was employed for qualitative data. Statements relevant to the research questions from the interviews were sorted by themes that reflected AI use, demand forecasting, inventory management, operational advantages, challenges of implementation, and strategic impacts. Next, the themes were compared between the firms involved in the study to reveal similarities and differences between how each firm uses AI and its effect on the performance of the supply chains. Quantitative data were collected through a structured questionnaire developed from existing literature and aligned with the study's conceptual framework. To validate accuracy and consistency, a pilot study of 30 experts was conducted. After that, the final 300 questionnaires were distributed online through Google Forms to employees in Egyptian retail organizations, and 220 valid responses were received and statistically analyzed.

Ethical principles were maintained during the study process. The participants of the study were informed about the objectives of the study and freely agreed to be part of the study by giving their consent. No personal data was gathered through the questionnaire, and the data obtained was kept confidential and only used for research purposes. Similarly, the participants of the interview agreed to take part in the study by willingly giving their consent and being assured that the information provided would remain confidential. The interviews were conducted through Microsoft Teams and were not recorded. Personal identification details of participants, such as names, were not mentioned, while the company and professional title of participants were used for research purposes only. The questionnaire and interview responses were safely kept on the researcher's personal computer for analysis and reporting of the study findings.

The variables of the research were formed from the theoretical framework and then measured through different items derived from previous studies to ensure Validity. AI capabilities are an independent variable, and demand forecasting and inventory management are dependent variables. Demand forecasting was measured through forecasting accuracy, while inventory management was measured through inventory optimization. Each variable in the study was measured using five items, and participants responded on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). For the AI implementation, the items measured how AI has improved decision-making capabilities, accuracy, and visibility of supply chain operations. Regarding demand forecasting, the

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items evaluated the accuracy of demand forecasting, the reduction of forecasting errors, real-time visibility of demand patterns, and market uncertainty. Finally, inventory management items measured the coordination of inventory replenishment, the prevention of overstocking and stockouts, the optimization of operational expenses, and the efficiency of inventory turnover.

Analysis of the collected data was done using the Statistical Package for Social Sciences (SPSS). Descriptive statistics were used to provide a summary of the demographic variables of the respondents. The reliability of the measurement scale was determined using Cronbach's alpha. Correlation analysis was used to find the relationship between artificial intelligence and supply chain operations. Regression analysis was also used to evaluate the hypotheses and determine how artificial intelligence affects supply chain operations to recognize empirical evidence for the research framework.

4. Results

4.1 Interview Findings

Qualitative findings developed from semi-structured interviews performed with professionals from seven retail and e-commerce companies operating in Egypt, including Carrefour, Amazon, Breadfast, Mantrac, Noon, Jumia, and Talabat.

All firms have used AI to enhance efficiency, improve forecast accuracy, and respond quickly to changes in the market. Furthermore, all industries benefit from the adoption of AI since firms can monitor their operations efficiently, make better decisions, and reduce their operating costs. Before the adoption of AI, firms were encountering several challenges, such as demand uncertainty, stock imbalance, and inefficient manual work. Nevertheless, the use of AI has achieved major improvements, such as enhanced inventory control, reduced waste, and maximized service efficiency.

The findings clarify that AI adoption increases the accuracy of demand forecasting. AI helps in organizing structured and unstructured data, recognizing trends, and adjusting to economic instabilities and changes in consumer behavior. Some of the advantages stated by the firms about AI usage include the ability to minimize forecasting mistakes, optimize product availability, and balance supply and demand. Furthermore, AI adoption increases the optimization of inventory management. AI allows inventory to be tracked instantly, makes automated decisions on inventory replenishment, and determines required safety stocks. Among the advantages reported by the firms, applying AI improves inventory turnover ratios, minimizes shortages and excess inventory, optimizes working capital management, and enhances visibility in the supply chain.

The findings show that the use of AI technology brings various advantages to firms in terms of operations and organization. These advantages include enhanced productivity, cost reduction, quicker decision-making, and better customer service. Operational effectiveness is achieved in firms by reducing the use of manual work and operating through a strategic approach. According to future predictions, the future of supply chain operations will be defined by artificial intelligence technology. Thus, firms have plans to implement AI in other supply chain operations for better decision-making. As revealed during the interviews, firms need not only to invest in AI technology but also in employees' training because, if not, AI cannot be valuable to the supply chain management process.

4.2 Questionnaire Findings

The quantitative study has been conducted using data collected from the structured questionnaire. A total of 220 valid responses were obtained and included in the analysis. The data collected were analyzed using SPSS.

4.2.1 Descriptive Analysis

The study investigates nine companies in Egypt's retail and e-commerce sector, which include Carrefour, Amazon, Breadfast, Jumia, Noon, Mantrac, Gourmet Egypt, Al Araby Group, and Talabat Mart. The sample consists of professionals who work in essential supply chain positions, with the largest proportions being operations managers 20.9% and inventory management professionals 20.0%, followed by supply chain managers 15.5% and demand planners (10.5%. Most respondents have 2 to 10 years of experience, and all participants work for large organizations that employ more than 250 staff members.

The sample population was drawn from e-commerce, which accounted for 40.9% of the sample, retail 35.0%, followed by electronics 12.7%, and heavy equipment 11.4%. Regarding AI adoption, 66.8% of organizations have implemented AI for 1–3 years, while 33.2% have used it for more than three years. AI is applied in both demand forecasting and inventory management using in-house systems, SAP, and other technologies such as Syncron PIC, RELEX, machine learning models, Amazon SageMaker, AI bots, and natural language processing tools.

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4.2.2 Reliability Analysis (Cronbach's Alpha)

➢ AI Capabilities Analysis

Table 3: AI Capabilities - Cronbach's Alpha Results

Variable	Cronbach's α	Number of Items
AI Capabilities	**.762**	**5**

As shown in Table 3, the AI capabilities scale consists of five items and has a Cronbach's alpha value of .762. This value shows an acceptable level of internal consistency among the items measuring AI capabilities.

➢ Demand Forecasting Analysis

Table 4: Demand Forecasting - Cronbach's Alpha Results

Variable	Cronbach's α	Number of Items
Demand Forecasting	**.805**	**5**

According to Table 4, the five items measuring demand forecasting have a Cronbach's alpha value of .805. This value shows a good level of internal consistency among the items measuring demand forecasting.

➢ Inventory Management Analysis

Table 5: Inventory Management - Cronbach's Alpha Results

Variable	Cronbach's α	Number of Items
Inventory Management	**.817**	**5**

As shown in Table 5, the five items measuring inventory management have a Cronbach's alpha value of .817. This value shows a good level of internal consistency among the items measuring inventory management.

4.2.3 Construct Validity

To assess construct validity, Exploratory Factor Analysis (EFA) was conducted to test whether the items within the questionnaire were appropriately grouped according to the three theoretical concepts of this study: AI Implementation, Demand Forecasting, and Inventory Management.

Table 6: KMO and Bartlett's Test Results

KMO Measure of Sampling Adequacy	**0.746**
Bartlett's Test of Sphericity – Approx. Chi-Square	**1093.195**
df	**105**
Sig.	**.001**

As presented in Table 6, the KMO value was 0.746, indicating an acceptable level of sampling adequacy for factor analysis. The result of Bartlett's Test was statistically significant (χ^2 = 1093.195, df = 105, p = .001). This indicated that there are significant correlations between the items of the questionnaires. These findings showed that the data were applicable for conducting factor analysis.

Table 7: Total Variance Explained Result

Factor	Initial Eigenvalue	% of Variance	Cumulative %	Extraction Sum of Squared Loadings	% of Variance	Cumulative %
1	3.522	23.481	23.481	3.015	20.099	20.099
2	2.733	18.219	41.700	2.238	14.920	35.019
3	2.125	14.169	55.869	1.606	10.704	**45.723**

According to Table 7, the eigenvalues exceeded 1 for the three factors, which were 3.522, 2.733, and 2.125. Therefore, the three factors explained 45.723% of the total Variance among all the 15 variables in the questionnaire, where the first factor contributed to 20.099%, the second factor to 14.920%, and the third factor to 10.704%. Accordingly, the findings support the inclusion of a three-factor solution, which aligns with the three theoretical variables of the research.

Table 8: Rotated Factor Matrix Results

Questionnaire Item	Factor 1: Inventory Management	Factor 2: Demand Forecasting	Factor 3: AI Capabilities
IM1	**0.838**		
IM2	**0.707**		
IM3	**0.665**		
IM4	**0.598**		
IM5	**0.598**		
DF1		**0.778**	
DF2		**0.758**	
DF3		**0.685**	
DF4		**0.634**	
DF5		**0.479**	
AI1			**0.831**
AI2			**0.664**
AI3			**0.606**
AI4			**0.550**
AI5			**0.460**

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As shown in Table 8, the items of the questionnaire were grouped into three extracted factors. In particular, five Inventory Management items were grouped into Factor 1 with factor loadings ranging from 0.598 to 0.838, five Demand Forecasting items were grouped into Factor 2 with factor loadings ranging from 0.479 to 0.778, and five AI Capabilities items were grouped into Factor 3 with factor loadings ranging from 0.460 to 0.831. Overall, the items showed an alignment with theoretical concepts, with no substantial cross-loadings observed.

To conclude, the loading of the factors was in relation to the conceptual framework used in the study. The findings from KMO and Bartlett's Test, as well as the three-factor solution through factor analysis, provide evidence supporting the construct validity of the measurement tool.

4.2.4 Correlation Analysis

Table 9: Correlation Analysis between the Variables

Variable	1	2	3
AI Capabilities			.862**
Demand Forecasting	.903**		
Inventory Management		.797**	
N = 220 **. Correlation is significant at the 0.01 level (2-tailed)			

As shown in Table 9, the research variables showed strong to very strong positive and statistically significant correlations at the 0.01 level. First, AI capabilities show a very strong positive correlation with demand forecasting ($r = .903$, $p < .001$), showing a statistically significant relationship between higher levels of AI capabilities and demand forecasting performance. Second, AI capabilities are very strongly and positively correlated with inventory management ($r = .862$, $p < .001$), showing a statistically significant relationship between AI capabilities and inventory management performance. Finally, demand forecasting and inventory management showed a strong positive and statistically significant relationship ($r = .797$, $p < .001$), signifying that higher demand forecasting performance is relevant to better inventory management performance.

4.2.5 Regression Analysis and Hypothesis Testing

➢ **Regression 1: AI Capabilities → Demand Forecasting**

Table 10: Regression 1 Model Statistics

Model	*R*	R^2	Adjusted R^2	Std. Error of the Estimate
1	.903 [a]	.816	.815	.182
Predictors: (Constant), AI Implementation				

The results in Table 10 indicate a very strong positive relationship between AI capabilities and demand forecasting. The correlation coefficient ($R = 0.903$) shows a strong relationship between the variables. The coefficient of determination ($R^2 = 0.816$) also indicates that AI capabilities explain 81.6% of the variation in demand forecasting. The adjusted R^2 (0.815) shows that, after adjustment for the number of predictors in the model, almost 81.5% of the Variance in demand forecasting is explained by AI capabilities. The standard error of the estimate (0.182) is the deviation between the detected and predicted values of demand forecasting.

Table 11: Variance for Regression 1

Model	Sum of Squares	*df*	Mean Square	*F*	Sig.
1 Regression	31.938	1	31.938	968.221	.000[b]
Residual	7.191	218	.033		
Total	39.129	219			
a. Dependent Variable: Demand Forecasting					
b. Predictors: (Constant), AI Capabilities					

As shown in Table 11, the ANOVA results show that the regression model is statistically significant, $F = 968.221$ at $p < .001$. This significant F-test shows that the regression model including AI capabilities provides a statistically significant prediction of demand forecasting compared with a model containing only the intercept. Thus, the results provide proof of a statistically significant relationship between AI capabilities and demand forecasting.

Table 12: Coefficients Table for AI Capabilities -Demand Forecasting Model

	B	Std. Error		*t*	Sig.
1 (Constant)	.794	.107		7.451	.000
AI Capabilities	.851	.027	.903	31.116	.000
a. Dependent Variable: Demand Forecasting					

As shown in Table 12, the results demonstrate a positive and statistically significant relationship between AI capabilities and demand forecasting performance ($\beta = 0.903$, $p < 0.001$). The positive coefficient indicates that higher levels of AI capabilities are associated with higher levels of demand forecasting performance. The unstandardized coefficient (B=0.851) means that for a one-unit increase in AI capabilities, the demand forecasting performance will increase by 0.851 units. The regression model can be expressed as:

Demand Forecasting = 0.794 + 0.851 (AI Capabilities)

The statistically significant positive regression coefficient provides empirical support for H1, which proposes that

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there is a statistically significant impact of AI capabilities on demand forecasting. Therefore, H1 is supported. From an RBV theory perspective, this finding suggests that AI capabilities could be considered valuable organizational resources for companies to manage all information and improve demand forecasting activities.

➢ **Regression 2: AI Capabilities → Inventory Management**

Table 13: Regression 2 Model Statistics

Model	*R*	R^2	Adjusted R^2	Std. Error of the Estimate
1	.862[a]	.743	.742	.252
a. Predictors: (Constant), AI Capabilities				

The regression analysis presented in Table 13 indicates a strong positive relationship between AI capabilities and inventory management. The correlation coefficient (R = 0.862) indicates a very strong relationship between both variables. The coefficient of determination (R^2 = 0.743) indicates that AI capabilities explains 74.3% of the Variance in inventory management. The adjusted R^2 of 0.742 indicates that, after adjustment for the number of predictors, almost 74.2% of the Variance in inventory management is explained by AI capabilities. The standard error of the estimate (0.252) is the deviation between the detected and predicted values of demand inventory management.

Table 14: Variance for Regression 2

Model	Sum of Squares	*df*	Mean Square	*F*	Sig.
1 Regression	39.971	1	39.971	630.376	.000[b]
Residual	13.823	218	.063		
Total	53.793	219			
a. Dependent Variable: Inventory Management					
b. Predictors: (Constant), AI Capabilities					

As presented in Table 14, the ANOVA results indicate that the regression model is statistically significant, F = 630.376, p < .001. This significant F-test indicates that the regression model, including AI capabilities, delivers a statistically significant prediction of inventory management. Therefore, the results provide evidence of a statistically significant relationship between AI capabilities and inventory management.

Table 15: Coefficients Table for AI Capabilities - Inventory Management Model

	B	Std. Error	β	*t*	Sig.
1 (Constant)	.129	.148		.876	.382
AI Capabilities	.952	.038	.862	25.107	.000
a. Dependent Variable: Inventory Management					

The results of Table 15 indicate that AI capabilities are a positive and statistically significant predictor of inventory management performance (β = 0.862, p < 0.001). The positive coefficient indicates that higher levels of AI capabilities are associated with higher levels of inventory management performance. The Unstandardized coefficient (*B*=0.952) means that a one-unit increase in AI capabilities will result in a 0.952-unit increase by 0.952 units in inventory management performance. The regression equation is as follows:

Inventory Management = 0.129 + 0.952 (AI Capabilities)

The statistically significant positive regression coefficient provides empirical support for H_2, which proposes that there is a statistically significant impact of AI capabilities on inventory management. Therefore, H_2 is supported. From an RBV perspective, this finding suggests that AI capabilities could be considered valuable organizational resources for companies to analyze inventory-related data and enhance inventory management activities.

Table 16: Summary of Regression Results and Hypotheses Testing Decision

Hypothesis	Regression Equation	Regression Results	Decision
H_1: There is a statistically significant impact of AI capabilities on demand forecasting.	Demand Forecasting = 0.794 + 0.851 (AI Capabilities)	β = 0.903, p < 0.001 *B* = 0.851	**Supported**
H_2: There is a statistically significant impact of AI capabilities on inventory management.	Inventory Management = 0.129 + 0.952 (AI Capabilities)	β = 0.862, p < 0.001 *B* = 0.952	**Supported**

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As summarized in Table 16, the quantitative analysis presents strong empirical evidence of statistically significant positive relationships between AI capabilities and demand forecasting and inventory management. Based on the results, AI capabilities are significantly correlated with improved demand forecasting and inventory management performance. For that reason, both H_1 and H_2 are supported.

4.3 Integration of Quantitative and Qualitative Findings

The integration of both the quantitative and qualitative findings provided further insight into the link between AI capabilities and supply chain operations in the Egyptian retail and e-commerce industry. Quantitative data collection included a sample of 220 questionnaires. Meanwhile, the qualitative data were gathered using semi-structured interviews conducted with seven retail and e-commerce firms in Egypt. The combination of both sources of evidence focuses on the two main relationships examined in the study.

4.3.1 AI Capabilities and Demand Forecasting

The results from the questionnaires conducted among 220 participants revealed a strong positive correlation between AI and demand forecasting ($r = .903$, $p < .001$), which also indicates that AI capabilities explains 81.6% of the variation in demand forecasting, supporting H_1. These results are validated by the results from the interviews, which show that the seven firms use AI in their operations in order to analyze data, spot trends, respond to changes in consumer behaviors, and minimize forecasting errors. Therefore, the qualitative findings deliver useful support for the strong relationship recognized quantitatively and show how AI contributes to improved demand forecasting.

4.3.2 AI Capabilities and Inventory Management

The results from the questionnaires conducted among 220 participants revealed a strong positive correlation between AI and inventory management ($r = .862$, $p < .001$), which also indicates that AI capabilities explain 74.3% of the variation in inventory management, supporting H_2. The interview results further strengthen these findings, where firms indicate that AI technology is being used in real-time inventory monitoring, automatic reordering, safety stock decisions, and the prevention of shortages and excessive inventory. Therefore, the qualitative evidence delivers real support for the quantitative finding that AI contributes to improved inventory management.

5. Discussion

After analyzing the relationship between all variables, the results of the study prove that AI technologies have a significant impact on improving supply chain operations performance in the retail and e-commerce industry in Egypt. Quantitative findings indicate a high degree of influence of artificial intelligence on demand forecasting and inventory management, implying that the application of artificial intelligence enhances the efficiency of forecasting and inventory management. Similarly, qualitative findings revealed that the respondents consider artificial intelligence an effective tool in conducting real-time analysis, hence improving forecasting and inventory management in a more controlled manner.

Regarding H_1: *There is a statistically significant impact of AI capabilities on demand forecasting*; the results show a strong positive relationship between AI capabilities and demand forecasting. The respondents justified that through AI technology, past and present data can be processed effectively, enabling companies to forecast the demand for their products or services with greater accuracy. From an RBV theory perspective, this finding recommends that AI capabilities can be considered as valuable organizational resources that support companies in demand forecasting activities. The ability to efficiently use AI capabilities may then provide companies with the vital ability to support data-driven forecasting decisions. These findings are consistent with those of previous research studies conducted by Tulli (2020), which recognized the importance of AI in supporting demand forecasting.

Similarly, H_2: *There is a statistically significant impact of AI capabilities on inventory management*; the findings revealed a positive relationship between AI capabilities and inventory management. The quantitative results also discovered that organizations utilizing AI technology experienced an improvement in inventory optimization, availability, and efficiency. Furthermore, the qualitative findings revealed that the use of AI technology enabled organizations to control inventory levels in real-time and thus avoid those demanding situations, either stock shortages or excess stock. From an RBV theory perspective, this finding suggests that AI capabilities could be considered valuable organizational resources for companies to analyze inventory-related data and enhance inventory management activities. The ability to utilize AI capabilities may then provide companies with a vital ability to support inventory-related decision-making. In general, the findings of this study are consistent with the findings of previous studies. Amosu et al. (2024) and Shahriar (2025) have both shown that the use of AI technology improves inventory management by minimizing stockout and excess stock situations.

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The findings contribute to the theoretical understanding of AI in supply chain operations by applying the Resource-Based View to the relationship between AI capabilities and supply chain operations. Specifically, empirical evidence of the significant relationship between AI capabilities and two key elements of supply chain operations: demand forecasting and inventory management. In view of the RBV theory, the findings propose that AI should not be viewed only as a technological tool but also as an organizational capability that can help firms leverage their data and technological resources to make better decisions regarding the supply chain. The robust relationships found from the study serve as evidence that validates the usefulness of AI capabilities within an RBV theory in explaining supply chain effectiveness.

The findings of this study show how AI could help meet the operational needs of the fast-growing retail and e-commerce industry in Egypt. The quantitative analysis findings indicated that AI technology reduced variation in demand forecasting by 81.6% and in inventory management by 74.3%, thus proving the positive influence of AI on the supply chain operations. This is mainly important since the fast-growing retail and e-commerce industry in Egypt, with revenues increasing from about USD 1.47 billion in 2017 to a forecast of USD 18 billion in 2029, is driven by increased digitization, internet penetration, mobile penetration, and changing customer behavior (E-Commerce Market in Egypt, 2024). As Egypt's e-commerce industry keeps growing, the ability to predict customer demand and have enough stock to meet that demand increases. Hence, the important role played by AI in demand forecasting and inventory management, as recognized in this study, becomes valid proof of how Egyptian companies can employ AI to recognize the challenges posed by such growth. This quantitative evidence is accompanied by the qualitative data delivered by interviews with the seven companies, which proved the practical use of AI for supply chain activities. Moreover, the findings of the study are aligned with Egypt's national agenda for AI implementation, since AI is aiming to play a role in recognizing the vision of Egypt 2030 and sustainable development initiatives in the country through the use of AI for economic development, technological innovation, and competitiveness (NCAI, 2025). In the context of Egypt's National AI Strategy, "AI for Development" is known as one of the strategy's pillars, with specific application areas of AI in Egypt, including retail (MCIT, 2025). Accordingly, the findings provide an Egypt-based empirical insight into the potential of AI for the development of the digital commerce industry and overcoming supply chain-related issues.

Overall, the above discussion shows that the application of AI plays a significant part in enhancing the efficiency of the supply chain by optimizing forecasting and inventory management. Organizations make suitable and accurate decisions after adopting AI in their supply chain operations.

6. Conclusion

Modern supply chain issues such as increasing market instability, ineffective inventory management, demand unreliability, and limited trend visibility were examined in this study. As evidenced by the above analysis, companies involve advanced technologies in their supply chain operations to overcome unpredictable difficulties, make effective decisions, and increase operational efficiency. Moreover, the research analyzed how AI impacts supply chain operations, and the findings proved that AI tools improve forecasting accuracy and inventory management optimization. AI technologies allow companies to forecast demand patterns with greater accuracy, which leads to better inventory management that avoids stockout and overstock problems. The research study indicated that the retail industry in Egypt is facing rapid growth, which drives its shift into digital technologies. Egypt shows its commitment to digitalization through increasing adoption of AI technologies, which supports the goals of Vision 2030. The competitive advantages of all companies have increased through AI adoption, which also results in better customer experience and more efficient supply chain management.

7. Implications of the Study

Theoretical Implications

This study contributes to the body of knowledge regarding artificial intelligence and supply chain management by providing empirical evidence of the significant relationship between AI capabilities, demand forecasting, and inventory management. It builds on the Resource-Based View (RBV) theory by defining artificial intelligence capabilities as organizational capabilities that will help firms use data, analytics, and technology to improve their supply chains. The study contributes additional context-specific evidence for the retail and e-commerce industry in Egypt, which is an emerging market that has limited empirical studies on artificial intelligence-based supply chain management. The study becomes more complete by combining quantitative evidence with industry insights to provide a contextual perspective of AI's capabilities in the supply chain, which also serves as a base for further studies in developing countries and motivates more academic investigations into the integration of AI technologies in supply chain processes in different sectors.

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Practical Implications

The results of the research help to provide practical guidance to retail and e-commerce companies trying to enhance their supply chain operations through the use of AI capabilities. The significant relationships identified between the three variables propose that companies could apply AI-based analytical tools and prediction methods to support more accurate forecasting, improve inventory planning, and respond more effectively to changes in market demand. Nevertheless, the successful implementation of such technology requires more than just the adoption of AI technologies. Companies need to ensure that there will be good-quality data available, develop employees' analytical and technological skills, and create organizational commitment to data-driven decision-making. The integration of AI in the supply chain and the development of technical capabilities among employees can enable companies to benefit from AI technology.

8. Recommendations

The government of Egypt should work towards strengthening national artificial intelligence strategies concerning Egypt Vision 2030 and the National Artificial Intelligence Strategy. The creation of clear control frameworks will empower companies to accomplish supply chain data collection and sharing, and usage practices, which will affect ethical and secure AI adoption. In addition, financial incentives and funding initiatives should be introduced to inspire investment in AI technologies and in advanced digital infrastructure with the aim of supporting large-scale digital transformation. Furthermore, the development of educational policies, training programs, and skill development initiatives will generate a workforce that has expertise in AI and data analytics.

Organizations in the Egyptian retail sector should implement an AI-powered demand forecasting and inventory management system to improve operational processes and decision-making accuracy. Retailers should adopt automation and the use of artificial intelligence in the supply chain process to avoid forecasting errors, stockout situations, and overstocking of goods. To activate AI technologies successfully, companies need to allocate resources to employee training programs that help workers develop skills. Moreover, companies must create practices that enable supply chain partners to share data and integrate systems, which will result in better visibility, coordination, and faster response times. Organizations should continue implementing digital technologies because this will contribute to the achievement of competitive advantages, the reduction of costs, and improved services.

9. Research Limitations and Future Research

The study has several limitations that need to be recognized. There is low use of AI in the supply chain by the Egyptian retail industry, and therefore, the availability of participants and the interview sample was affected negatively. The study is concentrated only on one geographical location and industry, and that means the results cannot be generalized to different areas and industries. In addition, the opinions of this study have been focused on supply chain managers and employees, but have ignored the thoughts of other participants who could provide further data related to AI implementation.

Regarding these limitations, this study needs to be enhanced by further research through integrating other new perspectives and stakeholders, such as suppliers and customers. Comparative studies between different sectors and countries will help us understand best practices that should be taken into consideration in the process of AI implementation. Future studies might be performed on how the execution of specific advanced AI, such as reinforcement learning, digital twins, or IoT, enhances the effectiveness of the supply chain. Furthermore, future studies can be conducted on how AI implementation impacts organizational and human aspects, which include workforce transformation, skill expansion, human-machine collaboration, and company culture revolution.

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