

# The Impact of Artificial Intelligence on Competitiveness—An Exploratory Study on Employees in Logistics Companies in Egypt

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## Abstract

This dissertation investigates the impact of artificial intelligence (AI) adoption on the competitiveness of logistics companies in Egypt, focusing on its role in enhancing operational efficiency, service quality, and customer satisfaction. Using a post-positivist quantitative approach, data were collected through structured interviews with 41 logistics professionals covering automation adoption, technology cost perception, demographic influences, operational challenges, and competitive outcomes, followed by a questionnaire survey of 384 employees across logistics organization includes three sections related to the two variables artificial intelligence and competitiveness, besides the demographic variables, containing (gender, age, place of residence, years of job experience, position of decision-makers, and company size). The findings indicate that AI implementation significantly improves competitiveness by reducing costs, enhancing productivity, and strengthening customer experience; however, most small and medium-sized firms face reduced efficiency due to early-stage adoption challenges, high implementation costs, weak strategic alignment, poor data quality, limited expertise, and employee resistance. Demographic factors such as age, experience, and company size significantly influenced AI awareness and competitiveness perceptions, while gender, residence, and job role did not. The study confirms a strong positive relationship between AI adoption and business growth, with competitiveness acting as a mediating factor, and concludes that effective, context-aware AI integration—balanced with human expertise—is essential for sustaining competitive advantage in the Egyptian logistics sector.

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## Keywords

Artificial Intelligence, Logistics, Competitiveness, Customer Experience, Operational Efficiency, Digital Transformation, Cost Reduction, Sustainability

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## 1. Introduction

In the era of rapid technological advancement and digital revolution, the logistics industry has witnessed an unprecedented rise in technology-based logistics trends, which heavily rely on automation and artificial intelligence (AI). In recent years, the logistics industry has relied heavily on its dynamism, adaptability, and continuous integration of advanced technologies into daily business operations. The integration of technology within logistics is a sign of a profound and lasting change in the industry, as the logistics journey is undeniably intertwined with technological advancements, and the adoption of this trend is crucial for improving productivity and service performance in an increasingly digital world, enhancing operational efficiency, and shaping the core of logistics operations (Manohar et al., 2024).

Bahayou (2023) reveals that the performance of the internal logistics system has a strong influence on the overall competitiveness of companies and that the evolution of global trade and business has created a fierce rivalry, requiring organizations to develop new strategies to maintain a sustainable competitive advantage. To maintain or improve competitiveness, it is necessary to continuously improve and enhance the internal logistics system. The main objective, therefore, is to gain a competitive edge by reducing the operational costs and improving service. Companies must therefore find solutions to keep costs low and remain competitive.

They are therefore forced to analyze all their operational activities to implement possible improvements. (Shahbandi, 2023) emphasized that companies with the continuous development and the rapid advancement of technology must set a new standard for doing business for the entire industry, and with digital transformation, carrying out activities through new technologies can provide a strong competitive edge for the company (Lan, 2022). The demand for intelligent automation is growing due to its ability to cover a wide range of domains in logistics and supply chain operations and has become a source of competitive advantage for sustainable business models and a company's ability to compete more effectively by relying on greater use of digital platforms to activate markets and thus develop activities and services. In this context, the new technological business channels, such as e-commerce and online trading, have increased in logistics companies (Fanas Rojas, 2023).

In the era of aggressive competition, companies' supply chains are powerless against unforeseen problems that may arise in the supply chains, such as in the wake of recent supply chain disruptions caused by pandemics and subsequent cri-

ses. As a result, companies need to improve their supply chain resilience, so measuring logistics costs and performance is very important to determine how best to reduce costs and improve overall performance to see where logistics operations can be made more efficient. that keeping costs low while ensuring high performance is the key to achieving a profitable business (Shahin et al., 2022).

The main objective of companies is to develop their ability to achieve profits despite competition. In this context, companies have to develop their strategies in a flexible and fast way, identifying resources and procedures that contribute to increasing productivity and developing technological techniques that allow them to achieve competitive edge and innovation, since technology has become one of the critical factors for the survival of companies in terms of developing strategic plans that allow the development of their resources and also the development of the activities and services they provide to meet the needs of customer requirements. Therefore, in this context, e-commerce activities have increased among logistics companies to meet the needs of their customers (Fanas Rojas, 2023).

Bargouthi (2023) explained in his dissertation that traditional supply chain management (SCM) is no longer sufficient for companies to gain a competitive advantage and remain successful and that companies must be able to quickly adapt to meet the customer demands. volatile market conditions and unexpected risks. This dissertation aims to study the impact of supply chain resilience enablers, namely supply chain flexibility (SCF), information sharing (ISH), integrated logistics capabilities (ILC), and supporting information technology (SIT), on enterprise performance (FP).

Logistics companies face ongoing pressure to reduce costs while optimizing resource utilization to enhance performance and competitiveness. In a globalized and technologically dynamic market, effective supply chain management has become essential for achieving sustainable competitive advantage. Advanced technologies, particularly artificial intelligence (AI), enable firms to improve operational efficiency, respond to changing customer demands, and enhance service quality across supply chain activities. Consequently, digital innovation is increasingly adopted by logistics companies to improve productivity, delivery speed, and customer satisfaction.

The rapid growth of e-commerce has intensified the need for real-time, data-driven logistics systems capable of optimizing costs and improving service performance. Prior research confirms that technology adoption strengthens competitiveness by enhancing organizational agility and responsiveness. However, despite growing interest in AI, its application in logistics and supply chain management—especially in developing economies such as Egypt—remains underexplored. Limited empirical evidence on AI adoption in resource-constrained environments creates uncertainty for logistics firms seeking to leverage AI as a source of competitive advantage.

## 2. Literature Review

Literature consistently positions artificial intelligence (AI) as a strategic organiza-

tional resource that enhances operational capabilities and drives firm competitiveness. Advances in machine learning, deep learning, and data-driven algorithms have enabled organizations to automate complex processes, optimize decision-making, and utilize internal resources more efficiently (Dwivedi et al., 2023; Ali et al., 2024). These developments support the conceptualization of AI adoption as an independent variable influencing organizational competitiveness.

Competitiveness is increasingly viewed as a multidimensional construct encompassing performance efficiency, cost control, quality, and customer experience rather than solely traditional financial indicators (Chikán et al., 2021). The literature indicates that improvements in these dimensions collectively strengthen a firm's competitive position by enhancing agility, flexibility, and adaptability in volatile markets. This supports Hypothesis H2, which proposes that the application of artificial intelligence positively influences overall firm competitiveness.

Several studies confirm that AI-based automation significantly improves operational performance by enhancing inventory management, warehouse utilization, demand forecasting, and delivery reliability (Helo & Hao, 2021; Sundarakani et al., 2021). AI-driven systems reduce process lead times, minimize human errors, and enable real-time operational control, thereby increasing efficiency and productivity (Nair et al., 2021). These findings directly support Hypothesis H2.1, which proposes that AI adoption has a positive effect on operational performance in logistics companies.

The literature further demonstrates that AI contributes to cost efficiency by automating repetitive and manual tasks, optimizing transportation routes, reducing labor and error-related costs, and improving resource allocation (Foster & Rhoden, 2020; Woschank et al., 2023). Intelligent automation allows firms to speed up processes while maintaining cost discipline, leading to improved financial performance. This empirical evidence supports Hypothesis H2.2, which states that AI adoption positively influences cost-effectiveness.

AI technologies also play a crucial role in improving service and process quality. Studies show that AI enhances accuracy, consistency, and reliability across logistics operations, including order fulfillment, inventory control, and performance monitoring (Lee & Chen, 2023). The use of smart systems and digital platforms improves productivity and service quality while enabling continuous process improvement, validating Hypothesis H2.3, which posits a positive relationship between AI adoption and quality enhancement.

Customer experience emerges in literature as a key outcome of AI implementation. AI-driven chatbots, machine learning-based personalization, and real-time shipment visibility improve customer interaction, responsiveness, and satisfaction (Wamba & Queiroz, 2021; Masriadi et al., 2023). Enhanced service reliability and transparency contribute to customer loyalty, sales growth, and market share expansion, supporting Hypothesis H2.4, which suggests that AI adoption positively affects customer experience.

Within the Egyptian logistics context, digital transformation and AI adoption are becoming critical for sustaining competitiveness amid rising e-commerce ac-

tivity and evolving customer expectations (Moussa & Tarek, 2023; Farid & El Sayed, 2023). Studies highlight the importance of ICT infrastructure, regulatory support, and organizational readiness in facilitating AI adoption and maximizing its competitive impact (Ng et al., 2021).

Ghanim et al., (2022) ensure in their research that AI is not just a technological enhancement but also a key method for business transformation, improving efficiency, agility, and innovation across industries. In Egypt, various sectors are experiencing transformative AI-enabled business operations in their respective fields.

The following table (Table 1) presents examples of successful innovation-driven startups that have achieved notable enhancements in the logistics sector.

Digital transformation in logistics is based on crucial theories and models that explain how technologies are adopted and used. By integrating these models into their AI adoption strategy, organizations can develop a systematic approach to digital transformation.

**Table 1.** Examples of innovation-driven Egyptian startups companies.

Startup Name	Description	Sector
SWVL	Sharing App of Dubai-based bus	Transportation
WUZZUF	The major platform of recruitment in Egypt	Logistics & Supply Chain
Instabug	A software platform for communication with users and teams.	Enterprise Management
PayMob	E-Payment tools for companies and individuals	Finance & Fintech
Bosta	Technology-enabled Local courier service solutions	Logistics & Supply Chain
Rology	On-demand remote radiology platform	Health
Vapulus	Smartphones' online payment gateway	Finance & Fintech
Eventtus	Platform for event management	Logistics & Supply Chain
Dopay	Cloud-based electronic payment of the payroll system	Finance & Fintech
Edfa3ly	US e-commerce sites are using payment methods to sell goods to the Middle East & Africa regions	e-Commerce
Orcas	Mobile app platform for booking babysitters and tutors in Egypt	Logistics & Supply Chain

Source: GEM Global Report, 2017/18.

In logistics, AI is not just a technology, but a strategic tool that can optimize processes, develop more personalized customer experiences, and drive innovation in business models. These models provide frameworks, tools, and pathways that

companies need to effectively integrate AI into their existing structures, making logistics operations more efficient, flexible, and better aligned with the demands of the digital economy.

The following table (**Table 2**) shows models of AI-driven technologies applied in logistics companies and the field of applications.

**Table 2.** Models of AI-driven technologies in the logistics sector.

Theory/Model	Reference	Description	Field of Application in Logistics	Examples in Application
Digital Maturity Model	Westerman et al. (2014)	offers a comprehensive framework for assessing an organization's readiness for digital transformation	The model emphasizes the alignment of strategy, culture, technology, operations, and customer experience—essential components for long-term competitiveness in the logistics sector.	UPS has applied this approach to evaluate and enhance their digital strategies, including investments in AI for predictive maintenance and digital twins for optimizing supply chain operations.
Diffusion of Innovation (DOI)	Rogers, E. M. (2003)	points on how innovations spread across organizations	In logistics, this can be seen in the adoption of technologies like autonomous mobile robots and real-time shipment tracking.	DHL has progressively integrated robotics and IoT solutions into its warehouses and last-mile operations activities.
Unified Theory of Acceptance and Use of Technology (UTAUT)	Venkatesh et al. (2003)	Depending on factors influencing technology usage, such as expectancy of performance and effort, social influence, and facilitating conditions	In logistics, factors are essential when adopting enterprise-wide platforms like IoT-enabled fleet management systems.	Maersk adopting Internet of Things (IoT) devices for fleet monitoring may depend not only on the expected efficiency benefits but also on employee training and leadership support.
Disruptive Innovation Theory	Christensen, C. M. (1997)	can eventually challenge and transform traditional logistics models with more agile and affordable solutions	particularly applicable in logistics, where low-cost, scalable innovations are redefining competition	Crowd-sourced delivery Apps such as Uber Freight or Amazon Flex exemplify how new entrants, initially serving niche or underserved markets
Technology Acceptance Model (TAM)	Davis, F. D. (1989)	Acceptance to use the new systems is based on perceived usefulness and ease	Within logistics firms, this model can identify how employees and managers evaluate new software platforms, such as transportation management systems (TMS) or warehouse management systems (WMS), before completely integrating them into daily operations.	FedEx has implemented AI-driven platforms to streamline delivery operations, with a strong emphasis on user-centric design to ensure seamless internal adoption.

Source: Authors own work.

## The Study Hypothesis

The proposed hypotheses are based on the literature review and exploratory study as follows:

H1: There is a significant correlation between the dimensions of the study variables (artificial intelligence and competitiveness).

H2: There is a significant impact of artificial intelligence on the dimensions of competitiveness in the operations of logistics companies in Egypt.

H2.1: There is a significant effect of artificial intelligence on operational efficiency in operations activities at logistics companies in Egypt.

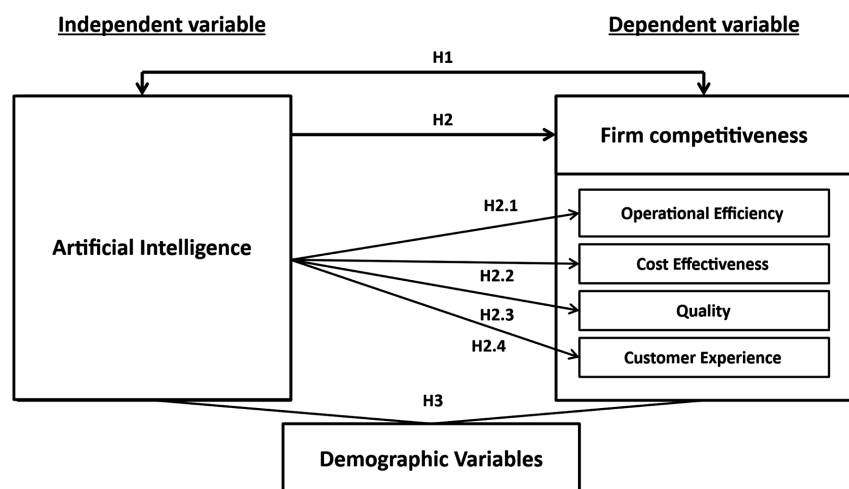
H2.2: There is a significant effect of artificial intelligence on cost effectiveness in operations activities at logistics companies in Egypt.

H2.3: There is a significant effect of artificial intelligence on quality in operations activities at logistics companies in Egypt.

H2.4: There is a significant effect of artificial intelligence on customer experience in operations activities at logistics companies in Egypt.

H3: There are significant differences in employees' awareness towards the research variables (artificial intelligence and competitiveness) according to the difference in their demographic variables (gender, age, place of residence, years of job experience, position of decision-makers, and company size).

**Figure 1** shows the conceptual framework, which presents the hypothesized relationships among the research variables forming the basis of the study hypotheses.



Source: Authors own work.

**Figure 1.** The conceptual framework.

## 3. Research Methodology

A supplementary interview with 41 employees working in logistics companies and supply chain departments covered automation adoption, technology cost perception, demographic influences, operational challenges, competitiveness outcomes and it revealed that the number of companies that have begun implementing au-

tomation is small and that the rest must accelerate in automating their services speedily because of its impact on the company's business.

A questionnaire was used as the main tool in this research to revise the effect of applying artificial intelligence on competitiveness in logistics companies in the Egyptian market. This questionnaire addressed senior management, managers, supervisors, and employees of different companies and consisted of four sections.

The questionnaire items scales were adapted from previous validated studies measuring artificial intelligence adoption across employee attitudes, organizational readiness, and operational use, and examine its impact on firm competitiveness through performance efficiency, cost effectiveness, service quality, and customer experience outcomes divided into three sections:

Section one: artificial intelligence contains (14) statements.

Section two: competitiveness contains (18) statements.

Section three: demographic variables, containing (gender, age, place of residence, years of job experience, position of decision-makers, and company size).

The research measured the responses that were collected in the questionnaire by using a Likert scale divided into five points: strongly disagree, disagree, neutral, agree, and strongly agree. Statistical methods were applied using the Statistical Package for Social Sciences (SPSS) to analyze the collected data.

The following statistical treatments were applied in research:

1) Iterations and percentages were calculated to describe the items' characteristics and to determine the responses towards the study dimensions.

2) Pearson Correlation Coefficient was used to ensure and verify the internal consistency by testing the correlation between each dimension and the overall score, as well as between each item and the respective dimensions to which it belongs.

3) Cronbach's Alpha was used to evaluate the reliability and stability of the study tool.

4) Arithmetic mean is applied to assess the general tendency of respondents' answers and to explore whether responses showed higher or lower values with each variable.

5) Standard deviation tests the degree of variation in responses. A value near zero indicates greater consistency and lower dispersion.

6) Statistical analyses for hypothesis testing:

- Descriptive analysis was conducted using arithmetic means, standard deviations, and weighted averages.
- Simple linear regression was applied to shape the impact of artificial intelligence on competitiveness.
- T-test and Kruskal Wallace nonparametric test to test the relationship between study dimensions and demographic variables.

## 4. Discussing Inferential Statistics

### 4.1. The First Study Hypothesis H1

**H1: There is a significant correlation between the dimensions of the study**

variables (artificial intelligence and competitiveness).

**Table 3** shows the test of the first study hypothesis; the researcher used a **correlation matrix** between study variables and results as follows:

**Table 3.** Correlation matrix between study variables.

		Artificial Intelligence	Operational Efficiency	Cost	Quality	Customer Experience	Competitiveness
Artificial Intelligence	Pearson Correlation	1	-.056	.222**	.245**	.143**	.258**
	Sig. (2-tailed)		.270	.000	.000	.005	.000
Operational Efficiency	Pearson Correlation	-.056	1	-.094	-.103*	-.015	.204**
	Sig. (2-tailed)	.270		.066	.043	.770	.000
cost	Pearson Correlation	.222**	-.094-	1	.511**	.345**	.695**
	Sig. (2-tailed)	.000	.066		.000	.000	.000
Quality	Pearson Correlation	.245**	-.103*	.511**	1	.415**	.798**
	Sig. (2-tailed)	.000	.043	.000		.000	.000
Customer Experience	Pearson Correlation	.143**	-.015	.345**	.415**	1	.657**
	Sig. (2-tailed)	.005	.770	.000	.000		.000
Competitiveness	Pearson Correlation	.258**	.204**	.695**	.798**	.657**	1

Source: Authors own work.

From the previous table we can notice

- 1) There is a negative, non-significant relationship between artificial intelligence and operational efficiency.
- 2) There is a positive significant relationship between artificial intelligence and cost.
- 3) There is a positive significant relationship between artificial intelligence and Quality.
- 4) There is a positive significant relationship between artificial intelligence and customer experience.
- 5) There is a positive significant relationship between artificial intelligence and competitiveness.

From previous results we can accept the first hypothesis H1

**There is a significant correlation between the dimensions of the study variables (artificial intelligence and competitiveness).**

## 4.2. The Second Study Hypothesis

**H2: There is a significant impact of artificial intelligence on the dimensions of competitiveness in the operations of logistics companies in Egypt.**

To test Second Study Hypothesis H2, the researcher tested the following sub hypothesis.

#### 4.2.1. The First Sub-Hypothesis

**H2.1: There is a significant effect of artificial intelligence on operational efficiency in operations activities at logistics companies in Egypt.**

**Table 4** shows the test of the first sub-Hypothesis, the researcher used simple regression analysis of the impact of artificial intelligence on operational efficiency.

**Table 4.** Test artificial intelligence on operational efficiency using the simple regression method.

Model	df	Sum of Squares	Mean Square	(R)	(R <sup>2</sup> )	F Test		T Test	
						Sig	value (F)	Sig	value (T)
Regression	1	205	205	-.056 <sup>a</sup>	.003	.270	1.222	.270	1.105
Residual	382	63.979	.157						
Total	383	64.183							

**Independent variable: Artificial intelligence.**

**Dependent variable: operational efficiency.**

\*\*A function at the level of significance less than (0.05). Source: Authors own work.

From the above, the first sub-hypothesis of the study is not accepted, and we accept the alternative sub-hypothesis:

**“There is a non-significant effect of artificial intelligence on operational efficiency in operations activities at logistics companies in Egypt.”**

#### 4.2.2. The Second Study Sub-Hypothesis

**H2.2: There is a significant effect of artificial intelligence on cost effectiveness in operations activities at logistics companies in Egypt.**

**Table 5** shows the test of the second study sub-hypothesis, the researcher used simple regression analysis of the impact of artificial intelligence on cost effectiveness.

**Table 5.** Test artificial intelligence on cost effectiveness using the simple regression method.

Model	df	Sum of Squares	Mean Square	(R)	(R <sup>2</sup> )	F Test		T Test	
						Sig	Value (F)	Sig	Value (T)
Regression	1	11.24	11.24	.222 <sup>a</sup>	.049	.000	19.738	.000	4.443
Residual	382	217.590	.570						
Total	383	228.833							

**Independent variable: Artificial intelligence.**

**Dependent variable: cost effectiveness.**

\*\*A function at the level of significance less than (0.05). Source: Authors own work.

From the above, it became clear that the second sub-hypothesis of the study is correct, which says:

H2.2: “There is a significant effect of artificial intelligence on cost effectiveness in operations activities at logistics companies in Egypt.”

#### 4.2.3. The Third Sub-Hypothesis

H2.3: “There is a significant effect of artificial intelligence on quality in operations activities at logistics companies in Egypt.”

Table 6 shows the test of the third sub-Hypothesis H2.3, of the study, the researcher used simple regression analysis of the impact of artificial intelligence on quality.

**Table 6.** Test the impact of artificial intelligence on Quality using the simple regression method.

Model	df	Sum of Squares	Mean Square	(R)	(R <sup>2</sup> )	F Test		T Test	
						Sig	Value (F)	Sig	Value (T)
Regression	1	19.53	19.53	.245 <sup>a</sup>	.060	.000	24.382	.000	4.938
Residual	382	306.008	.801						
Total	383	325.540							

Independent variable: artificial intelligence.  
Dependent variable: Quality.

\*\*A function at the level of significance less than (0.05). Source: Authors own work.

From the above, the third hypothesis of the study is correct, which says:

“There is a significant effect of artificial intelligence on quality in operations activities at logistics companies in Egypt.”

#### 4.2.4. Testing the Fourth Sub-Hypothesis

H2.4: “There is a significant effect of artificial intelligence on customer experience in operations activities at logistics companies in Egypt.”

Table 7 shows the test of the third sub-hypothesis H2.4 of the study, the researcher used simple regression analysis of the impact of artificial intelligence on customer experience.

**Table 7.** Test the impact of artificial intelligence on customer experience using the simple regression method.

Model	df	Sum of Squares	Mean Square	(R)	(R <sup>2</sup> )	F Test		T Test	
						Sig	Value (F)	Sig	Value (T)
Regression	1	3.641	3.641	.143 <sup>a</sup>	.020	.000	7.927	.005	2.815
Residual	382	175.443	.459						
Total	383	179.083							

Independent variable: artificial intelligence.  
Dependent variable: Customer experience.

\*\*A function at the level of significance less than (0.05). Source: Authors own work.

From the above, the fourth hypothesis of the study is correct, which says:

**“There is a significant effect of artificial intelligence on customer experience in operations activities at logistics companies in Egypt.”**

From the above-mentioned results, we can accept the second Study Hypothesis H2:

**“There is a significant effect of artificial intelligence on customer experience in operations activities at logistics companies in Egypt.”**

### 4.3. The Third Study Hypothesis

**H3: There are significant differences in employees’ awareness towards the research variables (artificial intelligence and competitiveness) according to the difference in their demographic variables (gender, age, place of residence, years of job experience, position of decision-makers, and company size).**

#### 4.3.1. Regarding the Gender Variable

To determine the validity of this hypothesis according to the gender variable, the T-test was relied upon to find out the differences in the gender variable between males and females.

**Table 8** shows the test to clarify the significant differences in employees’ awareness towards the gender variable and results were as follows:

**Table 8.** Results of the T-Test analysis test to clarify the significant differences in employees’ awareness towards the gender variable.

Variable	1. Gender	N	Mean	Std. Deviation	T-Value	Sig
Artificial Intelligence	Male	367	2.8389	0.68467	.691	.490
	Female	17	2.9600	0.72292	.657	.520
Competitiveness	Male	367	2.6045	0.48784	.639	.523
	Female	17	2.6838	0.42803	.721	.481

Source: Authors own work.

#### 4.3.2. Regarding the Age Variable

To know the opinion of the study sample regarding the difference in the impact of the study variables according to the age variable, the Kruskal-Wallis test (one of the non-parametric tests for testing the difference between more than two means) was relied upon to determine the presence or absence of statistically significant differences between the opinions of the surveyed employees regarding the difference in impact of the independent variable (artificial intelligence) and the dependent variable (competitiveness) according to the age variable.

**Table 9** shows the test to clarify the significant differences in employees’ awareness towards the age variable and results were as follows:

**Table 9.** Shows the results of the Kruskal-Wallis H test to clarify the differences between the sample's opinions regarding the variable (age) in relation to the study variables. (n = 384), DF = 2.

	2. Age	N	Mean Rank	Chi-Square	Sig.
Artificial Intelligence	less than (21) years	98	221.96	9.551	.008
	From (21) years to less than (40) years	189	180.10		
	(40) years and over	97	186.91		
Competitiveness	less than (21) years	98	204.10	1.439	.487
	From (21) years to less than (40) years	189	188.45		
	(40) years and over	97	188.67		

Source: Authors own work.

#### 4.3.3. Regarding the Place of Residence Variable

**Table 10** shows the test to clarify the significant differences in employees' awareness towards the place of residence variable and results were as follows:

**Table 10.** Shows the results of the Kruskal-Wallis H test to clarify the differences between the sample's opinions regarding the variable (Place of residence) in relation to the study variables. (n = 384), DF = 1.

	3. Place of Residence	N	Mean Rank	Chi-Square	Sig.
Artificial Intelligence	Rural	29	213.69	1.406	.236
	Urban	355	188.58		
Competitiveness	Rural	29	204.38	.502	.479
	Urban	355	189.35		

Source: Authors own work.

#### 4.3.4. Regarding the Job Experience Variable

**Table 11** shows the test to clarify the significant differences in employees' awareness regarding the job experience variable and results were as follows:

**Table 11.** Shows the results of the Kruskal-Wallis H test to clarify the differences between the sample's opinions regarding the variable (job experience) in relation to the study variables. (n = 384), DF = 3.

	4. Job Experience	N	Mean Rank	Chi-Square	Sig.
Artificial Intelligence	Less than 5 years	74	203.38	5.816	.121
	5 to less than 10 years	64	205.98		
	10 to less than 15 years	178	176.97		
	15 years and more	68	203.40		

**Continued**

Competitiveness	<b>Less than 5 years</b>	74	<b>188.93</b>	14.829	.002
	<b>5 to less than 10 years</b>	64	<b>232.45</b>		
	<b>10 to less than 15 years</b>	178	<b>172.82</b>		
	<b>15 years and more</b>	68	<b>205.86</b>		

Source: Authors own work.

**4.3.5. Regarding the Position Variable**

**Table 12** shows the test to clarify the significant differences in employees' awareness regarding the position variable and results were as follows:

**Table 12.** Shows the results of the Kruskal-Wallis H test to clarify the differences between the sample's opinions regarding the variable (Position) in relation to the study variables. (n = 384), DF = 3.

	5. Position	N	Mean Rank	Chi-Square	Sig.
Artificial Intelligence	<b>C level &amp; VP</b>	2	143.75	3.425	.331
	<b>Director</b>	49	206.89		
	<b>Manager</b>	162	181.18		
	<b>Middle level position</b>	171	198.64		
Competitiveness	<b>C level &amp; VP</b>	2	<b>192.25</b>	2.644	.450
	<b>Director</b>	<b>49</b>	<b>210.75</b>		
	<b>Manager</b>	<b>162</b>	<b>182.86</b>		
	<b>Middle level position</b>	171	<b>195.39</b>		

Source: Authors own work.

**4.3.6. Regarding the Company Size Variable**

**Table 13** shows the test to clarify the significant differences in employees' awareness regarding the company size variable and results were as follows:

**Table 13.** Shows the results of the Kruskal-Wallis H test to clarify the differences between the sample's opinions regarding the variable (Company size) in relation to the study variables. (n = 384), DF = 2.

	6. Company size	N	Mean Rank	Chi-Square	Sig.
Artificial Intelligence	<b>Large enterprise</b>	<b>89</b>	<b>199.06</b>	3.129	.209
	<b>Mid-size company</b>	<b>259</b>	<b>193.02</b>		
	<b>Small business</b>	<b>36</b>	<b>161.11</b>		
Competitiveness	<b>Large enterprise</b>	<b>89</b>	<b>223.94</b>	13.106	.001
	<b>Mid-size company</b>	<b>259</b>	<b>185.82</b>		
	<b>Small business</b>	<b>36</b>	<b>150.91</b>		

Source: Authors own work.

From the above results, we can achieve the following:

There are no significant differences in employees' awareness towards the research variables (artificial intelligence and competitiveness) according to the difference in their demographic variables (gender, place of residence, and position of decision-makers).

There are significant differences in employees' awareness of the research variables (artificial intelligence and competitiveness) according to the differences in their demographic variables (age, years of job experience, and company size).

The results show that artificial intelligence has a significant correlation with the dimensions of the study variables (artificial intelligence and competitiveness). As well, the results show that artificial intelligence has a slightly negative effect on operational efficiency and a significant positive impact on competitiveness along with cost, quality, and customer experience. The role of employees' awareness towards the research variables (artificial intelligence and competitiveness) according to the difference of their demographic variables (gender, age, place of residence, years of job experience, position of decision-makers, and company size) was also analyzed. The results show that employees' awareness of artificial intelligence and competitiveness does not significantly differ based on gender, place of residence, or decision-making position. However, significant differences exist in their awareness based on age, years of job experience, and company size.

**Table 14** below shows the results of all main and detailed hypotheses including the strength of the correlation relationship, if any.

**Table 14.** Hypothesis testing results.

Hypothesis	Independent Variable	Dependent Variable	Correlation	Regression	Supported	
H1	dimensions of artificial intelligence	dimensions of competitiveness	significant correlation	significance less than (0.05)	Yes	
H2	artificial intelligence	dimensions of competitiveness	significant effect	significance less than (0.05)	Yes	
H2.1	artificial intelligence	operational efficiency	Low negative correlation	significant level (.270), which is more than (0.05)	Non	
H2	H2.2	artificial intelligence	cost effectiveness	positive correlation	significance less than (0.05)	Yes
	H2.3	artificial intelligence	quality	positive correlation	significance less than (0.05)	Yes
	H2.4	artificial intelligence	customer experience	positive correlation	significance less than (0.05)	Yes
H3	Employees' awareness towards the research variables (artificial intelligence and competitiveness) according to the difference of their demographic variables (gender, place of residence, and position of decision-makers).	Employees' awareness of artificial intelligence and competitiveness	does not significantly differ based on gender, place of residence, or decision-making position. However, significant differences exist in their awareness based on age, years of job experience, and company size.			

Source: Authors own work.

The foregoing demonstrates that artificial intelligence (AI) has a significant impact on competitiveness. All four dimensions of competitiveness are affected by AI, except for operational efficiency, which has the least impact. This contrasts with the findings of many previous studies, as its statistical significance level was 0.270, higher than 0.05. This has been interpreted because of regulatory constraints and challenges that limit its impact.

AI is a transformative force in operational efficiency, enabling companies to improve productivity, reduce costs, and enhance customer experience. Success in an AI-driven future depends on organizations adopting a proactive approach by investing in talent and keeping pace with technological advancements. Companies that integrate AI as a core value-creation driver today will be able to compete tomorrow.

#### 4.4. Research Questions Revisited

This study explored the direct correlation between artificial intelligence and firm competitiveness. The results are discussed in detail throughout the following sections.

##### **H1: The first hypothesis explores the correlation between the study variables**

Research findings show that artificial intelligence has an impact on the competitiveness of logistics companies. Current research is based on statistical analysis and strengthens the research evidence based on theories.

Patel (2022) found that artificial intelligence (AI) can help companies gain their customers' trust and improve customer experience. The use of artificial intelligence techniques yields better supply chains, increased customer satisfaction, and improved operational performance compared to human involvement.

Kalasani (2023) analyzed in his study how artificial intelligence techniques support demand planning, supplier management, managing costs, enhancing customer experience, and improving productivity.

Another study, which was added to the literature, aimed to determine the relationship between smart technology, operating costs, and the value of a company. The article provides powerful evidence that more smart investments have a significant effect on the value of a company (Foster & Rhoden, 2020).

Edgeington & Kasztelnik (2023) have shown in their dissertation that organizations can increase their profitability by acquiring innovative products, and that technology is a means to improve competitiveness and business performance, and that innovation management plays a key factor in enhancing the internal logistics system.

##### **H2: The second hypothesis measures the effect of artificial intelligence on competitiveness through four sub-hypotheses: operations efficiency, cost, quality, and customer experience**

This study explores to measure the influence of Artificial Intelligence on companies' competitiveness and thus contributes to the overall growth of companies. The findings show the relationship between the adoption of AI and increased

competitiveness. Several authors have identified important factors that influence the competitiveness of companies, including improvements in profitability, productivity, and market share.

Research shows that AI applications contribute to direct cost reduction, an essential factor in improving operational efficiency (Fahad, 2021). Furthermore, studies have shown that there is a relationship between AI implementation and time savings in business processes, with logistics costs varying depending on the degree of automation applied (Groover, 2026).

Furthermore, research results show that AI significantly improves product quality. Gaffney (2022) previously argued that companies need technological insights to ensure efficient quality management processes. Implementing AI can help achieve quality goals, sustain competitiveness, and deliver superior efficiency and results compared to human experts (Agrawal et al., 2019; Bughin et al., 2018).

Artificial intelligence also has a substantial positive effect on customer experience. Previous studies confirm this idea, such as that of Patel (2022), who emphasizes that applying artificial intelligence helps in acquiring customer data, improving customer experience, and fostering consumer trust. From a broader perspective, Kruger (2004) states that a company's overall growth can be measured by its market position, product quality, and customer experience.

These studies illustrate the diverse applications of AI to enhance operational efficiency across industries. Companies that implement AI technologies report significant improvements in productivity, cost reduction, and service quality. Similarly, Li et al. (2022) conclude that digitalization has the greatest impact on business performance, underscoring the importance of continuous progress in digital transformation.

Pilot studies show that logistics companies face major challenges in increasing their competitiveness. Major challenges include improving operational efficiency, reducing processing time, and optimizing service quality while maintaining profitability. Advanced AI and machine learning techniques can improve business operations, but their implementation remains expensive.

The findings of the study show that artificial intelligence (AI) has no significant impact on the operational efficiency of logistics operations in Egypt. However, AI significantly improves profitability, quality, and customer experience in these operations. Based on these results, the second hypothesis of the study (H2) is accepted, which states that AI has a significant effect on customer experience in logistics operations in Egypt.

Our research shows that AI had a slightly negative impact on operational efficiency, contrasting with the findings of many previous studies. Most of the companies surveyed (293 out of 384) are small and medium-sized enterprises (SMEs). Our research shows that the insignificant impact of AI on operational efficiency may be due to early adoption challenges, internal organizational barriers, skilled labor shortages, and lack of alignment between AI solutions and logistics operations. Furthermore, the high initial investment costs are the biggest barrier to the

effectiveness of AI in improving operational efficiency.

To enhance the impact of AI, companies should focus on better integration, improved data management, workforce skills development, and high-value applications such as route optimization, predictive maintenance, and inventory management. Regular performance reviews and industry benchmarking can refine AI implementation strategies. Future research should focus on cross-industry comparisons, influencing factors, and long-term effects to better understand the role of AI in logistics.

**H3: The third hypothesis measures the significant differences in employees' awareness towards the research variables (artificial intelligence and competitiveness) according to the difference in their demographic variables (gender, age, place of residence, years of job experience, position of decision-makers, and company size).**

The research findings show that employees' knowledge of artificial intelligence (AI) and their perception of competitiveness do not differ significantly based on gender, place of residence, or whether an employee holds a decision-making position. This suggests that employees in these demographic groups exhibit relatively similar levels of understanding and awareness of AI and its role in improving competitiveness.

The lack of significant differences based on decision-making positions can be attributed to several factors. Both decision makers and non-decision makers often have equal access to AI-related knowledge and good awareness through corporate training programs, digital learning platforms, and exposure to industry trends. Many companies have standardized their policies and internal strategies that ensure that AI knowledge is shared evenly across departments and roles. Additionally, the environment of collaboration encourages employees to participate in collaborative AI discussions and initiatives, which fosters collective awareness. In some cases, the responsibilities of a role require even non-decision makers to stay updated on emerging AI technologies. This contributes to a relatively unified level of knowledge across all roles within the company.

On the other hand, significant differences emerge when employees' knowledge of AI is analyzed based on age, years of work experience, and company size. Age plays a significant role: different levels of AI knowledge can be seen in different age groups. This may be due to differences in education level and familiarity with recent technological developments.

Work experience has also been shown to be an important factor affecting AI knowledge. Employees with more years of work experience have a higher level of understanding. This may be because they have been exposed to technology-driven changes over time. Experience can also increase employees' confidence and help them adapt to AI-related tools and concepts.

Finally, company size is also related to the level of AI knowledge among employees. People who work in larger organizations have greater familiarity with AI. This is likely due to greater access to training resources, technological infrastructure, and practical applications of AI within their role. Larger companies can also

be more proactive in implementing AI-driven strategies, increasing awareness and expertise among their workforces.

**Table 15** below shows the results of all main and detailed hypotheses including the strength of the correlation relationship, if any.

**Table 15.** Research questions revisited.

Questions	Objectives	Hypothesis	Results
1) What is the nature of the correlation between artificial intelligence and competitiveness?	1) Identifying the nature of the correlation between artificial intelligence and competitiveness.	H1 There is a significant correlation between artificial intelligence and competitiveness.	Accepted
2) What is the significant influence of artificial intelligence on competitiveness?	2) Measuring the effect of artificial intelligence on competitiveness	H2 The second hypothesis measures the effect of artificial intelligence on competitiveness through four sub-hypotheses: operations efficiency, cost, quality, and customer experience	Accepted
3) What is the nature of the difference of employees' awareness towards the research variables (artificial intelligence and competitiveness) according to the difference of their demographic variables (gender, age, place of residence, years of job experience, position of decision-makers, and company size)?	3) Determining the nature of the difference of employees' awareness towards the research variables (artificial intelligence and competitiveness) according to the difference of their demographic variables (gender, age, place of residence, years of job experience, position of decision-makers, and company size).	H3 There are significant differences of employees' awareness towards the research variables (artificial intelligence and competitiveness) according to the difference of their demographic variables (gender, age, place of residence, years of job experience, position of decision-makers, and company size).	Employee knowledge of AI and competitiveness does not differ significantly by gender, location, or decision-making position. However, their knowledge varies significantly depending on age, years of work experience, and company size.

Source: Authors own work.

## 5. Conclusion

The research highlights how AI can be used as an automation tool to develop a competitive edge and what impact it has on logistics and supply chain management. Therefore, I have chosen this field of study to investigate how artificial intelligence can solve logistics problems and create value based on recent trends in artificial intelligence. As AI investment continues to grow, future research will focus on analyzing global AI investment trends, the growth rate of AI-based startups, and the changing skill requirements for the workforce. In the logistics industry, automation has stood out as a critical driver of competitiveness, enabling companies to reduce operating costs and enhance efficiency.

In conclusion, AI applications today are a potential way to improve the competitiveness of businesses, enabling faster and more accurate decision-making. Thanks to continued research and technological advancements in AI, it is expected that by the end of 2035, machines will become useful tools in our lives: robots will serve as doctors in hospitals, teachers in classrooms, and bus drivers.

Soon, humans will merge with machines that are more capable and powerful than any other machine, and businesses will deploy autonomous systems – from robots to AI support systems—that will have a direct impact on the future of personal and professional life.

### **Recommendations for Future Research**

Artificial intelligence is revolutionizing the logistics industry, providing enhanced solutions for supply chain management. In Egypt, logistics companies are increasingly adopting AI technologies to improve and enhance their competitiveness. However, more research is needed to evaluate the level of artificial intelligence application, the challenges to its implementation, and the potential impact on the logistics and supply chain.

Studies show that logistics companies face major challenges in increasing their competitiveness. Major challenges include improving operational efficiency and optimizing service quality while maintaining profitability. Advanced AI and machine learning techniques can optimize business operations, but their implementation remains expensive. Future studies should examine how AI improves decision-making, reduces costs, and optimizes logistics operations. This should provide insights into the best practices and strategic adoption. We also propose that future research focus on AI-driven workforce transformation. This study examines skills gaps and the potential of AI to augment rather than replace the human workforce. It is also essential to understand the regulatory framework that governs the adoption of AI in Egypt's logistics sector, where policies must strike a balance between fostering innovation and addressing ethical concerns, including data privacy and security.

On the other hand, researchers should delve deeper into how AI-driven competitiveness contributes to business growth by improving business expansion, revenue generation, and market adaptability. An important area for future research is measuring AI's direct and indirect impact on competitive indicators such as efficiency, market share, and customer service quality. Future research should focus on how Egyptian logistics companies use AI to remain competitive while ensuring economic and environmental sustainability. By examining the effect of AI in improving supply chain resilience, optimizing transportation networks, and streamlining strategic decision-making, researchers can provide valuable recommendations to industry stakeholders on how Egyptian logistics companies can fully leverage the potential of AI, achieve sustainable growth, and position themselves competitively in the global market.

### **Conflicts of Interest**

The authors declare no conflicts of interest regarding the publication of this paper.

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