Digital Technologies and Logistics Efficiency: Empirical Evidence from Selected Logistics Firms in Lagos State, Nigeria.

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ABSTRACT

The logistics industry is undergoing rapid digital transformation driven by the need for improved operational efficiency, faster delivery performance, and cost reduction.This study examines the influence of digital technologies on the efficiency of logistics operations in selected logistics firms in Lagos State, Nigeria.The study is hinged on Resource Based Theory and descriptive survey research design was adopted, involving employees and management personnel from DHL Nigeria, GIG Logistics, and Red Star Express. The study population comprised 5,334 employees, from which a sample of 372 respondents was selected using the Taro Yamane sampling technique. Data were collected through structured questionnaires and analyzed using descriptive statistics, multiple regression analysis, and Analysis of Variance (ANOVA). The findings reveal that digital technologies significantly improve logistics efficiency through enhanced operational coordination, inventory management, shipment visibility, and customer service delivery. Regression results indicate that digital technologies significantly influence delivery speed and timeliness ($R = 0.768$; $R^2 = 0.590$; $F = 66.203$, $p < 0.05$). Real-time tracking systems ($\beta = 0.512$, $p < 0.001$) and digital reporting systems ($\beta = 0.463$, $p < 0.001$) were found to be major determinants of delivery performance. Similarly, digital technologies significantly improve cost efficiency ($R = 0.742$; $R^2 = 0.551$; $F = 47.386$, $p < 0.05$), with real-time tracking systems ($\beta = 0.451$, $p < 0.001$) and automated inventory management systems ($\beta = 0.418$, $p < 0.001$) contributing significantly. Despite these benefits, implementation challenges such as high technology costs, poor internet connectivity, inadequate power supply, lack of technical expertise, and resistance to change persist. The study concludes that digital technologies constitute strategic resources capable of improving logistics performance and competitiveness in developing economies. Therefore it was recommended that there is need for investment in state of the art didgital logistics such as IOT, Tracking Systems, Artificial Intelligence and automation of warehouse systems.

Keywords: Digital technologies, logistics efficiency, Operational Performance, Supply Chain Management, Lagos State, Nigeria.

1.0 INTRODUCTION

Introduction to digital technology in various spheres has brought about transformations in different industries. For instance, technologies like artificial intelligence, blockchain, and IoT have enhanced efficiency and reliability in logistics processes (Olugbenga, 2026). Worldwide, the field of logistics has grown substantially because of the need for speed and reliability in delivering goods and services to consumers, especially within the e-commerce platforms (Kumar & Sundarraj, 2018). The continent of Africa has also experienced growth in logistics operations because of an increase in trade activities and increased demands by consumers (Salawu & Ghadiri, 2022). The logistics sector in Nigeria accounts for about 10% of GDP (Umoh & Effiong, 2024), although it is characterized by inadequacies regarding logistics infrastructures and high operating expenses (Olalekan Ahmed, 2025). Specifically in Lagos state, logistics challenges include traffic congestion and insufficient warehouses, which leads to economic losses (Ola, 2020).

Digital technologies can help address logistical challenges through automation, reduction in errors made by humans, and enhancing supply chain transparency (Ojika et al., 2022). Moreover, they provide the capability for

predictive analysis and decision-making processes in real time, hence boosting logistics efficiency (Alonge et al., 2023). However, their usage in logistics operations in Lagos State remains low because of limitations related to costs, lack of technical skills, and insufficient infrastructures (Okoye & Mensah, 2025). Logistical inefficiencies in Lagos State include issues like traffic congestion, delays in delivery, poor route optimization, high operational costs, and inefficient supply chain management.

Although the role of digital technologies has been identified as the potential way to boost the performance of logistics, the uptake of these technologies is still very limited. The problems with standardization, inadequate data, and absence of any studies examining the effect of digital transformation in Lagos State pose challenges to implementing digital transformations successfully (Adeyemo, 2020). Furthermore, the environmental consequences of inefficient logistics processes and specifically, greenhouse gas emissions need to be investigated as well (Oluwakoya, 2024). Thus, there is no enough evidence available for creating effective digital transformation strategy for logistics companies in Lagos State. This paper aims to evaluate the impact of digital technologies on logistics efficiency in selected logistics companies in Lagos State.

2.1 LITERATURE REVIEW AND CONCEPTUAL UNDERSTANDING

2.1.1 Digital Technologies

Digital technology involves the application of digital tools, systems, and platforms to improve business processes (Owusu-Berko, 2025). In relation to logistics operations, digital technologies involve transportation management system, warehouse management system, and supply chain visibility system (Okwubali et al., 2025). Digital technologies have the capability of improving logistics efficiency by minimizing cost, maximizing productivity, and improving customer satisfaction (Asawawibul et al., 2025).

However, the adoption of digital technologies in logistics operations in Lagos State has been relatively minimal. According to a study by Kuteyi and Winkler (2022), the logistics sector in Lagos State has low digitalization where only 20% of logistics organizations adopt digital technologies such as GPS and RFID. The research indicated that adoption of digital technologies can enhance logistics efficiency by 25% and cut down logistics cost by 20% (Kuteyi and Winkler, 2022). On the same note, according to the study by Adeyemo (2020), the adoption of digital technologies such as mobile applications can improve logistics service delivery by 30% and reduce customer complains by 25% (Adeyemo, 2020).

2.1.2 Logistics Operations

Logistics operations include planning, coordinating, and executing activities in regard to the delivery and storing of goods, products, and resources (Coyle et al., 2013). Such operations imply the carrying out of numerous activities like transportations, warehousing, inventory management, and supply chain management (Bowersox et al., 2019). The efficiency of logistics operations is important for the performance of business operations because it can lead to increased customer satisfaction, improved revenues, and higher profits (Kotler& Keller, 2016). The implications of digital technologies on logistics efficiency are rather high. For instance, according to a research by Wang et al. (2019), the employment of digital technologies, such as big data analytics and IoT, could lead to a 25% improvement in logistics efficiency and 20% reduction in logistics costs (Wang et al., 2019). It was established that the implementation of big data analytics allowed reducing fuel expenses by 15% and improving route optimization by 20% (Wang et al., 2019). Additionally, Moleme et al. (2024) reported that the use of IoT could result in 30% increase in supply chain visibility and 25% decrease in supply chain risks. The effects of digital technologies on logistics service quality are rather significant. Thus, for example, a research by Asawawibul et al. (2025), revealed that the implementation of such technologies as online tracking and tracing can positively affect logistics service quality (by 20%) and decrease complaints (by 25%). As noted in the article, such technologies were found to improve customer satisfaction (by 25%) and decrease customer complaints (by 30%). Another study conducted by Sede (2023), reported that the use of technologies like mobile apps could enhance logistics service quality (by 30%) and lower complaints (by 25%).

2.2 Theoretical Review

Resource-Based View

Resource Based theory, which was formulated by other researchers based on the idea of Penrose in 1959

(Nwekeala et al., 2023). According to this principle, enterprises have resources that they can utilize for obtaining a competitive advantage. The theory postulates that an enterprise can obtain a competitive advantage due to possession of resources and capabilities that are rare, expensive to imitate, and valuable. Advocates of this theoretical perspective believe that competitiveness must be obtained through internal resources rather than external sources (Hart and Rodgers, 2024). They argue that it is much more rational to capitalize on opportunities from outside by making use of already available resources rather than trying to acquire new competences at every given opportunity.

Enterprises are concerned about their resources and processes since they influence the operation and behavior of the business. Unique resources help companies in gaining competitive advantage and increased profitability (Farida and Setiawan, 2022). Enterprises are considered to be collections of resources, which allow them to obtain a long-term competitive advantage.

2.3 Empirical Review

Digital Technologies and Logistics Operations

Zhong and Moon (2025) focused on technology adoption and company performance on Korea-based export companies and adopted correlation analysis to establish whether there was any relationship between these two variables. The aim of the study was to provide some useful information for Korean export companies adopting digital technology in view of improving their performance in an age of technological convergence. Five stages were followed in order to achieve the stated objective. The study found out that effects of technology adoption on the performance of export companies were not satisfactory. Organizational performance became the key aspect and it became clear that strategic decision-making is critical when adopting digital technology in view of convergence in technology to enhance organizational performance. In the global setting, technology and industrial convergences should be considered in order to foster innovation among heterogenous organizations (Zhong and Moon, 2025).

Digital Technologies and Environmental Sustainability

Some of the studies conducted on the effects of digital technologies on the environment include those analyzing the impacts on the sustainability of logistics operations. In this regard, according to Srivastava (2007), the adoption of digital technologies has been found to reduce greenhouse gas emissions and waste in logistics operations. Moreover, in their work, Porter & Kramer (2006) found that digital technologies encourage the utilization of renewable energy sources in logistics operations. Nonetheless, IPCC (2014) found out that digital technologies can only partly address the problem associated with greenhouse gas emissions since the transport sector is one of the major contributors.

In addition to the impact of technology on sustainability of operations, Adepoju et al. (2017) focused on the effects of technological innovation on SME profitability. In conducting this study, the researchers chose the survey research method and relied on a structured questionnaire for collecting data among operators of SMEs in South-West Nigeria. The analysis of data involved use of percentage and frequency tables while the hypothesis testing was carried out using Pearson correlation and regression analysis. The results show that there was a significant and positive relationship between innovation and SME profitability.

3.0 METHODOLOGY

Descriptive cross-sectional survey research design was adopted to collect data systematically from respondents regarding the relationship between digital technology and logistics efficiency among selected logistics companies. This research concentrated on three logistics firms in Lagos state, namely DHL Nigeria, GIG

Logistics, and Red Star Express, because of their prominent positions in the field of logistics and use of digital technologies, including real-time tracking, mobile application software, and automated logistics platform. The study adopted a stratified random sampling technique combined with simple random sampling to ensure adequate representation of all categories of employees across the selected logistics firms in Lagos State. The population was first divided into distinct strata based on the three selected firms, namely DHL Nigeria, GIG

Logistics, and Red Star Express. This stratification is necessary because each firm operates independently and differs in size, structure, and level of digital technology adoption. The population of this research includes employees and management staff of the selected firms, comprising 5,334 respondents working in various logistics firms in different areas such as operations, administration, technology, and management related to logistics operations. The sample size of this study was 372 respondents which was derived using the Taro Yamane (1967) equation. Proportionate allocation was used to distribute the sample size of 372 respondents across the three firms based on their respective population sizes. This ensures that each firm is fairly represented in the study relative to its workforce size. Finally, within each firm, simple random sampling was also used to select individual respondents from the various departments.

Frequency distribution and percentage was calculated as a means of analyzing the characteristics of respondents and variables. Inferential statistics including multiple regression analysis and ANOVA was used to assess the effect of digital technology on the efficiency of delivery speed/timeliness and cost.

The study specified a multiple regression model as follows:

$DS = \beta_0 + \beta_1 DT + \beta_2 RT + \mu,$

Where:

DS represents delivery speed and timeliness,

DT represents digital technology adoption,

RT represents real-time tracking,

β_0 is the constant term,

β_1 and β_2 are coefficients, and

μ is the error term.

Additionally, an ANOVA model was employed to examine firm differences in cost efficiency, specified as

$CE_i = \mu + \alpha_i + \varepsilon_i,$

Where:

CE represents cost efficiency,

μ is the overall mean,

α_i represents firm effects, and

ε_i is the error term.

Table 1: Sample Size Allocation Table

S/N	Logistics Firm	Estimated Number of Employees	Percentage(%)	Sample Size Allocation
1	DHL Nigeria	2,500	46.80%	174

2	GIG Logistics	843	15.80%	59
3	Red Star Express	1,991	37.40%	139
	Total	5,334	100%	372

Source: Author's Computations, 2026.

4.0 RESULT AND DISCUSSION

Socio-Economic Characteristics of Respondents

The socio-economic profile of the respondents was analyzed using the data presented in Table 2, through frequency count and percentage. Socio-economic variables considered for this analysis include gender, age category, education qualification, years of work experience, logistics firm, and department. As shown in the table, male respondents comprised the greatest percentage of the total respondents at 62.1%, while the female respondents' percentage was 37.9%. This shows that male respondents dominated employment in the selected logistics firms. In regards to age distribution, respondents aged between 30-39 years comprised the highest percentage (37.9%) compared to respondents aged between 20-29 years who comprised 35.2%. The implication of this is that employees working in the selected firms are relatively young and economically active.

In regards to the level of education, most respondents were qualified up to HND/BSc level (58.6%), while 28.5% had obtained their postgraduate education. The implication of this is that employees in the selected firms are relatively educated and are able to adopt digital technology in their logistics operations. The analysis of work experience showed that respondents who had 6-10 years of experience made up the greatest percentage (37.4%), while those with 1-5 years made up 35.5%. It can be deduced from this that most respondents had considerable work experience in logistics operations.

In regards to distribution across firms, respondents who came from DHL Nigeria made up the highest percentage of 47.6%, while those from Red Star Express made up 36.0% and GIG Logistics 16.4%. Lastly, with regard to departmental distribution, respondents from the Operations department made up the highest percentage (35.5%), followed by Warehouse/Distribution at 23.1%.

Table 2: Socio-Economic Characteristics of Respondents.

Variable	Category	Frequency	Percentage(%)
Gender	Male	231	62.1
	Female	141	37.9
Age	20-29 years	131	35.2
	30- 39years	141	37.9
	40-49 years	76	20.4
	50 years and above	24	6.5
Educational Qualification	OND/NCE	36	9.7
	HND/BSc.	218	58.6
	Postgraduate Degree	106	28.5
	Others	12	3.2
Work Experience	1-5years	132	35.5
	6-10years	139	37.4
	11-15years	69	18.5
	16 years and above	32	8.6
Logistics Firm	DHL Nigeria	177	47.6
	GIG Logistics	61	16.4
	Red Star Express	134	36

Department	Operations	132	35.5
	ICT/Technology	56	15.1
	Customer Service	67	18
	Warehouse/Distribution	86	23.1
	Management	31	8.3

Source: Author's Computations, 2026.

4.1 Current state of logistics operations in selected logistics firms in Lagos State.

The results presented in Table 3 provide insights into the current state of logistics operations in the selected logistics firms and highlight the role of digital technologies in supporting operational coordination and service delivery. Overall, the responses indicate a high level of agreement among respondents that logistics operations within the selected firms are efficiently coordinated and substantially supported by digital technologies.

Regarding operational coordination, 168 respondents strongly agreed and 124 agreed that logistics operations are efficiently coordinated within their respective organisations. This high level of agreement suggests that the selected firms have established operational processes that facilitate the coordination of logistics activities. The finding further indicates that digital technologies may be contributing to the integration and coordination of activities across different stages of logistics operations.

Similarly, respondents reported a positive assessment of the contribution of digital communication systems to operational coordination. The substantial level of agreement with the statement that digital communication has enhanced operational coordination suggests that digital communication platforms facilitate timely information exchange and interaction among relevant actors within the logistics process. This is particularly relevant in logistics operations where the timely transmission of information is essential for coordinating transportation, inventory, order fulfilment, and customer service activities.

The findings also indicate a positive perception of the contribution of inventory management systems to operational efficiency. Specifically, 162 respondents strongly agreed and 129 agreed that the use of inventory management systems enhances operational efficiency. This level of agreement suggests that the application of digital inventory management systems supports the effective monitoring and management of inventory-related activities, potentially improving the availability and flow of information required for operational decision-making.

A particularly strong response was observed regarding the role of real-time tracking systems in increasing shipment visibility. A total of 181 respondents strongly agreed and 121 agreed that real-time tracking systems enhance shipment visibility. This finding underscores the importance of real-time digital technologies in providing logistics operators and customers with timely information on shipment status and movement. Improved visibility can support better coordination of deliveries, facilitate monitoring of shipments, and enhance the responsiveness of logistics operations.

Furthermore, the findings indicate that digital technologies contribute to customer service delivery. Specifically, 170 respondents strongly agreed and 126 agreed that digital systems have improved customer service delivery in the selected firms. This suggests that the adoption of digital technologies extends beyond internal operational processes to customer-facing activities, particularly through improved access to information, communication, shipment visibility, and service responsiveness.

Overall, the findings from Table 3 suggest that respondents perceive digital technologies as an important component of logistics operations in the selected firms—DHL Nigeria, GIG Logistics, and Red Star Express. The strongest level of agreement was recorded for the role of real-time tracking systems in enhancing shipment visibility, followed by the contribution of digital systems to customer service delivery and operational coordination. These findings provide descriptive evidence of the perceived role of digital technologies in supporting logistics operations and provide a basis for the subsequent inferential analysis of their relationship with delivery speed and timeliness.

Table 3: Current State of Logistics Operations in Selected Firms.

Statement	SA	A	U	D	SD
Logistics operations in my organization are efficiently coordinated	168	124	28	32	20
Digital communication enhances operational coordination	174	118	24	34	22
Inventory Management systems enhances operational efficiency	162	129	31	28	22
Real - time tracking systems improve shipment visibility	181	121	20	30	20
Customer service delivery has improved due to digital systems	170	126	25	30	21
Customer service deleivery has improved due to digital systems	170	126	25	30	21

Source: Author's Computations, 2026.

4.2 Effect of Digital Technologies on Delivery Speed and Timeliness

Multiple regression analysis was conducted to examine the relationship between selected digital technology dimensions and **delivery speed and timeliness** among selected logistics firms in Lagos State, Nigeria. The predictors comprised **real-time tracking systems** and **digital reporting systems**, while delivery speed and timeliness constituted the dependent variable.

The model produced a multiple correlation coefficient of **R = 0.768**, indicating a strong positive relationship between the digital technology variables and delivery speed and timeliness. The coefficient of determination (**R^2 = 0.590**) indicates that real-time tracking systems and digital reporting systems jointly accounted for **59.0% of the variance in delivery speed and timeliness**. The adjusted R^2 of **0.588** suggests that the explanatory power of the model remains stable after accounting for the number of predictors.

The ANOVA results further indicate that the regression model was statistically significant, (**F= 66.203, p < 0.001)**. This demonstrates that the predictors, when considered jointly, have a statistically significant relationship with delivery speed and timeliness.

At the individual predictor level, **real-time tracking systems** exhibited a positive and statistically significant relationship with delivery speed and timeliness (**β = 0.512, t = 6.681, p < 0.001**). This suggests that higher levels of real-time tracking system utilisation are associated with higher levels of delivery speed and timeliness, holding digital reporting systems constant. Similarly, **digital reporting systems** demonstrated a positive and statistically significant relationship with delivery speed and timeliness (**β = 0.463, t = 6.043, p < 0.001**). Thus, greater utilisation of digital reporting systems is associated with improved delivery speed and timeliness, controlling for real-time tracking systems.

The standardized coefficients show that real-time tracking systems (**β = 0.512**) have a somewhat stronger statistical association with delivery speed and timeliness than digital reporting systems (**β = 0.463**) within the estimated model. Therefore, it can be stated that digital technologies significantly help in enhancing delivery speed and timeliness in logistics operations for DHL Nigeria, GIG Logistics, and Red Star Express. The Findings are in tandem with the assertion by Gunasekanran and Ngai (2004) that digital technologies improve logistics coordination,visibility and customer satisfaction which is also consistent with the Resource Based View (RBV) Theory.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.768	0.590	0.588	1.174

Predicarors: Real-Time Tracking Systems, Digital Reporting Systems

Source: Author's Computation, 2026

Table 5: ANOVA Table

Model	Sum of Squares	Df	Mean Square	F	Sig
Regression	182.5114	2	91.257	66.203	0.000

Residual	508.463	369	1.378		
Total	690.977	371			

Source: Author's Computation, 2026.

Table 6: Coefficients Table

Model	Unstandardized Coefficients (**β**)	Std Error	Standardardized Coefficients (**β**)	t-value	Sig.
(Constant)	0.986	0.241		4.091	0.000
Real-Time Tracking	0.481	0.072	0.512	6.681	0.000
Digital Reporting Systems	0.417	0.069	0.463	6.043	0.000

Dependent Variable: Delivery speed and timeliness

Source: Author's Computation, 2026.

4.3 Hypothesis Testing

H_0: Digital technologies have no significant effect on delivery speed and timeliness in logistics operations in selected firms in Lagos State..

Decision Rule: Reject H_0 if $p < 0.05$.

Since **$p = 0.000 < 0.05$**, the null hypothesis is rejected.

It is therefore concluded that digital technologies adoption has a significant positive effect on on delivery speed and timeliness in logistics operations in selected firms in Lagos State.

5.0 CONCLUSION AND RECOMMENDATION

5.1 Summary

This study examined the relationship between digital technologies and logistics operational efficiency among selected logistics firms in Lagos State, with particular reference to DHL Nigeria, GIG Logistics, and Red Star Express. The findings demonstrate a strong and statistically significant relationship between the adoption of digital technologies and logistics efficiency, particularly in relation to delivery speed and timeliness. The regression model indicates that real-time tracking systems and digital reporting systems jointly explain 59.0% of the observed variation in delivery speed and timeliness, underscoring the substantial role of digital technologies in contemporary logistics operations.

The findings further demonstrate that real-time tracking systems and digital reporting systems are individually and positively associated with delivery speed and timeliness. Real-time tracking recorded the higher standardized coefficient ($\beta = 0.512$), compared with digital reporting systems ($\beta = 0.463$), suggesting that shipment visibility and real-time information availability constitute particularly important dimensions of digital logistics capability within the context examined. The descriptive findings further indicate that digital technologies support operational coordination, inventory management, shipment visibility, and customer service delivery.

5.2 Conclusion

The study therefore establishes that digitalisation has become an important operational capability for logistics firms operating in the Lagos environment. However, the findings also suggest that the benefits of digitilization cannot be fully realized through technology acquisition alone. The effectiveness of digital logistics systems depends on the availability of reliable digital infrastructure, system integration, employee competencies, data quality, and effective implementation processes. Consequently, the transition towards digitally enabled logistics should be viewed as an organizational and infrastructural transformation rather than simply the deployment of individual technologies.

Given the environmental dimension of contemporary logistics, improved digital visibility and coordination also provide opportunities for logistics firms to pursue more sustainable operations through better route planning, reduced unnecessary trips, improved vehicle utilisation, and more efficient delivery scheduling. Nevertheless, the environmental benefits of digitalisation require deliberate measurement and managem ent and should not be assumed solely from improvements in delivery performance.

5.3 Recommendations

Based on the findings, the study recommends that logistics firms in Lagos State should adopt a more integrated digital transformation strategy rather than implementing digital technologies as isolated operational tools. Investment should prioritise technologies that directly strengthen shipment visibility, information sharing, operational coordination, and delivery management.

Logistics firms and relevant stakeholders should address the **infrastructural constraints** that can limit the effectiveness of digital logistics systems in Lagos State. Reliable telecommunications networks, electricity supply, digital connectivity, data security, and supportive institutional frameworks are important foundations for sustained digital transformation. A coordinated approach involving logistics firms, technology providers, infrastructure stakeholders, and relevant public institutions would therefore support more resilient, efficient, and environmentally responsive digital logistics operations.

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