



# **Information Technology and Its Effect on Performance of Logistics Firms in Nigeria**

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### **Author's contribution**

*The sole author designed, analyzed and interpreted and prepared the manuscript.*

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## **ABSTRACT**

This study investigates the impact of Information Technology (IT) on logistics firms' performance in Lagos Nigeria. Purposive sampling technique was used to select ten (10) logistics firms in Lagos, while simple random sampling was employed select eight (8) respondents from each logistics firm in Lagos, totalling eighty (80) respondents as the sample size for the study. Simple percentage and regression analysis were used to analyse the data. Result reveals that adoption and usage of information technologies such as radio frequency identification, web-based tracking, voice recognition technology, geographical information system, automated guided vehicle system, automated inventory tracking system and geographical positioning system are very low. Results also show that tracking and security system, usage of IT for the customer service delivery system and information integration have a positive and significant influence on the performance. Subsequently, the study recommends that management of logistics firms should adopt IT in their operations such as radio frequency identification, web-based tracking, voice recognition technology, geographical information system, automated guided vehicle system, automated inventory tracking system and geographic positioning system. This will assist them to improve inventory visibility in the supply chain, and it will also increase logistics system productivity through speed, accuracy and reliability.

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## 1. INTRODUCTION

The pivotal roles of logistics firms in economic growth and development have been acknowledged by scholars, professionals and researchers globally. Research has shown that logistics industry has a considerable share in Gross Domestic Product (GDP) of the US, Europe and Asia. [1] argue that logistics industry has considered as a significant tool for competition, which in turn increased the interest for the industry, especially in developed countries. [2] confirms that countries have currently increased their investments in logistics sector since it has become prominent as a segment which proliferates. However, global competition is forcing logistics firms around the world to reshape their logistics operations and systems with aims to reduce costs and improve customer satisfaction.

Information Technology (IT) has offered solutions that make logistics and supply chain management, even more, streamline and efficient than it has ever been. According to Weill, [3], provident IT-infrastructure investments make it possible for enterprises to react rapidly and cost-effectively to electronics-based challenges. Enterprises which have better infrastructure can react more quickly, as well as to reach better growth rate, better sales and to realise a shorter return on investment. [4] also argue that effective information flows within and across organisations are essential to managing supply chains, and such Supply Chain Management operations cannot be possible without IS management. Information technology (IT) is the use of any computers, storage, networking and other physical devices, infrastructure and processes to create, process, store, secure and exchange all forms of electronic data. [5] define information technology as a critical factor to enhance the supply chain performance, and the huge advances in information technology over the past two decades enabled the emergence of modern supply chain management, with its power to provide timely, accurate, and reliable information, to enhance collaboration and integration between partners, and to improve the agility and flexibility of both the focal firm and the partners in the supply chain [6].

In Nigeria, numbers of logistics firms are under pressure from their suppliers and customers to

change both their traditional styles of operation and organisation to replacing them with integrated systems that help increase the speed and fluidity of physical and information flows [7]. According to [8], most significant percentages of technology in use by most of logistics firms are from the low technology, while fewer of them use high technology for information gathering, due to a high cost of acquisition coupled with the absence of government infrastructures to support the use of IT. In the same vein, [9] notes that Nigerian logistics firms cannot leverage on technology, due to severe infrastructure challenges. Consequently, the growth of logistics industry has been constrained. Time delays, bottlenecks for international shipments, poor tracking and tracing capabilities and poor logistics quality and competence are all industry risks that weigh on growth prospects for logistics and transport industries. No wonder why Nigeria was ranked poor from Logistics Performance Index 2012. This implies that Nigeria is lagged behind in IT adoption.

Positive and significant effects of IT on logistics' performance have been affirmed by many scholars and researchers, while other scholars and researchers had contrary views that there was no real consensus about how that maintenance of competitive advantage was related to IT capabilities, this phenomenon is widely cited in the literature as the productivity paradox in information technology [10,11]. [12] also argue that many firms have spent large investments in developing and implementing information technologies and systems to enhance their supply chain performance with little benefit, while others have spent a similar amount of money with great success. The IT productivity paradox in logistics' performance is widely cited as a polemic that needs more investigation [12].

Based on this background, this study, therefore, intends to examine the effect of information technology on the performance of Logistics Firms in Lagos, Nigeria.

### 1.1 Objectives of the Study

The general aim of this study is to establish the effects of Information Technology on the performance of logistics firms in Lagos, Nigeria. The specific objectives are;

- To identify types of IT used in Logistics Firms in Lagos, Nigeria.
- To establish the influence of cargo tracking and security system on the performance of logistic firms in Lagos, Nigeria.
- To establish the effect of IT usage for the customer service delivery system on the performance of logistic firms in Lagos, Nigeria.
- To determine the impact of information integration on the performance of logistics firms in Lagos, Nigeria.

## 1.2 Research Questions

The following research questions shall be the focus of this study:

- What are the types of IT used in Logistics Firms in Lagos, Nigeria?
- How does cargo tracking and security system influence the performance of logistic firms in Lagos, Nigeria?
- Does IT usage the customer service delivery influence performance of logistic firms in Lagos, Nigeria?
- How information integration influences the performance of logistics firms in Lagos, Nigeria?

## 2. LITERATURE REVIEW

The emerging new technologies are creating strategic opportunities for the organisations to build competitive advantages in various functional areas of management including logistics and supply chain management. However, the degree of success depends on the selection of the right technology for the application, availability of proper organisational infrastructure, culture and management policies. In logistics, information, communication and automation technologies have substantially increased the speed of identification, data gathering, processing, analysis and transmission, with a high level of accuracy and reliability [13]. According to [13], technology is a means to enhance business competitiveness and performance. It plays a major role in success of supply chain by enhancing the overall effectiveness and efficiency of the logistics system. In logistics many new technologies are used in developed country while in India adoption process is very slow. However due to liberalization of the Indian economy the competitive pressure is building up and the only

option to face the competition in to go in for technology enabled operations [13].

## 2.1 Technologies used in Logistics and Supply Chain Management

### 2.1.1 Automatic identification technology

According to [13], Automatic Identification (Auto ID) is the term used to describe the direct entry of data or information in the computer system, programmable logic controllers or any microprocessor-controlled device without operating a keyboard. These technologies include; Bar Coding, Radio Frequency Identification (RFID) and Voice Recognition. Auto ID can be used for tracking the containers, packages, cartons or a truck carrying the goods on time bound dispatches to the customers [13].

#### *2.1.1.1 Bar coding*

Bar coding is one of the most IT enablers to date and has made significant impact in the practice. Starting in 1960's some of the earliest implementation of bar codes were in rail road cars. Nowadays it is rampant in anything that needs to be identified and tracked. Historically bar codes was first used in a supermarkets in USA in 1952. The information printed in bar code include, country code, manufacturer name, product details, date of manufacture, material content etc. Bar coding is a sequence of parallel lines of different thickness with spaces in between. These bars are nothing but the items of information in the codified form, which can be read with the help of a scanner [13,14]. [13] states that bar coding helps in identification of inventory items during storage, retrieval, pickup, inspection and dispatch. Similarly, [14] affirm that bar coding assists to reduce human error, paper work, and processing time leading and also increases logistics system productivity through speed, accuracy and reliability.

#### *2.1.1.2 Radio Frequency Identification (RFID)*

RFID is an Automatic Identification and Data Capture (AIDC) technology. RFID first appeared in tracking and access applications during 1980. RFID-based systems allows for non - contact reading and are effective in manufacturing and other hostile environment where bar codes could not survive. According to [15], the use of RFID is expected to increase rapidly in coming years. Often referred to as the next step in the evolution of bar-coding, RFID is growing rapidly in the

automatic data capture and identification market. [16] argue that RFID provides longer read distances; store more data; require no direct line of sight between tag and reader; and can collect data from multiple sources simultaneously. [13] also reiterates that RFID improves the ability of manufacturers to better manage the inventory levels; the complex distribution system for the defense operation and implement automatic toll collection on vast network of highways.

### *2.1.1.3 Voice Recognition Technology (VRT)*

VRT provides communications between the crane operator and the ground personnel. This system could be used standalone or it can be integrated with other technologies in communications between the crane operator and on quay personnel during loading and unloading of a vessel. Voice systems use pattern recognition similar to that in barcode systems. Instead of an image, the computer recognizes words in a pre-programmed vocabulary. When it is activated, crane operators speak into a microphone; the machine recognizes words or phrases and then converts them into electronic impulses for the micro- or host computer [17].

## **2.1.2 Information and communication technology (ICT)**

According to [7] and [8], ICT is the application of computers; internet and information communication systems can be seen in virtually all activity in the logistics industry, such as transportation, warehousing, order processing, materials management, and procurement. ICT in logistics includes; Electronic Data Interchange (EDI), Very Small Aperture Terminal (VSAT), Geographical Positioning System (GPS), Geographical Information System (GIS), Web Based Tracking (WBT), Automated Guided Vehicle System (AGVS), Enterprise Resource Planning (ERP), Distribution Requirement Planning (DRP) and Automated Inventory Tracking System (AITS).

### *2.1.2.1 Electronic Data Interchange (EDI)*

EDI technology is used for transfer of business documents from one computer to other computer. With EDI the business documents such as invoices, cheques, and challans are sent electronically from one organization to another. According to [13], EDI has successfully enhanced the communication between firms which is essential for logistics in term of real time

document transfer in the supply chain, Just-in-Time, reduction in transaction cost due to paperless operations, reduction in order cycle time and inventory.

### *2.1.2.2 Very Small Aperture Terminal (VSAT)*

The satellite communication channels are playing a crucial role in real time data collection and its exchange, which is vital for customer service. To trace and track the goods carrier, a dish antenna is fixed on the vehicle. This allows the communication between driver, consignor and consignee. The real – time interaction helps in having the up-to-date information on the location of truck and the delivery position [13].

### *2.1.2.3 Geographical Positioning System (GPS)*

The GPS is a system used to trace vehicle with the aid of Geo Stationary Satellites to the accuracy of one meter in terms of latitude and longitude. Once the position of the vehicle is known, it can be transmitted to consignor or consignee through the transmission network i.e. mobile phones or internet [13].

### *2.1.2.4 Geographical Information System (GIS)*

GIS is a software tool for visualization of special location of any entity on earth which is stored in databases relating to geography .This could be in terms of physical maps of the surface of earth, layout of inner surface of earth or a layout of streets or roads. According to [13], GIS in integration with GPS can be used in logistical operation for tracking and tracing of the consignment location to the extent of road or street in particular city.

### *2.1.2.5 Web Based Tracking (WBT)*

WBT is a software tool for tracking consignments to their clients. AFL, Fed-Ex, Blue Dart and others are providing the status report of the consignment to their clients. The clients can download this report by connecting through the Internet. This information helps in planning the dispatch schedule and also making follow up with clients for payment collections [13].

### *2.1.2.6 Automated Guided Vehicle System (AGVS)*

The system makes use of magnetic or optical guidance system. The magnetic system uses energized wire laid on the warehouse floor for

guiding the material handling equipment. AGVS can perform all the material handling operation without any human involvement. Robot coupled with AGVS is used to pick up exact material requirement for a customer order [13].

#### 2.1.2.7 Enterprise Resource Planning (ERP)

ERP is integrated software, encompassing all the business operations and bring about significant change in the way people work. ERP is a business solution that addresses to certain identified business issues [13].

##### **Customer Service:**

- Freight Payments
- Auditing
- Order Management
- Fulfillment
- Help Desk
- Carrier Selection
- Rate Negotiation

##### **Inventory and Logistics Management:**

- Freight Consolidation
- Freight Distribution
- Shipment Planning
- Traffic Management
- Inventory Management
- Carrier Selection
- Order Entry/ Management
- Information Flow

##### **Transportation:**

- Fleet Management
- Cross Docking
- Product Return

##### **Warehousing:**

- Packaging
- Product Making
- Labeling
- Warehousing
- Material Flow

#### **Fig. 1. Logistics functions model**

#### 2.1.2.8 Distribution Requirement Planning (DRP)

According to [13], DRP is another IT tool and also a sophisticated planning approach that takes into consideration multiple distribution

stages and the characteristics of the distribution system. DRP helps in consolidating the shipments to multiple locations spread over the vast geographical area, and thus help in reducing freight cost. DRP improves inventory visibility in the supply chain resulting into reduction in inventory level and warehouse space requirement [13].

#### 2.1.2.9 Automated Inventory Tracking System (AITS)

The AITS is an IT tool that gives real time status of the inventory levels of all the items at retail stores, feeder and mother warehouses [13]. [18] develops a model on how physical and information flows in logistics function as indicated in Fig. 1. As shown in the figure, information flows between logistics function are managed, coordinated and supported by various logistics technologies.

### **3. EMPIRICAL REVIEW**

Previous studies on IT and logistics performance has mixed results, some argue that IT is an alternative paradigm to logistics firms performance, while some disagree. For instance, [13] examines the impact of the technology on logistics and supply chain management. The author mainly focuses on the secondary data for collecting data relating to various technology used in logistics and supply chain management. The author draws conclusion that technology is a vehicle to enhance supply chain competitiveness and performance by enhancing the overall effectiveness and efficiency of logistics system. [19] also examine the effects of information technology on Logistic firm's performance in Nairobi Kenya to realize its significant impact on their operations in order to guarantee their profitability and growth. Data was collected from 10 firms in the logistic industry suppliers in Nairobi. The data was analyzed with the aid of SPSS and result shows that there is a strong relationship between IT and the performance of logistic firms in Nairobi County.

In another study, [20] determine the effect of information technology on warehouse management. The researcher used descriptive research design taking Jomo Kenyatta University of Agriculture and Technology as a case for this study. The target population was 930 and a sample size of 50. The sampling design adopted was stratified random sampling. Data collection was done by use of questionnaires and informal

interviews. Result indicates that information technology has positive effect warehouse management. Similarly, [21] also examine the impact of ICT usage on logistics activities of manufacturing companies in Southwestern Nigeria. Both descriptive and inferential statistics were employed to analyze the data. The study reveals that ICT has strong relationships between with Logistics activities. Also, [22] investigate the impact of technological innovation on the performance of China's Logistics Industry. The paper employs the questionnaire survey to study the factors influencing the adoption of technological innovations by logistics service providers in China as well as the influences of technological innovation on supply chain performance. Technological innovations are categorized into data acquisition technologies, information technologies, warehousing technologies, and transportation technologies. The results show that the adoption of technological innovations is significantly influenced by technological, organizational and environmental factors, and adopting innovative technologies increase supply chain performance for the logistics industry in China.

[14] also provide empirical evidences indicating that technology has the potential to improve overall logistics capabilities. The study indicates that IT is a high priority for 3PL users. IT capabilities also are seen as exceptionally critical

to the integration of logistics services provided by 3PLs [23]. Also, [24] investigate the impact of supply chain management and Enterprise Resource Systems (ERP) on organizational performance and competitive advantage in Tunisia by conducting a survey on 216 Tunisian managers. Their results show the importance of SCM and ERP systems adoption as well as reveal their positive impact on organizational performance and competitive advantage in Tunisians companies.

However, the findings of [8] and [26] are contrary the previous studies, their studies reveal that information technology had no moderate effects on the logistics performance. In another study, [27] argue that making investments in IT does not necessarily guarantee the increase of enterprise performance.

#### 4. METHODOLOGY

##### 4.1 Research Design

Descriptive survey method is adopted for this research study because it guides the researcher in collecting, analyzing and interpreting observed facts [28]. Purposive sampling technique was used to select Ten (10) logistics firms in Lagos. [28] argues that purposive sample is to produce a sample that can be logically assumed to be representative of the population. Simple random

**Table 1. Application of IT in different aspects of logistics**

Activities/aspects	IT application Areas	Benefits
Transportation	Fleet management-car tracking, maintenance, driver management, speed management, fuel management and health& safety management, route management	Recovery of stolen vehicles Increase in personal safety and security Reduction in insurance costs Decrease in unnecessary over time Increased customer satisfaction
Warehousing	Warehouse management- Receive goods • Identify the goods • Dispatch goods to storage • Pick goods • Dispatch shipment	Reduction in paper work • Real time dispatch • Time saving in locating of inventory • Increase of safety and security of goods • Cargo consolidation
Custom clearance	Documentation, duty payment, inspection	• Increased customer satisfaction • Reduced paperwork in clearance • Reduced administrative costs • Enhancing compliance with KRA
Cargo management	Container leasing, cargo security, loading and offloading	Improved security and safety • Real time cargo tracking • Cargo documentation

Source. [25] in [19]

sampling was employed select eight (8) respondents from each logistics firm in Lagos, totaling eighty (80) respondents as sample size for the study.

**4.2 Data Collection**

A structured questionnaire that was developed and validated by Wilson et al. [19] was used to collect relevant information from the study's participants. The response format was in Likert form with range from strongly agree (5) to strongly disagree (1).

**4.3 Validity and Reliability of Research Instruments**

Reliability and content validities of the research instrument was determined by making use of a test - retest method and experts respectively. The scales were subjected to further item analysis as to determine their psychometric soundness as indicated in Table 1.

Table 2 shows that factor loads of all the indicators are higher than 0.5, this implies that the questions highly explain the variance of their variables. This means that the measurement model has high factor validity.

**4.4 Data Analysis**

Simply percentage and regression analysis were used to analyze the data.

**5. RESULTS AND DISCUSSION**

From Table 3, it can be deduced that majority of logistics firms are making use of bar coding (97.5%), very small aperture terminal (95%), electronic data interchange (90%), enterprise resource planning (81.25%) and distribution requirement planning (77.5%), while adoption and usage of radio frequency identification (2.5), web based tracking (3.75%), voice recognition technology (6.25%), geographical information system (7.5%), automated guided vehicle system (8.75%), automated inventory tracking system (10%) and geographical positioning system (11.25%) is very low. This implies that integration of IT in logistics firms in Nigeria is at infancy stage. The result is in agreement with the work of [8] who found that largest percentages of technology in use by most of logistics firms are from the low technology, while fewer of them use high technology for information gathering. This finding also supports earlier findings by [29] that only few logistic firms in third world countries embrace the use of IT in delivering services to their audience.

The implication of this finding is that for logistics industry to survival in this 21<sup>st</sup> century and to generate employment for over one million unemployed youths by 2020, the industry must leverage on IT.

Table 4 reveals that tracking and security system ( $\beta = 0.630$ ;  $t = 6.919$ ;  $p < 0.05$ ) has positive and significant influence on the performance.

**Table 2. Summary of results of the measurement instruments validation**

Scale	No of items	Meaning Bartlett	KMO	Eigenvalue of the principal component	% of the variance	$\alpha$ of Cronbach
Security and tracking system Questionnaire	7	p = .000 (significant)	0.708	3.124	71.09%	0.81
Usage of IT for Customer Service Delivery Questionnaire	5	p = .000 (significant)	0.791	3.145	75.60%	0.79
Information Integration system Questionnaire:	6	p = .000 (significant)	0.815	3.534	81.10%	0.83
Organizational Performance Questionnaire	3	p = .000 (significant)	0.698	2.712	65.76%	0.73

**Table 3. Types of IT used in logistics firms**

Types of IT	Number of observation	Percentage (%)
Bar Coding	78	97.5
Radio Frequency Identification (RFID)	2	2.5
Voice Recognition Technology	5	6.25
Electronic Data Interchange (EDI)	72	90
Very Small Aperture Terminal (VSAT)	76	95
Geographical Positioning System (GPS)	9	11.25
Geographical Information System (GIS)	6	7.5
Web Based Tracking (WBT)	3	3.75
Automated Guided Vehicle System (AGVS)	7	8.75
Enterprise Resource Planning (ERP)	65	81.25
Distribution Requirement Planning(DRP)	62	77.5
Automated Inventory Tracking System (AITS)	8	10

Source: Field Survey

Furthermore, result reveals that tracking and security system has precise 38% influence on the performance of logistic firms. This implies that if tracking and security system is fully implemented, it will improve the logistics. The study agrees with the findings of [19], they confirm that tracking and security system helps in cost reduction, boost customer confidence and reduces security bond expenses hence improves the company profitability.

Table 5 shows the effect of usage of IT for customer service delivery system on the performance of logistics firms. The result reveals that customer service delivery system ( $\beta = 0.524$ ;

$t = 5.770$ ;  $p < 0.05$ ) has positive and significant effect on the performance of logistics firms. Result also indicates that customer service delivery system has precise 29.9% contribution to the performance of logistics firms. This implies that usage of IT for customer service delivery system may help Logistic firm can gain competitive advantage by operational effectiveness. The study is in line with [19] that usage of IT for customer service delivery system is a catalyst to logistics firms' performance in Nairobi. This study also supports the findings of [30] who confirm that there is correlation between usage of IT for customer service delivery system and performance.

**Table 4. Influence of cargo tracking and security system on the performance of logistic firms**

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		Beta	Std. error	Beta		
1	Constant	1.590	.405		3.931	.000
	Tracking and Security System	.630	.091	.617	6.919	.000
R <sup>2</sup>		<b>0.38</b>				
Dependent Variable: Performance						

**Table 5. Effect of usage of IT for customer service delivery system on the performance of logistics firms**

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		Beta	Std. error	Beta		
1	Constant	2.056	.404		5.091	.000
	Usage of IT for Customer Service Delivery System	.524	.091	.547	5.770	.000
R <sup>2</sup>		0.299				
Dependent Variable: Performance						



**Table 6. Impact of information integration on the performance of logistics firms**

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	
	Beta	Std. error	Beta			
1	Constant	1.339	.364		3.676	.000
	Information Integration	.672	.080	.688	8.381	.000
	R <sup>2</sup>	0.474				

Dependent Variable: Performance

Table 6 reveals that information integration ( $\beta = 0.672$ ;  $t = 8.381$ ;  $p < 0.05$ ) has positive and significant influence on the performance. Furthermore, result reveals that information integration has precise 47.4% influence on the performance of logistic firms. This implies that if logistics firms integrate their systems it may improve payment system, document processing and suppliers relationship. This study is in support of [13,19,20,21,14] findings that there is a strong relationship between information integration and the performance of logistic firms.

The implication of this finding is that if logistics industry is leverage on IT and government provides infrastructure facilities that will sustain information integration, the sector will remain in perpetual profitableness.

## 6. CONCLUSION

This study investigates the impact of IT on logistics firms' performance in Lagos Nigeria. The study establishes that adoption and usage of information technologies such as radio frequency identification, web-based tracking, voice recognition technology, geographical information system, automated guided vehicle system, automated inventory tracking system and geographical positioning system are very low. However, the study confirms that tracking and security system, usage of IT for the customer service delivery system and information integration have a positive and significant influence on the performance. The study concludes that IT is an alternative paradigm to logistics firms' performance.

## 7. RECOMMENDATIONS

Based on the findings and conclusion, the study recommends that management of logistics firms should adopt IT in their operations such as radio frequency identification, web based tracking, voice recognition technology, geographical

information system, automated guided vehicle system, automated inventory tracking system and geographical positioning system. This will assist them to improve inventory visibility in the supply chain and it will also increases logistics system productivity through speed, accuracy and reliability. Also, government should provide enabling environment for logistics firms to leverage on IT.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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