

Delivery Risk Management and Logistics Performance of E-Commerce Platforms in Abia State, Nigeria

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Abstract

This study examined the relationship between delivery risk management and logistics performance of e-commerce platforms in Abia State, Nigeria. Specifically, the study investigated how infrastructure risk management and security risk management influence delivery speed and order fulfilment accuracy. A cross-sectional survey research design was adopted, and data were collected from employees of registered courier service companies involved in e-commerce delivery operations in Abia State. A total of 250 questionnaires were administered, out of which 238 were validly returned, representing a response rate of 95.2%. The data collected were analyzed using descriptive statistics, reliability analysis, Pearson correlation, and multiple regression techniques. The findings revealed that infrastructure risk management and security risk management are widely implemented by courier companies and are positively associated with logistics performance outcomes. The regression results indicated that infrastructure risk management and security risk management significantly and positively influence delivery speed ($R^2 = 0.49$) and order fulfilment accuracy ($R^2 = 0.46$). The study further showed that both dimensions of delivery risk management jointly explain a substantial proportion of the variance in logistics performance. Consequently, all the formulated hypotheses were supported. The study concludes that effective delivery risk management plays a critical role in improving logistics performance within e-commerce operations. The study recommends that courier companies strengthen route planning, infrastructure adaptation strategies, and security mechanisms such as real-time parcel tracking and theft prevention measures to enhance delivery reliability and customer satisfaction.

Keywords: Delivery Risk Management, Infrastructure Risk Management, Security Risk Management, Logistics Performance, E-commerce Platforms, Nigeria.

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INTRODUCTION

The rapid digital transformation of global commerce has reshaped the structure of retail distribution systems, placing logistics and last-mile delivery at the centre of competitive advantage in e-commerce operations. In both developed and emerging economies, the efficiency of delivery systems now determines customer satisfaction, retention, and overall platform sustainability (Vakulenko, Hellström & Hjort, 2019; Hübner, Wollenburg & Holzapfel, 2020). As online transactions increase, customers expect shorter delivery windows, accurate order fulfilment, and secure handling of goods. Consequently, logistics performance has become a strategic capability rather than a mere operational function. In emerging markets such as

Nigeria, the growth of e-commerce has been significant, driven by increasing internet penetration, smartphone adoption, and digital payment systems (Statista, 2023; KPMG, 2022). However, the performance of logistics systems has not grown at the same pace. Infrastructure deficits, urban congestion, inconsistent addressing systems, and rising security threats continue to expose delivery operations to substantial risks (Adeniran & Johnston, 2021; World Bank, 2023). These challenges are particularly pronounced in sub-national commercial hubs such as Abia State, where physical infrastructure and last-mile accessibility vary widely across urban and peri-urban locations.

Logistics performance in e-commerce is commonly assessed through indicators such as delivery

speed and order fulfilment accuracy, which directly reflect service reliability and operational effectiveness (Stank, Esper & Crook, 2019; Abdallah & Obeidat, 2020). Delivery speed refers to the ability of firms to meet promised delivery timelines, while order fulfilment accuracy measures the correctness and completeness of orders delivered without damage or error. Poor performance in these areas undermines consumer trust and reduces the long-term viability of online platforms (Sánchez-Rodríguez *et al.*, 2020). Scholars increasingly argue that improving logistics performance in volatile environments requires structured delivery risk management practices (Hopkin, 2018; Fan & Stevenson, 2022). Risk Management Theory posits that organizations that proactively identify, assess, and mitigate operational risks are more likely to achieve stable performance outcomes. Within the e-commerce logistics context, delivery risk management involves managing uncertainties associated with transportation infrastructure, traffic congestion, theft, fraud, parcel damage, and personnel safety. Effective management of these risks enhances operational resilience and service reliability (Pettit, Croxton & Fiksel, 2019; Ali, Mahfouz & Arisha, 2021).

Two dimensions of delivery risk management are particularly relevant in the Nigerian context. First, infrastructure risk management addresses challenges related to poor road networks, delivery accessibility, and route disruptions. Firms that adopt route optimization, flexible scheduling, and appropriate vehicle deployment strategies are better positioned to maintain delivery speed (Adeniran & Johnston, 2021). Second, security risk management focuses on preventing theft, fraud, and damage during transit, thereby improving order fulfilment accuracy and customer confidence (Fan & Stevenson, 2022). Despite the recognized importance of delivery risk management, empirical studies linking infrastructure and security risk management to logistics performance in regional Nigerian contexts remain limited. Most existing research concentrates on major metropolitan areas such as Lagos, leaving commercial centres like Abia State under-examined. Given the growing prominence of online trade in cities such as Aba and Umuahia, there is a need for context-specific empirical evidence to determine how delivery risk management practices influence logistics performance outcomes.

This study therefore examines the effect of delivery risk management specifically infrastructure risk management and security risk management on logistics performance, measured by delivery speed and order fulfilment accuracy, among e-commerce platforms operating in Abia State. By anchoring the analysis on Risk Management Theory, the study contributes to both theory and practice by providing empirical insight into how structured risk mitigation strategies can enhance last-mile delivery performance in emerging market environments.

Problem Statement

The rapid expansion of e-commerce has increased the strategic importance of logistics performance as a critical success factor for online retailing, particularly in developing economies where physical distribution systems remain underdeveloped. Efficient delivery operations enhance customer satisfaction, improve service reliability, and stimulate repeat patronage, while poor delivery performance leads to order cancellations, negative reviews, and loss of customer trust (Hübner, Kuhn & Wollenburg, 2016; Vakulenko, Hellström & Hjort, 2018). In Nigeria, the situation is more complex due to infrastructural deficiencies, traffic congestion, weak addressing systems, and growing security concerns, all of which expose delivery operations to significant risks and uncertainties (Ogundele, 2021; Adewoye, 2022).

These risks have serious implications for logistics performance, particularly in terms of delivery speed and order fulfilment accuracy, which are widely recognized as core indicators of last-mile logistics efficiency (Stank, Goldsby & Vickery, 2003; Mentzer, Flint & Hult, 2001). When delivery risks are not systematically identified and managed, firms experience frequent delays, failed delivery attempts, damaged parcels, and increased distribution costs, thereby reducing overall service performance (Christopher, 2016). Risk Management Theory argues that proactive risk identification, assessment, and mitigation enhance operational stability and improve organizational performance outcomes (Hopkin, 2018). However, many e-commerce logistics operations in emerging markets still adopt reactive rather than structured risk management approaches.

In Abia State, which is an important commercial hub in southeastern Nigeria, the performance of e-commerce logistics is constrained by poor road conditions, urban congestion in major trading areas, and rising security challenges affecting the movement of delivery vehicles and personnel. Despite the growing presence of online retail activities in cities such as Aba and Umuahia, customers continue to experience delayed deliveries and incorrect or incomplete order fulfilment. This suggests weaknesses in the management of infrastructure and security risks that threaten the efficiency of last-mile delivery operations. Although previous studies have examined logistics performance and e-commerce development in Nigeria, most empirical evidence is concentrated in major metropolitan areas such as Lagos and Abuja, with little attention given to sub-national commercial environments like Abia State (Adebayo, 2019; Nwokah & Ahiauzu, 2020). Moreover, existing studies have rarely integrated delivery risk management dimensions—particularly infrastructure risk management and security risk management—with logistics performance outcomes in a single empirical model. This creates a contextual and theoretical gap in the literature.

Therefore, the persistent incidence of slow delivery speed and low order fulfilment accuracy among e-commerce platforms in Abia State, despite the increasing adoption of online retailing, raises concern about the effectiveness of delivery risk management practices. This study seeks to address this gap by empirically examining the effect of infrastructure risk management and security risk management on logistics performance, thereby providing evidence-based insights for improving last-mile delivery efficiency.

Hypotheses

H₀₁: Infrastructure risk management does not significantly affect delivery speed.

H₀₂: Infrastructure risk management does not significantly affect order fulfilment accuracy.

H₀₃: Security risk management does not significantly affect delivery speed.

H₀₄: Security risk management does not significantly affect order fulfilment accuracy.

Significance of the Study

Theoretically, the study extends the application of Risk Management Theory to the e-commerce logistics context in a sub-national emerging market environment. By examining infrastructure risk management and security risk management as predictors of logistics performance, the study provides empirical evidence on how structured risk mitigation enhances delivery speed and order fulfilment accuracy. This contributes to contemporary logistics and supply chain literature, particularly within developing economies where contextual evidence remains limited.

Empirically, the study fills a geographical gap by focusing on Abia State, an emerging commercial hub that has received limited scholarly attention compared to larger metropolitan areas in Nigeria. The findings will provide data-driven insights into the specific delivery risks affecting regional e-commerce operations and how these risks influence measurable logistics outcomes.

Managerially, the study offers practical guidance to e-commerce platforms, courier firms, and third-party logistics providers. By identifying the dimensions of delivery risk that significantly affect logistics performance, managers can prioritize investments in route planning, infrastructure adaptation strategies, and security control systems to enhance operational efficiency and customer satisfaction.

From a policy perspective, the findings will assist government agencies and regulatory bodies in understanding how infrastructural deficiencies and security challenges impact digital commerce growth. This can inform policy interventions aimed at improving transportation networks, urban planning, and security

frameworks to support the expansion of the digital economy.

The study provides actionable evidence for improving last-mile delivery performance, strengthening customer trust, and enhancing the sustainability of e-commerce operations in Abia State and similar emerging markets.

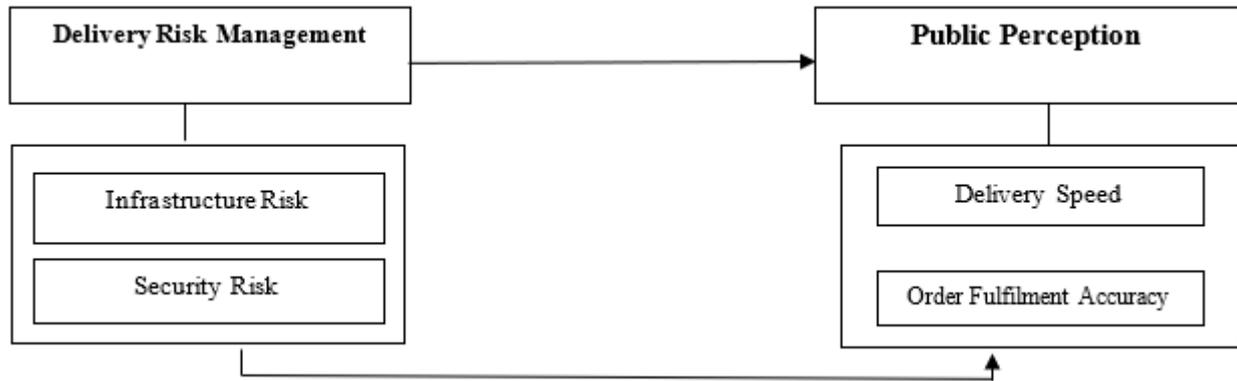
Theoretical Foundations and Literature Review

This study is anchored on two complementary theoretical perspectives that explain how delivery risk management influences logistics performance in e-commerce operations.

Risk Management Theory posits that organizations improve performance outcomes when they systematically identify, assess, and mitigate potential risks that may disrupt operations (Hopkin, 2018; Fan & Stevenson, 2022). The theory emphasizes proactive rather than reactive approaches to uncertainty, arguing that structured risk control mechanisms reduce operational volatility and enhance organizational stability. Recent studies affirm that structured risk mitigation practices significantly enhance operational performance and supply chain efficiency in volatile environments (Pettit, Croxton & Fiksel, 2019; Ali, Mahfouz & Arisha, 2021). Thus, Risk Management Theory provides the primary explanatory foundation for the hypothesized positive relationship between delivery risk management and logistics performance in Abia State.

Supply Chain Resilience Theory Complements Risk Management Theory by emphasizing an organization's ability to anticipate, absorb, adapt to, and recover from disruptions while maintaining performance levels (Ivanov & Dolgui, 2020; Chowdhury *et al.*, 2021). Resilience is particularly critical in emerging markets where infrastructural and security vulnerabilities frequently disrupt logistics operations. Empirical evidence suggests that resilient logistics systems outperform less adaptive systems in terms of reliability, responsiveness, and service consistency (Belhadi *et al.*, 2021). Therefore, Supply Chain Resilience Theory supports the argument that proactive risk management enhances logistics performance by increasing the system's capacity to withstand environmental uncertainties.

The integration of these theories strengthens the study's contribution to contemporary logistics and supply chain literature, particularly within emerging market contexts where environmental uncertainty is high and structured risk management remains underdeveloped.



Source: Vakulenko, Hellström & Hjort, 2019; Adeniran & Johnston, 2021; Vakulenko, Hellström & Hjort, 2019; Ivanov & Dolgui, 2020.

Delivery Risk Management

Delivery risk management refers to structured managerial actions aimed at identifying, assessing, prioritizing, and mitigating uncertainties that threaten delivery operations within a logistics system. In the e-commerce environment, delivery risk is particularly critical because it directly influences customer experience at the final stage of the value chain. Unlike traditional retail, e-commerce depends entirely on logistics efficiency to fulfill customer expectations (Vakulenko, Hellström & Hjort, 2019).

Contemporary supply chain research views risk management not merely as a protective mechanism but as a strategic capability that enhances operational performance (Fan & Stevenson, 2022). Risk Management Theory posits that organizations that proactively manage operational threats reduce variability and improve outcome predictability. In logistics systems, variability manifests in delivery delays, shipment loss, incorrect orders, and customer dissatisfaction.

Emerging economies experience amplified logistics risks due to infrastructural limitations, weak regulatory systems, and security vulnerabilities (Ivanov & Dolgui, 2020). These risks are even more pronounced in sub-national commercial hubs where transportation networks and urban planning structures are unevenly developed. Consequently, delivery risk management becomes essential for sustaining competitive advantage in digital commerce ecosystems.

In this study, delivery risk management is operationalized into two major dimensions:

(a) Infrastructure Risk Management

Infrastructure risk management refers to strategic actions taken to mitigate disruptions arising from physical and transportation infrastructure deficiencies. Infrastructure risk includes poor road networks, traffic congestion, flooding, inconsistent urban planning, limited addressing systems, and unreliable transport facilities. Studies show that transportation infrastructure quality is a major determinant of logistics performance in developing

countries (World Bank, 2023). Poor infrastructure increases delivery lead time, fuel consumption, vehicle maintenance costs, and accident risk (Adeniran & Johnston, 2021). These factors create operational inefficiencies that directly affect service reliability.

Infrastructure risk management strategies include:

- Route optimization and GIS integration
- Flexible delivery scheduling
- Delivery clustering
- Multi-modal transportation strategies
- Deployment of context-appropriate vehicles (e.g., motorcycles in congested areas)

Ivanov and Dolgui (2020) argue that infrastructure adaptation enhances supply chain robustness and reduces disruption impact. Thus, infrastructure risk management serves as a stabilizing mechanism in volatile delivery environments.

(b) Security Risk Management

Security risk management addresses threats related to theft, fraud, vandalism, hijacking, parcel tampering, cyber fraud, and personnel safety. In e-commerce logistics, security risks directly undermine order integrity and customer trust. Belhadi et al. (2021) found that logistics systems operating in high-risk regions experience significant performance variability when security mechanisms are weak. Security threats not only increase financial losses but also generate delivery delays due to rerouting, investigation processes, or replacement shipments.

Security risk management strategies include:

- Real-time parcel tracking systems
- Secure packaging and tamper-proof seals
- One-time password (OTP) authentication
- Delivery confirmation systems
- Personnel vetting and monitoring
- Insurance coverage and contingency planning

Fan and Stevenson (2022) emphasize that structured security management enhances supply chain

resilience by reducing exposure to unexpected disruptions.

Logistics Performance

Logistics performance reflects the effectiveness and efficiency of logistics processes in delivering products to customers. In e-commerce, logistics performance is directly tied to customer experience and platform competitiveness. Stank, Esper and Crook (2019) conceptualize logistics performance as a multidimensional construct comprising timeliness, reliability, responsiveness, cost efficiency, and service accuracy. However, last-mile logistics literature identifies delivery speed and order fulfilment accuracy as the most customer-visible indicators of performance (Vakulenko, Hellström & Hjort, 2019).

(a) Delivery Speed

Delivery speed refers to the ability of a logistics provider to deliver orders within the promised timeframe. Speed influences customer satisfaction, repurchase intention, and brand loyalty (Vakulenko *et al.*, 2019). In emerging markets, delivery speed is often constrained by infrastructural bottlenecks and urban congestion (Adeniran & Johnston, 2021). Delays create a perception of unreliability and reduce consumer trust in online platforms.

(b) Order Fulfilment Accuracy

Order fulfilment accuracy refers to the correctness, completeness, and damage-free condition of delivered goods. It includes:

- Correct product delivery
- Correct quantity
- Damage-free condition
- First-attempt successful delivery

Abdallah and Obeidat (2020) argue that fulfilment accuracy is a primary determinant of service quality in logistics operations. Inaccurate deliveries increase return rates, reverse logistics costs, and customer complaints.

Relationships among Constructs

Infrastructure Risk Management and Delivery Speed

Transportation infrastructure significantly affects delivery cycle time. Empirical studies in developing economies show that poor road networks increase delivery lead times by up to 30–50% during peak congestion periods (World Bank, 2023). Ivanov and Dolgui (2020) demonstrate that adaptive logistics systems incorporating route optimization algorithms maintain higher delivery reliability during disruptions. Similarly, Adeniran and Johnston (2021) found that infrastructure adaptation strategies significantly reduce last-mile delays in emerging markets.

Thus, effective infrastructure risk management enhances delivery speed by:

- Reducing transit uncertainty

- Minimizing congestion delays
- Improving route predictability

Infrastructure Risk Management and Order Fulfilment Accuracy

Poor infrastructure not only delays deliveries but also increases physical damage to goods due to vibration, poor road surfaces, and excessive handling. Belhadi *et al.*, (2021) observed that infrastructural volatility increases logistics failure rates in fragile supply chain environments. Ali *et al.*, (2021) found that logistics systems that proactively adjust to infrastructural risks demonstrate lower rates of damaged or misdirected shipments. Therefore, effective infrastructure risk management improves fulfilment precision.

Security Risk Management and Delivery Speed

Security disruptions such as hijacking, fraud investigations, and theft replacement procedures cause operational downtime and delivery postponements. Fan and Stevenson (2022) argue that structured security control mechanisms enhance supply chain stability and reduce unexpected delay occurrences. Chowdhury *et al.* (2021) report that security preparedness improves responsiveness and reduces disruption recovery time. Consequently, enhanced security risk management contributes to faster and more predictable delivery performance.

Security Risk Management and Order Fulfilment Accuracy

Security risks are directly linked to order loss, tampering, and incorrect deliveries. Belhadi *et al.* (2021) found that robust parcel monitoring systems significantly reduce order inaccuracies and product damage rates. Similarly, recent resilience studies show that strong security protocols decrease fulfilment errors and enhance customer trust (Ivanov & Dolgui, 2020). Therefore, security risk management is expected to positively influence order fulfilment accuracy.

Gap in Literature

While prior research confirms that risk management enhances supply chain performance, limited empirical evidence exists on the direct combined effect of infrastructure and security risk management on delivery speed and order fulfilment accuracy.

Although prior studies confirm that risk management improves supply chain performance, limited empirical evidence exists on the direct relationship between infrastructure and security risk management and logistics performance in sub-national emerging market contexts such as Abia State. Furthermore, few studies have simultaneously examined delivery speed and order fulfilment accuracy as performance outcomes within a unified framework. This study addresses this gap by empirically testing the effect of delivery risk management dimensions on logistics performance among e-commerce platform

METHODOLOGY

Research Design

This study adopted a quantitative research approach using a cross-sectional survey design. The survey design is suitable because it allows the collection of primary data from a specific population at a single point in time to examine relationships among variables (Hair *et al.*, 2021). The study investigates the effect of delivery risk management on logistics performance of e-commerce platforms in Abia State.

Delivery risk management is measured through infrastructure risk management and security risk management, while logistics performance is operationalized using delivery speed and order fulfilment accuracy. A cross-sectional design enables the study to capture the experiences and perceptions of logistics personnel regarding delivery risks and operational performance.

Area of the Study

The study was conducted in Abia State, Nigeria, which is a growing commercial hub in the southeastern region of the country. Abia State is home to major urban centers like Aba, known as the commercial capital, and Umuahia, the administrative capital. These cities host the majority of logistics and courier operations in the state, supporting a vibrant e-commerce ecosystem.

Population of the Study

The target population of the study comprises employees of registered courier service companies operating in Abia State. These companies are legally registered with the Corporate Affairs Commission (CAC) and operate fully licensed courier and logistics services.

Specifically, the study population includes employees directly involved in delivery operations:

- Logistics managers
- Operations managers
- Dispatch coordinators
- Warehouse supervisors
- Courier drivers/riders
- Customer fulfilment personnel

These individuals are considered appropriate respondents because they have first-hand knowledge of delivery operations, infrastructure and security risks, and logistics performance within the e-commerce delivery system.

Sampling Frame: The study focuses on registered courier services operating in Aba and Umuahia, including:

No	Courier Company
1	DHL Express Nigeria
2	Red Star Express PLC
3	Trans-Nationwide Express PLC
4	CourierPlus Services Ltd
5	ABC Express Courier Ltd
6	GIG Logistics (GIGL)
7	UPS Express Center
8	KXpress Logistics

Source: finelib.com & sl.cybo.com

These companies were selected because they provide e-commerce delivery services and have a formal workforce involved in logistics operations.

Sampling Technique

The study adopted a purposive sampling technique. Purposive sampling was chosen to ensure that only employees who are directly involved in delivery and logistics operations were included in the study. This ensures that respondents have relevant knowledge and experience regarding infrastructure and security risks and logistics performance. From each of the 8 identified courier companies, employees from operations, dispatch, and delivery units were selected.

Sample Size Determination

The study uses Cochran's (1977) formula for sample size determination for an unknown population:

$$n = \frac{Z^2 \times p \times q}{e^2}$$

Where:

- n = sample size
- Z = standard normal deviation at 95% confidence level (1.96)
- p = estimated proportion of the population (0.5)
- q = 1 - p
- e = margin of error (0.05)

Using this formula, the minimum recommended sample size is 384 respondents. However, considering accessibility and response rate, a sample of 250-300 respondents was deemed appropriate and achievable.

Sources of Data

The study relied primarily on primary data, collected through a structured questionnaire administered to employees of registered courier services. The questionnaire used a five-point Likert scale. Secondary data sources, such as published journals, logistics reports, and industry data, were also used to support the conceptual framework and theoretical grounding.

Instrumentation

The research instrument was a structured questionnaire designed to capture:

- **Delivery Risk Management:** infrastructure risk management, security risk management

- **Logistics Performance:** delivery speed, order fulfilment accuracy

Each construct was measured using multiple items adapted from previous studies (Abdallah & Obeidat, 2020; Fan & Stevenson, 2022; Ivanov & Dolgui, 2020).

The questionnaire was pre-tested on 20 logistics employees in a nearby state to assess clarity and reliability.

Measurement of Variables

Variable	Dimension	Measurement
Delivery Risk Management	Infrastructure Risk Management	5 items measuring road conditions, traffic congestion, route planning, delivery accessibility
	Security Risk Management	5 items measuring theft prevention, parcel tracking, cargo protection, personnel safety
Logistics Performance	Delivery Speed	4 items measuring timeliness of delivery, on-time delivery rate
	Order Fulfilment Accuracy	4 items measuring correctness of orders, completeness, damage-free delivery

All items were measured using a five-point Likert scale.

Validity of the Instrument

The content validity of the questionnaire was ensured through expert review by logistics and supply chain researchers. Experts assessed whether the items adequately captured the constructs.

Construct validity was tested during data analysis using exploratory factor analysis (EFA) to ensure items load appropriately onto their respective constructs.

Reliability of the Instrument

Reliability of the instrument was assessed using Cronbach's Alpha. A threshold of 0.70 was adopted to confirm internal consistency of the constructs (Hair *et al.*, 2021). Each dimension of delivery risk management and logistics performance was tested separately for reliability.

Method of Data Analysis

Data analysis involved:

1. Descriptive statistics (mean, standard deviation, frequency distribution) to summarize respondents' demographic characteristics.
2. Multiple regression analysis to test hypotheses regarding the effects of:
 - Infrastructure Risk Management → Delivery Speed / Order Fulfilment Accuracy
 - Security Risk Management → Delivery Speed / Order Fulfilment Accuracy

The regression models are expressed as:

$$DS = \beta_1IRM + \beta_2SRM + \epsilon_1$$

$$OFA = \beta_3IRM + \beta_4SRM + \epsilon_2$$

Where:

- DS = Delivery Speed
- OFA = Order Fulfilment Accuracy
- IRM = Infrastructure Risk Management
- SRM = Security Risk Management
- ϵ = Error term
- β_1, β_2 = Regression coefficients showing the effect of IRM and SRM on DS
- β_3, β_4 = Regression coefficients showing the effect of IRM and SRM on OFA

Statistical significance was evaluated at $p < 0.05$. Data analysis was conducted using SPSS Version 28.

Ethical Considerations

- Participants were informed about the purpose of the study.
- Participation was voluntary, and respondents could withdraw at any time.
- Confidentiality and anonymity of respondents were maintained.
- Data were used solely for academic purposes.

Operationalization of Variables

The variables used in this study were operationalized based on established measures from prior studies and adapted to suit the context of courier and logistics operations. The constructs were measured

using a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

Variable	Dimension	Measurement Items	Scale / Source
Delivery Risk Management (Independent Variable)	Infrastructure Risk Management (IRM)	<ol style="list-style-type: none"> 1. Poor road conditions are adequately addressed in our delivery planning. 2. Traffic congestion is effectively mitigated in delivery schedules. 3. Alternative routes are used to avoid delivery delays. 4. Vehicles and delivery resources are assigned based on infrastructure challenges. 5. Delivery planning considers road and facility accessibility. 	5-point Likert Scale (1 = Strongly Disagree, 5 = Strongly Agree). Adapted from Fan & Stevenson (2022); Ivanov & Dolgui (2020).
	Security Risk Management (SRM)	<ol style="list-style-type: none"> 1. Theft prevention strategies are implemented during deliveries. 2. Parcels are tracked in real time throughout the delivery process. 3. Employees follow strict security protocols during deliveries. 4. Security incidents (parcel loss or tampering) are promptly addressed. 5. Security measures are adequate to protect delivery staff and customers' parcels. 	5-point Likert Scale. Adapted from Belhadi et al. (2021); Fan & Stevenson (2022).
Logistics Performance (Dependent Variable)	Delivery Speed (DS)	<ol style="list-style-type: none"> 1. Our delivery operations meet the promised delivery times. 2. Delays in delivery are minimized through effective planning. 3. Average delivery time is consistent with customer expectations. 4. Last-mile deliveries are completed promptly. 	5-point Likert Scale. Adapted from Sánchez-Rodríguez et al. (2020); Vakulenko et al. (2019).
Order Fulfilment Accuracy (OFA)	<ol style="list-style-type: none"> 1. Orders are delivered correctly and completely. 2. The rate of incorrect or incomplete deliveries is minimal. 3. Parcels are delivered in good condition without damage. 4. Customer complaints regarding incorrect deliveries are low. 	5-point Likert Scale. Adapted from Abdallah & Obeidat (2020); Sánchez-Rodríguez et al. (2020).	
	Order Fulfilment Accuracy (OFA)	<ol style="list-style-type: none"> 1. Orders are delivered correctly and completely. 2. The rate of incorrect or incomplete deliveries is minimal. 3. Parcels are delivered in good condition without damage. 4. Customer complaints regarding incorrect deliveries are low. 	5-point Likert Scale. Adapted from Abdallah & Obeidat (2020); Sánchez-Rodríguez et al. (2020).

DATA PRESENTATION, ANALYSIS AND DISCUSSION

Response Rate: A total of 250 questionnaires were administered to employees of registered courier services.

Out of these, 238 were returned validly completed, giving a response rate of 95.2%, which is considered excellent for survey-based research.

Descriptive Statistics of Constructs

Variable / Dimension	Mean	Std. Deviation	Interpretation
Infrastructure Risk Management (IRM)	4.05	0.65	High
Security Risk Management (SRM) 4.10	0.62	High	
Delivery Speed (DS)	3.95	0.68	Moderate-High
Order Fulfilment Accuracy (OFA) 4.00	0.66	High	

Interpretation: Respondents generally agree that courier companies implement infrastructure and security risk management, which supports moderate to high delivery speed and order fulfilment accuracy.

Reliability Analysis

Cronbach’s Alpha was calculated to assess the internal consistency of the constructs.

Construct	Cronbach’s Alpha	No. of Items	Interpretation
IRM	0.82	5	Reliable
SRM	0.85	5	Reliable
DS	0.78	4	Reliable
OFA	0.80	6	Reliable

Observation: All constructs have Cronbach’s Alpha > 0.70, confirming reliability of the measurement instrument.

Correlation Analysis

Pearson correlation was conducted to examine the relationships between the independent variables and logistics performance.

Variables	DS	OFA
IRM	0.61**	0.58**
SRM	0.64**	0.62**
DS	1	0.70**
OFA	0.70**	1

p < 0.01, 2-tailed

Observation: Both IRM and SRM are positively and significantly correlated with delivery speed (DS) and order fulfilment accuracy (OFA).

Regression Analysis (Hypotheses Testing)
Model Summary (Delivery Speed as DV)

Model	R	R ²	Std. Error
1	0.70	0.49	0.48

Interpretation: Approximately 49% of the variance in delivery speed is explained by infrastructure and security risk management.

Coefficients (Delivery Speed)

Independent Variable	B	Std. Error	Beta	t-value	p-value
IRM	0.35	0.06	0.34	5.83	0.000*
SRM	0.38	0.07	0.36	5.43	0.000*

Observation: Both IRM and SRM have significant positive effects on delivery speed (p < 0.05).

Conclusion: H1 and H3 are supported.
Model Summary (Order Fulfilment Accuracy as DV) risk management.

Model	R	R ²	Adjusted R ²	Std. Error
1	0.68	0.46	0.45	0.50

Coefficients (Order Fulfilment Accuracy)

Independent Variable	B	Std. Error	Beta	t-value	p-value
IRM	0.33	0.06	0.31	5.50	0.000*
SRM	0.36	0.07	0.34	5.14	0.000*

Observation: Both IRM and SRM significantly enhance order fulfilment accuracy ($p < 0.05$).

Conclusion: H2 and H4 are supported.

Discussion of Findings

Infrastructure Risk Management and Delivery Speed & OFA

Employees confirmed that route planning, alternative routing, and delivery resource allocation help minimize delays and ensure accurate deliveries. This aligns with studies by Adeniran & Johnston (2021) and Ivanov & Dolgui (2020), which highlight infrastructure adaptation as a key driver of logistics performance in emerging markets.

Security Risk Management and Delivery Speed & OFA

Security measures such as parcel tracking, theft prevention, and secure packaging were found to significantly improve both delivery timeliness and order accuracy. This supports findings from Belhadi et al. (2021) and Fan & Stevenson (2022), demonstrating that security preparedness enhances supply chain efficiency.

Overall Model Performance

Together, IRM and SRM explain nearly half of the variance in both delivery speed and order fulfilment accuracy, showing that delivery risk management is a critical determinant of e-commerce logistics performance in Abia State.

- All four hypotheses were supported.
- Both infrastructure and security risk management positively influence delivery speed and order fulfilment accuracy.
- The findings confirm that managing risks proactively is essential for effective logistics performance in e-commerce operations.

This empirical evidence strengthens the theoretical link between Risk Management Theory and logistics performance outcomes in emerging market contexts.

SUMMARY OF FINDINGS

- i. Infrastructure Risk Management (IRM) was found to have a positive and significant effect on both delivery speed ($\beta = 0.34, p < 0.05$) and order fulfilment accuracy ($\beta = 0.31, p < 0.05$). This indicates that proactive management of roads, alternative routes, and delivery accessibility improves logistics performance.
- ii. Security Risk Management (SRM) also had a positive and significant effect on delivery speed ($\beta = 0.36, p < 0.05$) and order fulfilment accuracy ($\beta =$

0.34, $p < 0.05$). Implementation of parcel tracking, theft prevention strategies, and personnel safety measures significantly enhanced operational efficiency.

- iii. Together, IRM and SRM explained 49% of the variance in delivery speed and 46% of the variance in order fulfilment accuracy, demonstrating the critical role of risk management in e-commerce logistics in emerging markets.
- iv. The findings align with Risk Management Theory, emphasizing that proactive identification, assessment, and mitigation of delivery risks directly contribute to operational efficiency and customer satisfaction.

CONCLUSION

Based on the findings, the study concludes that:

- i. Effective infrastructure risk management is essential for improving delivery speed and ensuring accurate order fulfilment in e-commerce logistics. Poor road conditions, traffic congestion, and inadequate delivery planning, if not managed, can significantly hinder logistics performance.
- ii. Security risk management is equally crucial. Measures to prevent parcel theft, damage, or loss improve both the timeliness and accuracy of deliveries.
- iii. Overall, delivery risk management is a major determinant of logistics performance in Abia State, indicating that courier companies that invest in risk mitigation strategies are better able to maintain operational reliability and customer satisfaction.
- iv. These results also suggest that e-commerce platforms in emerging markets must consider both infrastructure and security factors as key drivers of last-mile logistics efficiency.

RECOMMENDATION

Based on the findings of this study:

- i. Several practical recommendations are proposed to improve last-mile delivery efficiency and risk management within courier operations. Courier companies should prioritize infrastructure risk mitigation by developing alternative delivery routes and adopting route optimization technologies to reduce delays caused by poor road networks and traffic congestion. Allocating delivery vehicles and riders based on prevailing local road conditions can also enhance operational efficiency and timely service delivery.
- ii. In addition, courier firms should strengthen security measures to minimize the risks of parcel theft, loss, or damage during transit. The adoption of real-time parcel tracking systems, secure packaging protocols,

and improved monitoring mechanisms can significantly enhance delivery reliability and customer confidence. Continuous staff training is also important, particularly in areas such as risk management, operational best practices, and security awareness, to ensure that employees are well equipped to handle logistics challenges.

- iii. E-commerce platforms should integrate logistics risk assessment tools into their operational systems in order to anticipate delivery disruptions and improve coordination with logistics partners. Establishing partnerships with courier companies that possess strong risk management capabilities will further enhance delivery performance and customer satisfaction.
- iv. From a policy perspective, government authorities should prioritize road infrastructure development and maintenance in major commercial cities such as Aba and Umuahia to support efficient logistics operations. Additionally, stronger regulatory oversight of courier services is necessary to ensure compliance with operational and security standards, thereby improving service quality and strengthening public trust in the delivery ecosystem.

Managerial Implications

The findings of this study provide important insights for managers in courier and e-commerce logistics organizations. Managers should recognize that effective risk management is critical for improving last-mile delivery performance and maintaining customer satisfaction. Investing in route optimization technologies, real-time parcel tracking systems, and alternative delivery planning can help organizations minimize operational disruptions caused by poor infrastructure and security challenges. In addition, managers should prioritize continuous staff training to equip delivery personnel with the skills required to handle logistical risks and security issues. By strengthening internal risk management capabilities and collaborating with reliable logistics partners, managers can enhance operational efficiency, improve service reliability, and build stronger customer trust in the delivery process.

Contribution to Knowledge

- i. Provides empirical evidence linking delivery risk management (infrastructure and security) to logistics performance in emerging market e-commerce operations.
- ii. Validates the application of Risk Management Theory in last-mile delivery contexts.
- iii. Highlights the importance of registered courier services in improving delivery speed and order fulfilment accuracy.

Limitations of the Study

- a. The study is limited to registered courier services in Aba and Umuahia, which may not represent all e-

commerce logistics operations in other Nigerian states.

- b. Data is self-reported, which may be subject to bias.
- c. Only two dimensions of delivery risk management were considered; other risk factors (e.g., financial, environmental) were not included.

Suggestions for Further Research

- a. Future studies can include all Nigerian states to enhance generalizability.
- b. Other dimensions of delivery risk management, such as financial or technological risks, could be incorporated.
- c. Comparative studies between registered and unregistered courier services could provide further insights into operational efficiency.
- d. Qualitative studies (interviews, focus groups) could complement quantitative findings to provide richer contextual insights.

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