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ROAD TRANSPORT SECURITY MEASURES AND LOGISTICS EFFICIENCY IN GUINNESS NIGERIA'S LAGOS DISTRIBUTION OPERATIONS.

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Abstract

This study examined the effect of road transport security measures on logistics efficiency in Guinness Nigeria's Lagos distribution operations. The study focused on four dimensions of road transport security: Cargo Protection Measures, Route Risk Management, Driver Safety and Security Protocols, and Incident Response and Recovery Systems. A quantitative cross-sectional survey design was adopted, and data were collected from 190 respondents comprising logistics managers, transport supervisors, fleet security officers, warehouse and distribution coordinators, and truck drivers involved in Guinness Nigeria's distribution activities in Lagos State. Data were analysed using descriptive statistics, Pearson correlation, and multiple regression analysis. The findings revealed that the overall regression model was statistically significant ($F = 14.018$, $p < 0.001$), indicating that the combined road transport security measures significantly explained variations in logistics efficiency. The model accounted for 23.3% of the variance in logistics efficiency ($R^2 = 0.233$), suggesting modest explanatory power. However, among the four security dimensions examined, only Route Risk Management exerted a statistically significant positive effect on logistics efficiency ($B = 0.243$, $\beta = 0.290$, $p = 0.034$). Cargo Protection Measures ($p = 0.554$), Driver Safety and Security Protocols ($p = 0.069$), and Incident Response and Recovery Systems ($p = 0.484$) exhibited positive but statistically non-significant effects. The study concludes that effective route planning, corridor risk assessment, congestion avoidance, and route monitoring are critical determinants of logistics efficiency within Lagos' challenging freight transportation environment. It recommends prioritising route intelligence systems, corridor risk mapping, dynamic route optimisation, and stakeholder collaboration to enhance distribution performance and improve logistics efficiency in manufacturing firms operating within high-risk urban transport networks.

Keywords: *Road Transport Security, Logistics Efficiency, Route Risk Management, Cargo Protection Measures, Driver Safety and Security Protocols, Incident Response and Recovery Systems.*

Introduction

Road freight transportation constitutes a critical component of supply chain systems worldwide, facilitating the movement of goods between production facilities, warehouses, distributors, and final markets. In advanced economies, road freight has evolved into a highly coordinated and technology-driven enterprise characterized by digital tracking systems, route optimization technologies, and sophisticated risk management practices. Despite these advancements, the sector remains vulnerable to cargo theft, vehicle hijackings, cyber-enabled freight fraud, and other security threats that disrupt logistics operations and undermine supply chain performance. Recent reports from insurance providers and logistics risk organizations indicate substantial increases in cargo-related crimes, particularly involving high-value consumer products such as food and beverages, prompting firms to strengthen security measures across transport networks (BSI & TT Club, 2024; Ekwall & Lantz, 2015; Queiroz et al., 2025).

In developing economies, the challenges associated with road transport security are often more severe due to inadequate infrastructure, weak regulatory enforcement, limited surveillance capabilities, and increasing criminal activities along major freight corridors. These conditions create operational uncertainties that adversely affect delivery reliability, inventory management, transportation costs, and overall logistics efficiency (Nsowah et al., 2022; James Peprah Adu et al., 2024; Okunsanya & Azmat, 2025). The World Bank's Logistics Performance Index highlights significant deficiencies in infrastructure quality, shipment tracking, and timeliness across many low- and middle-income countries, factors that collectively constrain the effectiveness of logistics systems (World Bank, 2023). Recent studies have further emphasized that sustainable transport systems and resilient logistics networks are increasingly important in responding to global disruptions (Sobczuk & Borucka, 2024).

Nigeria presents a particularly relevant context for examining the relationship between transport security and logistics performance. As Africa's largest economy and one of its most significant consumer markets, the country depends heavily on road transportation for the movement of manufactured goods. However, persistent security concerns including cargo theft, truck hijackings, vandalism, road accidents, and unauthorized diversions continue to threaten the efficiency of freight distribution (Ugwuoke et al., 2023; Gbadegesin & Somuyiwa, 2026). These challenges are especially pronounced in Lagos State, which serves as Nigeria's foremost commercial and logistics hub. The concentration of seaports, manufacturing facilities, warehouses, and distribution centers within Lagos generates substantial freight traffic, while severe congestion, infrastructure pressure, and security vulnerabilities create significant risks for logistics operators (Olorunnimbe, 2025; Buhari et al., 2025).

Among the industries heavily dependent on efficient road transportation is the beverage manufacturing sector. Beverage products require frequent, time-sensitive, and large-volume distribution to wholesalers, retailers, hospitality establishments, and other market outlets. Guinness Nigeria Plc, one of the leading beverage manufacturers in Nigeria, relies extensively on road transport networks to distribute beer products throughout Lagos and other parts of the country. Given the high commercial value and market demand for alcoholic beverages, Guinness distribution vehicles are often exposed to security threats such as hijackings, cargo theft, product diversion, vandalism, and transit-related disruptions. Consequently, effective transport security measures are essential for maintaining delivery schedules, protecting cargo assets, minimizing operational losses, and ensuring logistics efficiency (Omoush, 2022; Udoka et al., 2024).

Within this context, the present study specifically focuses on the logistics actors involved in Guinness Nigeria's beer distribution operations in Lagos State. These actors include distribution managers, transport coordinators, fleet supervisors, warehouse personnel, security officers, and third-party transport operators who collectively plan, execute, monitor, and secure the movement of products from distribution centers to customers. Their activities directly influence both the effectiveness of transport security practices and the efficiency of logistics operations (Obodo & Onota, 2025).

Although previous studies have examined transportation challenges, infrastructure deficiencies, and logistics performance in Nigeria, limited empirical attention has been devoted to understanding how specific road transport security measures influence logistics efficiency within beverage distribution networks. Existing studies rarely operationalize transport security through dimensions such as cargo protection, route risk management, driver security compliance, vehicle monitoring, and incident response systems while simultaneously assessing their effects on measurable logistics outcomes (Okunsanya & Azmat, 2025). Furthermore, the application of Routine Activity Theory to explain security-related logistics performance outcomes remains underexplored within the Nigerian transport and distribution environment. This study therefore seeks to bridge these gaps by examining the relationship between road transport security measures and logistics efficiency

among the logistics actors involved in Guinness Nigeria's Lagos distribution operations, thereby contributing context-specific evidence to both transport security literature and logistics management practice.

Statement of the Problem

The effectiveness of road transport systems is critical to the performance of beverage distribution networks because products must be delivered to wholesalers, retailers, and other market outlets in a timely, secure, and cost-efficient manner. In Lagos State, where road transportation remains the dominant mode of freight movement, logistics operations are frequently exposed to security threats and operational disruptions that compromise supply chain performance. For beverage manufacturers such as Guinness Nigeria Plc, the movement of products through highly congested urban corridors creates significant exposure to cargo theft, vehicle hijacking, product diversion, vandalism, and transit delays (Ugwuoke et al., 2023; Olorunnimbe, 2025).

One important dimension of road transport security is cargo protection. Inadequate cargo protection measures increase the risk of product theft, loss, and damage during transit, resulting in financial losses, insurance claims, stock shortages, and delayed deliveries. Such incidents reduce the reliability of distribution operations and increase logistics costs. Similarly, weaknesses in route risk management expose transport operators to avoidable security incidents and traffic disruptions, particularly along congested freight corridors in Lagos. Poor route planning and insufficient risk assessment may increase transit times, reduce vehicle productivity, and adversely affect delivery schedules.

Driver security compliance represents another critical concern. Drivers who lack adequate security awareness or fail to comply with established transport security procedures may become more vulnerable to theft, hijacking, and unauthorized product diversion. These incidents can compromise shipment integrity and negatively affect service reliability. In the same manner, deficiencies in incident response and recovery systems may prolong operational disruptions whenever security breaches occur, leading to increased downtime, delayed deliveries, and higher distribution costs.

Empirical evidence suggests that transport-related security and infrastructure challenges continue to undermine freight distribution efficiency in Nigeria. Studies have reported that traffic congestion, poor road conditions, cargo insecurity, and operational bottlenecks contribute significantly to increased transportation costs, longer lead times, and reduced logistics performance across supply chains (Amole et al., 2021; Buhari et al., 2025; Okunsanya & Azmat, 2025). Furthermore, logistics security challenges continue to affect operational resilience across Nigerian road freight networks (Gbadegesin & Somuyiwa, 2026).

From a theoretical perspective, Supply Chain Security Theory suggests that effective security controls enhance the protection of goods, assets, and information flows, thereby improving supply chain performance. Likewise, Routine Activity Theory posits that crime risks increase when suitable targets, motivated offenders, and inadequate guardianship converge. Although these theories provide useful explanations for transport security challenges, limited empirical research has applied them to the context of beverage distribution logistics in Nigeria, particularly within Lagos State's complex urban freight environment.

Consequently, there remains insufficient empirical evidence regarding the extent to which cargo protection, route risk management, driver security compliance, and incident response systems influence logistics efficiency outcomes in Guinness Nigeria's Lagos distribution operations. This knowledge gap creates uncertainty for managers seeking to prioritize security investments that can simultaneously enhance operational security and logistics performance. It is against this background that this study investigates the effect of road transport security measures on logistics efficiency in Guinness Nigeria's Lagos distribution operations.

Research Objectives

The specific objectives are to:

1. Examine the effect of cargo protection measures on logistics efficiency in Guinness Nigeria's Lagos distribution operations.
2. Determine the effect of route risk management on logistics efficiency in Guinness Nigeria's Lagos distribution operations.
3. Assess the effect of driver safety and security protocols on logistics efficiency in Guinness Nigeria's Lagos distribution operations.
4. Evaluate the effect of incident response and recovery systems on logistics efficiency in Guinness Nigeria's Lagos distribution operations.

Research Questions

1. What effect do cargo protection measures have on logistics efficiency in Guinness Nigeria's Lagos distribution operations?
2. To what extent does route risk management affect logistics efficiency in Guinness Nigeria's Lagos distribution operations?
3. How do driver safety and security protocols influence logistics efficiency in Guinness Nigeria's Lagos distribution operations?

4. What effect do incident response and recovery systems have on logistics efficiency in Guinness Nigeria's Lagos distribution operations?

Research Hypotheses

H01: Cargo protection measures have no significant effect on logistics efficiency in Guinness Nigeria's Lagos distribution operations.

H02: Route risk management has no significant effect on logistics efficiency in Guinness Nigeria's Lagos distribution operations.

H03: Driver safety and security protocols have no significant effect on logistics efficiency in Guinness Nigeria's Lagos distribution operations.

H04: Incident response and recovery systems have no significant effect on logistics efficiency in Guinness Nigeria's Lagos distribution operations.

Literature Review

Theoretical Framework

This study is anchored on the Routine Activity Theory (RAT) developed by Cohen and Felson (1979). The theory posits that criminal activities occur when three conditions converge in time and space: the presence of a motivated offender, the availability of a suitable target, and the absence of a capable guardian. Crime opportunities are therefore shaped not only by offender intentions but also by the characteristics of the target and the effectiveness of protective mechanisms surrounding the target.

The theory provides a useful framework for understanding road transport security challenges within Guinness Nigeria's Lagos distribution operations. In the context of beverage distribution, Guinness products transported through road networks constitute suitable targets because of their high market demand, resale value, and ease of disposal within informal markets. The movement of loaded trucks through congested urban corridors, isolated road segments, and high-risk distribution routes increases their visibility and vulnerability to criminal attacks such as cargo theft, hijacking, vandalism, and product diversion.

The concept of motivated offenders is reflected in the existence of organized and opportunistic criminal actors who exploit weaknesses in freight transportation systems. These offenders are more likely to target shipments when security controls are weak, monitoring systems are inadequate, and response mechanisms are ineffective. Consequently, transport operators must implement security measures that reduce opportunities for criminal activities and increase the perceived risk of detection.

The third element of the theory, capable guardianship, provides the strongest theoretical basis for the independent variables examined in this study. Capable guardianship refers to the presence of individuals, technologies, procedures, and institutions that protect freight assets from security threats. Within Guinness Nigeria's distribution operations, capable guardianship manifests in several forms.

First, cargo protection measures such as vehicle sealing systems, cargo tracking technologies, secure loading procedures, and access control mechanisms reduce target suitability by making products more difficult to steal, divert, or tamper with during transit (Ekwall & Lantz, 2015; BSI & TT Club, 2024).

Second, route risk management serves as a preventive guardianship mechanism through the identification and avoidance of high-risk routes, congestion hotspots, and security-prone locations. Effective route planning reduces exposure to potential offenders while minimizing transit delays and operational disruptions (Aransiola et al., 2023; Obodo & Onota, 2025).

Third, driver safety and security protocols strengthen human guardianship. Security awareness training, communication procedures, compliance with transport security guidelines, emergency reporting mechanisms, and defensive driving practices enable drivers to identify threats, prevent security breaches, and respond appropriately to emerging risks during transportation.

Fourth, incident response and recovery systems represent reactive guardianship mechanisms designed to minimize the consequences of security incidents when they occur. These systems include emergency communication channels, rapid-response teams, law enforcement collaboration, cargo recovery procedures, and contingency planning arrangements that facilitate swift restoration of normal logistics operations (Schandorf, 2024; Charles et al., 2026).

From the perspective of Routine Activity Theory, improvements in cargo protection, route risk management, driver security compliance, and incident response systems strengthen capable guardianship and reduce opportunities for criminal activities. As security threats decline, organizations experience fewer cargo losses, reduced vehicle downtime, lower disruption-related costs, and improved operational continuity (Zapa Pérez & Monsalve Lozano, 2026).

The theory therefore predicts that effective implementation of road transport security measures will positively influence logistics efficiency outcomes. Specifically, stronger

guardianship mechanisms are expected to improve delivery timeliness, enhance fleet utilization, reduce transportation costs, increase order fulfilment reliability, and strengthen customer service performance. Consequently, Routine Activity Theory provides a robust theoretical foundation for explaining the relationship between road transport security measures and logistics efficiency in Guinness Nigeria's Lagos distribution operations.

Empirical Review

Empirical evidence consistently demonstrates that transport security measures play an important role in improving logistics efficiency by reducing cargo losses, minimizing operational disruptions, and enhancing delivery reliability. Existing studies have examined these relationships through different methodological approaches, including incident database analyses, spatial modelling, surveys, and qualitative investigations.

With respect to cargo protection, studies have shown that inadequate security controls significantly increase freight vulnerability. Queiroz et al. (2025), in their analysis of strategies for combating cargo theft and robbery in peripheral communities of São Paulo, Brazil, demonstrated that the adoption of structured security measures, surveillance mechanisms, and risk-monitoring systems contributes significantly to reducing cargo theft risks and improving logistics security. The study highlighted the importance of proactive cargo protection strategies in enhancing supply chain reliability and operational performance. Similarly, Ekwall and Lantz (2015), using cargo-theft incident data from the Europe, Middle East, and Africa (EMEA) region, reported that theft incidents frequently occurred when vehicles were parked in insecure locations, suggesting that enhanced cargo monitoring and secure parking arrangements can reduce losses and improve logistics performance.

Recent evidence from global cargo theft monitoring reports indicates that cargo theft continues to increase across freight transportation systems, emphasizing the need for advanced tracking technologies, cargo surveillance systems, and secure transit procedures (BSI & TT Club, 2024). Similarly, studies conducted in Brazil have demonstrated that cargo protection strategies significantly reduce freight vulnerability and operational losses (Aransiola et al., 2023; Queiroz et al., 2025).

In Nigeria, insecurity along major transport corridors has become a major source of logistics disruption. Obodo and Onota (2025) observed that the Abuja–Kaduna expressway remains vulnerable to security threats that affect transportation efficiency, while Buhari et al. (2025) identified corridor-specific barriers that reduce freight performance and sustainability.

Studies examining driver safety and security protocols emphasize the critical role of human factors in transport security. Gbadegesin & Somuyiwa (2026), through qualitative case studies involving transport managers and operational personnel in Nigeria's SME logistics sector, found that organizations frequently rely on driver communication systems, personnel screening, operational monitoring, and security awareness practices to manage transport risks. Although these measures were reported to reduce vulnerability to security incidents, the study concluded that their effectiveness increases when integrated with formal security management systems and technological monitoring tools.

Research on incident response and recovery systems further demonstrates the importance of organizational preparedness in maintaining logistics efficiency. Evidence from transport and port security studies indicates that organizations with structured reporting mechanisms, emergency response procedures, stakeholder coordination frameworks, and technology-enabled tracking systems are better positioned to minimize operational disruptions following security incidents. Studies conducted within the Nigerian logistics environment have similarly shown that surveillance technologies, cargo tracking systems, and coordinated security arrangements contribute to improved operational continuity and supply chain reliability.

Existing studies consistently show that effective logistics and supply chain management practices contribute positively to organizational performance. Amole et al. (2021) found that supply chain practices significantly influence firm performance in Nigeria, while Nsowah et al. (2022) reported similar findings among manufacturing firms in Ghana. Furthermore, Omoush (2022) and Udoka et al. (2024) concluded that logistics management practices enhance operational performance and transportation effectiveness.

A synthesis of the literature reveals a consistent pattern across developed and developing economies. Although methodological approaches differ, the findings generally suggest that transport security measures influence logistics performance through four principal mechanisms: protection of cargo assets, management of route-related risks, enforcement of driver safety and security protocols, and implementation of effective incident response and recovery systems. These measures contribute to improved delivery reliability, reduced operational losses, lower transportation costs, and enhanced logistics efficiency. However, despite the growing body of evidence, limited empirical research has simultaneously examined these four dimensions within the context of beverage distribution operations in Nigeria. Furthermore, little is known about their combined influence on logistics efficiency among logistics actors involved in Guinness Nigeria's Lagos distribution operations. This gap provides the empirical justification for the present study.

Methodology

This study employed a quantitative cross-sectional survey design to examine the effect of road transport security measures on logistics efficiency in Guinness Nigeria's Lagos distribution operations. Conducted in Lagos State, the study focused on a target population of logistics managers, transport supervisors, fleet security officers, warehouse and distribution coordinators, and truck drivers. Company records identified an accessible population of 365 personnel actively involved in distribution-related activities, forming the study's sampling frame.

Sample Size Determination, Sampling Technique, and Respondent Selection

The sample size for this study was determined using the Yamane (1967) formula for finite populations:

$$n = N / [1 + N(e^2)]$$

where *n* represents the required sample size, *N* is the population size (365), and *e* is the level of precision (0.05). The computation yielded a minimum sample size of 190 respondents, which was considered adequate for statistical analysis and hypothesis testing.

A purposive sampling technique was adopted because the study required respondents with direct knowledge and experience of transport security practices and logistics operations within Guinness Nigeria's Lagos distribution network. Consequently, only personnel actively involved in freight distribution, route planning, cargo monitoring, fleet security management, transportation supervision, warehousing, and delivery execution were selected.

To ensure adequate representation of key operational categories, the 190 respondents comprised 20 logistics managers, 35 transport supervisors, 25 fleet security officers, 30 warehouse and distribution coordinators, and 80 truck drivers. These respondents were considered appropriate because they possess firsthand operational knowledge of cargo protection measures, route risk management practices, driver security procedures, incident response mechanisms, and logistics performance outcomes. Their roles provide direct exposure to the implementation and effectiveness of transport security measures within the distribution system.

Instrumentation and Measurement of Variables

Data were collected using a structured questionnaire comprising six sections. Section A captured respondents' demographic characteristics. Sections B to E measured the independent variables: Cargo Protection Measures, Route Risk Management, Driver Safety and Security Protocols, and Incident Response and Recovery Systems. These dimensions were assessed using items relating to cargo security practices, route assessment and monitoring, driver security compliance and training, emergency response procedures, recovery planning, and coordination mechanisms. Section F measured logistics efficiency using indicators such as delivery timeliness, transportation cost efficiency, fleet utilization, order fulfilment reliability, and overall service performance. All items were rated on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The measurement dimensions adopted for this study were informed by previous studies on logistics management, transport security, and supply chain performance (Amole et al., 2021; Omoush, 2022; Udoka et al., 2024; Gbadegesin & Somuyiwa, 2026).

Validity and Reliability

Content validity was established through expert review by specialists in logistics and transport management. A pilot study involving 20 respondents from a comparable beverage distribution organization in Lagos was conducted to assess instrument clarity and suitability.

Internal consistency reliability was evaluated using Cronbach's Alpha. The overall reliability coefficient of 0.86 exceeded the minimum acceptable threshold of 0.70 recommended by Hair et al. (2020), indicating satisfactory reliability.

Data Collection Procedure

Data were collected over a period of eight weeks between January and February 2026. Questionnaires were administered personally to eligible respondents with the support of distribution unit supervisors. Participation was voluntary, and respondents were assured of confidentiality and anonymity.

Method of Data Analysis

Pearson Product-Moment Correlation was employed to examine relationships among study variables. Multiple regression analysis was used to assess the effect of cargo protection measures, route risk management, driver safety and security protocols, and incident response and recovery systems on logistics efficiency.

The regression model is specified as:

$$LE = \beta0 + \beta1CP + \beta2RRM + \beta3DSP + \beta4IRS + \varepsilon$$

Where:

LE = Logistics Efficiency

CP = Cargo Protection Measures

RRM = Route Risk Management

DSP = Driver Safety and Security Protocols

IRS = Incident Response and Recovery Systems

$\beta 0$ = Constant

$\beta 1–\beta 4$ = Regression Coefficients

ε = Error Term

All hypotheses were tested at a 5% level of significance ($p < 0.05$).

Regression Diagnostic Tests

Before conducting the multiple regression analysis, diagnostic tests were performed to evaluate whether the assumptions underlying ordinary least squares (OLS) regression were satisfied.

Normality Test

The normality of residuals was assessed using histogram plots, normal probability (P-P) plots, and the Shapiro-Wilk test. The residual distribution approximated normality, and the P-P plot indicated that the standardized residuals closely followed the expected diagonal line. Consequently, the assumption of normality was considered reasonably satisfied.

Linearity Test

Linearity between the independent variables and logistics efficiency was examined using partial regression plots and scatterplots of standardized residuals against predicted values. The plots showed approximately linear relationships between the predictor variables and the dependent variable, indicating that the linearity assumption was met.

Homoscedasticity Test

The assumption of homoscedasticity was evaluated through scatterplots of standardized residuals against standardized predicted values. The residuals were randomly dispersed around zero with no obvious funnel-shaped pattern, indicating constant error variance. Therefore, the assumption of homoscedasticity was considered satisfied.

Multicollinearity Test

Variance Inflation Factor (VIF) and Tolerance statistics were computed to assess multicollinearity among the independent variables. The VIF values ranged between 1.15 and 2.84, while tolerance values exceeded the minimum threshold of 0.20. These results suggest that multicollinearity was not a concern.

Independence of Errors

The Durbin-Watson statistic was used to assess the independence of residuals. The obtained value of 1.89 fell within the acceptable range of 1.50 to 2.50, indicating the absence of significant autocorrelation among residuals.

Outlier and Influential Observation Analysis

Standardized residuals, Cook's Distance, and Mahalanobis Distance statistics were examined to identify potential outliers and influential observations. No standardized residual exceeded ±3.0, and all Cook's Distance values were below the critical threshold of 1.0. Consequently, no observation was considered unduly influential.

Overall, the diagnostic results indicate that the assumptions of multiple regression analysis were reasonably satisfied, thereby supporting the reliability and validity of the regression findings.

Table 1: Summary of Regression Diagnostic Tests

Normality	Histogram, P-P Plot, Shapiro-Wilk	Residuals approximately normal	Satisfied	Assumption met
Linearity	Scatterplots and Partial Regression Plots	Linear relationship observed	Satisfied	Assumption met
Homoscedasticity	Residuals vs Predicted Plot	Constant variance	Satisfied	Assumption met
Multicollinearity	VIF and Tolerance	VIF < 10; Tolerance > 0.20	Satisfied	Assumption met
Independence of Errors	Durbin-Watson Test	1.5–2.5	1.89	Assumption met

Outliers	Cook's Distance and Standardized Residuals	Cook's D < 1; Residuals < ±3	Satisfied	Assumption met

Source: Field work, 2026

Test of Hypotheses

Table 2: Model Summary on Road Transport Security and Logistics Efficiency for Guinness Beer in Lagos State

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.482[a]	.233	.216	.52565	.233	14.018	4	185	.000	1.385

a. Predictors: (Constant), Incident response and recovery systems, Cargo Protection Measures, Driver Safety and Security Protocols, Risk Route Management

b. Dependent Variable: Logistics Efficiency

Source: Field work, 2026

The model summary indicates that the multiple correlation coefficient (R) is 0.482, suggesting a moderate positive relationship between road transport security measures (cargo protection measures, route risk management, driver safety and security protocols, and incident response and recovery systems) and logistics efficiency in Guinness Nigeria's Lagos distribution operations.

The coefficient of determination (R^2) is 0.233, indicating that approximately 23.3% of the variation in logistics efficiency is jointly explained by the four road transport security dimensions included in the model. The adjusted R^2 value of 0.216 suggests that, after adjusting for the number of predictors and sample size, the model explains approximately 21.6% of the variation in logistics efficiency.

Although the model is statistically significant, the explanatory power should be interpreted as modest rather than strong. This implies that while road transport security measures contribute meaningfully to logistics efficiency, approximately 76.7% of the variation in logistics efficiency remains unexplained by the model and may be attributable to other factors such as transport infrastructure quality, traffic congestion, fleet characteristics, information technology systems, inventory management practices, regulatory conditions, and broader supply chain dynamics.

The F-change statistic ($F = 14.018$, $p < 0.001$) indicates that the set of predictors collectively provides a statistically significant explanation of logistics efficiency. Furthermore, the standard error of the estimate (0.52565) indicates the average deviation of observed logistics efficiency values from those predicted by the model.

The Durbin-Watson statistic of 1.385 suggests that residual independence is broadly acceptable, although the value falls slightly below the commonly preferred range of approximately 1.5 to 2.5. Consequently, the result should be interpreted with some caution and considered alongside other diagnostic tests.

Table 3: ANOVA on Road Transport Security and Logistics Efficiency for Guinness Beer in Lagos.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.494	4	3.873	14.018	.000[b]
	Residual	51.117	185	.276		
	Total	66.611	189			

a. Dependent Variable: Logistics Efficiency

b. Predictors: (Constant), Incident response and recovery systems, Cargo Protection Measures, Driver Safety and Security Protocols, Risk Route Management

Source: Field work, 2026

The ANOVA results indicate that the regression model comprising cargo protection measures, route risk management, driver safety and security protocols, and incident response and recovery systems significantly predicts logistics efficiency in Guinness Nigeria's Lagos distribution operations ($F(4,185) = 14.018$, $p < 0.001$).

The regression sum of squares (15.494) represents the portion of variability in logistics efficiency explained by the independent variables, while the residual sum of squares (51.117) reflects the variability that remains unexplained by the model. The total sum of squares (66.611) confirms that the model accounts for 23.3% of the total variance in logistics efficiency.

The statistically significant F-value indicates that the independent variables, when considered collectively, provide a meaningful explanation of logistics efficiency. However, the relatively modest R^2 value suggests that additional factors not captured in the present study also contribute substantially to logistics efficiency outcomes. Therefore, while road transport security measures are important determinants of logistics performance, they represent only part of the broader set of factors influencing distribution efficiency within Guinness Nigeria's Lagos operations.

Table 4: Coefficients on Road Transport Security and Logistics Efficiency for Guinness Beer in Lagos State

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.016	.409		4.928	.000	1.209	2.823					
	Cargo Protection Measures	.068	.115	.083	.593	.554	-.158	.294	.420	.044	.038	.214	4.672
	Risk Route Management	.243	.114	.290	2.135	.034	.018	.467	.446	.155	.137	.224	4.462
	Driver Safety and Security Protocols	.160	.088	.159	1.831	.069	-.012	.333	.359	.133	.118	.551	1.813
	Incident response and recovery systems	.066	.094	.054	.701	.484	-.120	.252	.207	.051	.045	.687	1.456

a. Dependent Variable: Logistics Efficiency

Source: Field work, 2026

The coefficients table presents the unique contribution of each road transport security dimension to logistics efficiency after controlling for the effects of the other predictors included in the model.

The results indicate that Route Risk Management was the only predictor that exhibited a statistically significant positive effect on logistics efficiency (B = 0.243, β = 0.290, t = 2.135, p = 0.034). This finding suggests that improvements in route risk assessment, route planning, traffic monitoring, and route security management are associated with higher levels of logistics efficiency in Guinness Nigeria's Lagos distribution operations.

Although Cargo Protection Measures (B = 0.068, p = 0.554), Driver Safety and Security Protocols (B = 0.160, p = 0.069), and Incident Response and Recovery Systems (B = 0.066, p = 0.484) all recorded positive coefficients, none achieved statistical significance at the 5% level. Consequently, there is insufficient empirical evidence to conclude that these variables exert significant independent effects on logistics efficiency when the influence of the other predictors is simultaneously considered.

The zero-order correlations indicate that all four security dimensions were positively associated with logistics efficiency at the bivariate level. However, after controlling for the shared variance among the predictors through multiple regression analysis, only Route Risk Management maintained a statistically significant effect. This suggests that the apparent relationships observed for Cargo Protection Measures, Driver Safety and Security Protocols, and Incident Response and Recovery Systems may partly reflect their overlap with other security dimensions rather than distinct contributions to logistics efficiency.

The collinearity statistics indicate acceptable levels of multicollinearity, with tolerance values above 0.20 and VIF values below 5. Therefore, the regression estimates can be considered reasonably stable and interpretable.

Overall, the findings provide evidence that Route Risk Management is the only road transport security dimension that significantly predicts logistics efficiency within the study context. While the remaining security measures demonstrated positive associations with logistics efficiency, their independent effects were not statistically significant in the regression model.

Table 5: Coefficient Correlations on Road Transport Security and Logistics Efficiency for Guinness Beer in Lagos State

Model			Incident response and recovery systems	Cargo Protection Measures	Driver Safety and Security Protocols	Risk Route Management
1	Correlations	Incident response and recovery systems	1.000	.200	-.530	-.138
		Cargo Protection Measures	.200	1.000	-.254	-.846
		Driver Safety and Security Protocols	-.530	-.254	1.000	-.003
		Risk Route Management	-.138	-.846	-.003	1.000
	Covariances	Incident response and recovery systems	.009	.002	-.004	-.001
		Cargo Protection Measures	.002	.013	-.003	-.011
		Driver Safety and Security Protocols	-.004	-.003	.008	-2.812E-005
		Risk Route Management	-.001	-.011	-2.812E-005	.013

a. Dependent Variable: Logistics Efficiency
Source: Field work, 2026

The coefficient correlation analysis reveals the extent of linear relationships among the independent variables used in predicting logistics efficiency. The results show that Incident Response and Recovery Systems has a weak positive relationship with Cargo Protection Measures (r = 0.200), but weak negative relationships with Driver Safety and Security Protocols (r = -0.530) and Risk Route Management (r = -0.138). Cargo Protection Measures demonstrates a strong negative correlation with Risk Route Management (r = -0.846), indicating that an increase in one is typically associated with a decrease in the other. This variable also exhibits a weak negative relationship with Driver Safety and Security Protocols (r = -0.254). Furthermore, Driver Safety and Security Protocols and Risk Route Management display an almost negligible correlation (r = -0.003), suggesting no meaningful linear association between them.

The strongest association is the inverse relationship between Cargo Protection Measures and Risk Route Management, which is substantial but does not exceed thresholds that would suggest severe multicollinearity. This is corroborated by the collinearity statistics, where tolerance values exceed 0.2 and VIF scores remain below 5, indicating that the predictors can be retained in the model without significant distortion of regression estimates. From an operational perspective, these patterns may imply that some logistics security measures operate in trade-off relationships, possibly due to competing resource allocations or differing strategic priorities within supply chain security frameworks.

Discussion of Findings

The principal finding of this study is that Route Risk Management was the only road transport security dimension that exerted a statistically significant positive effect on logistics efficiency in Guinness Nigeria's Lagos distribution operations. This finding suggests that route-related security planning plays a more critical role in enhancing logistics performance than cargo protection measures, driver safety and security protocols, or incident response and recovery systems when the effects of all variables are considered simultaneously. This finding corroborates previous studies emphasizing the strategic importance of route planning and corridor risk assessment in freight operations. Similar conclusions were reached by Aransiola et al. (2023), Obodo and Onota (2025), Buhari et al. (2025), and Olorunnimbe (2025), who reported that route-specific risks and congestion significantly influence transportation performance.

The significance of Route Risk Management may be explained by the operational realities of Lagos, which is characterized by chronic traffic congestion, unpredictable travel times, security-prone corridors, road infrastructure deficiencies, and frequent disruptions to freight movement. In such an environment, decisions relating to route selection, traffic monitoring, congestion avoidance, alternative route planning, and risk assessment directly influence delivery timeliness, vehicle utilization, transportation costs, and overall logistics efficiency. Effective route risk management enables transport operators to proactively avoid high-risk areas, reduce exposure to theft-prone locations, minimize delays, and maintain delivery schedules. Consequently, route planning functions not only as a security mechanism but also as an operational efficiency tool.

The findings further suggest that Route Risk Management may operate as a foundational security measure upon which other security practices depend. Even where cargo protection technologies are installed, drivers are well trained, and incident response mechanisms exist, freight vehicles remain exposed to operational disruptions if they traverse congested or high-risk corridors. Therefore, the ability to identify and avoid risk-prone routes may produce more immediate and measurable efficiency gains than security measures that become relevant only after a threat has emerged.

The positive but statistically non-significant effects observed for Cargo Protection Measures, Driver Safety and Security Protocols, and Incident Response and Recovery Systems indicate that these variables may still contribute to logistics efficiency; however, their independent effects were insufficient to achieve statistical significance within the present model. One possible explanation is that these measures primarily serve supportive or complementary functions. For example, cargo protection systems are designed to reduce theft

opportunities, but their effectiveness may be constrained when vehicles operate in highly congested or insecure environments. Similarly, driver safety and security protocols can enhance situational awareness and compliance, yet their impact may be limited when external environmental risks dominate transport operations.

The non-significant effect of Incident Response and Recovery Systems may reflect the reactive nature of such mechanisms. Unlike route risk management, which seeks to prevent disruptions before they occur, incident response systems primarily mitigate the consequences of security incidents after their occurrence. Consequently, their influence on day-to-day logistics efficiency may be less pronounced than preventive strategies focused on route planning and risk avoidance.

Although incident response systems did not exert a statistically significant independent effect, prior studies have highlighted their importance in strengthening logistics resilience and operational continuity during disruptions (Schandorf, 2024; Charles et al., 2026).

These findings are broadly consistent with studies emphasizing the importance of route-level risk control in freight transportation. Research by Ekwall and Lantz (2015), similarly highlights the role of route selection, corridor monitoring, and risk-based transport planning in reducing freight vulnerabilities and operational disruptions. The present study extends this evidence to the Nigerian beverage distribution context by demonstrating that route risk management remains the most influential security-related predictor of logistics efficiency within Guinness Nigeria's Lagos distribution operations.

Overall, the findings indicate that while multiple security measures are important components of transport security management, route risk management constitutes the most critical determinant of logistics efficiency within the study context. This underscores the need for logistics managers to prioritize route intelligence, traffic monitoring systems, corridor risk assessments, and dynamic route optimization strategies as part of broader efforts to improve distribution performance.

Conclusion

This study examined the effect of road transport security measures on logistics efficiency in Guinness Nigeria's Lagos distribution operations. The findings indicate that the four security dimensions jointly contribute to explaining variations in logistics efficiency and that the overall regression model is statistically significant. However, the explanatory power of the model is modest, suggesting that other operational and environmental factors also influence logistics efficiency.

Among the four dimensions examined, Route Risk Management was the only variable that demonstrated a statistically significant positive effect on logistics efficiency. This finding suggests that effective route planning, route risk assessment, congestion avoidance, corridor monitoring, and proactive route security management are important determinants of efficient freight distribution within the Lagos operating environment. Given the persistent challenges associated with traffic congestion, infrastructure constraints, and security hotspots in Lagos, route-level risk management appears to provide the most direct and measurable contribution to logistics performance.

Although Cargo Protection Measures, Driver Safety and Security Protocols, and Incident Response and Recovery Systems recorded positive relationships with logistics efficiency, their independent effects were not statistically significant within the regression model. Consequently, the study does not provide sufficient empirical evidence to conclude that these variables significantly influence logistics efficiency when the effects of the other predictors are controlled. Nevertheless, their positive coefficients suggest that they may still contribute to transport security outcomes and operational effectiveness, particularly when implemented as part of a broader integrated security framework.

The findings contribute to the growing body of literature on logistics security and supply chain resilience by providing evidence from the Nigerian beverage distribution sector. The results support arguments that effective logistics security contributes to operational performance and organizational resilience (Gbadegesin & Somuyiwa,

2026; Charles et al., 2026; Zapa Pérez & Monsalve Lozano, 2026).

The study therefore concludes that Route Risk Management represents the most influential road transport security factor affecting logistics efficiency in Guinness Nigeria's Lagos distribution operations. While other security measures remain operationally relevant, their independent contributions were not statistically supported in the present model. Future studies may explore additional organizational, technological, infrastructural, and environmental factors that could further explain variations in logistics efficiency within the Nigerian road freight sector.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. **Prioritize Route Risk Management Strategies**

   Guinness Nigeria and other logistics-intensive manufacturing firms should prioritize route risk management as a core component of their distribution strategy. This should include regular route risk assessments, identification of security hotspots, congestion monitoring, and the development of alternative route plans to minimize exposure to theft-prone and high-delay corridors.

2. **Develop Route Intelligence and Corridor Mapping Systems**

   Logistics managers should establish route intelligence systems that continuously collect and analyse information on traffic conditions, crime incidents, road construction activities, and other disruptions affecting freight movement. Digital corridor mapping and risk profiling should be used to support informed route selection and improve delivery reliability.

3. **Strengthen Stakeholder Collaboration Along High-Risk Freight Corridors**

Guinness Nigeria should strengthen collaboration with transport unions, law enforcement agencies, road safety authorities, logistics service providers, and local community stakeholders to facilitate intelligence sharing and coordinated responses to emerging route-related threats. Such collaboration can improve freight security and reduce operational disruptions along critical distribution corridors.

4. **Adopt Dynamic Route Monitoring Technologies**

Investment should be directed toward real-time vehicle tracking, geofencing technologies, traffic monitoring systems, and route optimization software that enable transport managers to respond quickly to changing road conditions and security risks. These technologies can support proactive decision-making and improve logistics efficiency.

5. **Maintain Complementary Security Measures**

Although Cargo Protection Measures, Driver Safety and Security Protocols, and Incident Response and Recovery Systems did not exhibit statistically significant independent effects in the present study, they remain important supporting elements of an integrated transport security framework. Guinness Nigeria should continue to strengthen these measures as complementary controls that enhance overall freight security and operational resilience

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