SECURITY-INDUCED DISRUPTIONS AND ADAPTIVE RESILIENCE IN ROAD FREIGHT TRANSPORTATION: EVIDENCE FROM THE MINNA-KONTAGORA CORRIDOR, NIGERIA

BY

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Abstract
Road freight transportation along the Minna–Kontagora corridor in Niger State, Nigeria, has increasingly been disrupted by insecurity, including armed banditry, kidnapping for ransom, and cargo theft. These challenges have significantly undermined operational efficiency, delivery reliability, and freight stability, with wider economic and social consequences. This study examines the nature of security-induced disruptions and the resilience strategies adopted by freight operators along the corridor. Anchored in resilience theory, the study emphasises adaptive capacity, flexibility, and redundancy as key mechanisms for sustaining operations under adverse conditions. A descriptive survey design was adopted, with a sample size of 400 respondents determined using Taro Yamane's formula. Primary data were collected through structured questionnaires using four-point Likert scale items. Data were analysed using descriptive statistics, including frequencies, percentages, and tables. Weighted values were assigned to Likert responses (1.5 for strongly agree, 1.0 for agree, 0.5 for disagree, and 0 for strongly disagree) to rank the severity of disruptions and the effectiveness of resilience strategies. Findings indicate that banditry attacks, kidnapping incidents, proliferation of security checkpoints, and pervasive fear among transport workers are major sources of disruption. In response, operators adopt strategies such as rescheduling travel times, rerouting, collaboration with security agencies and local vigilantes, use of communication technologies, and absorption of increased operational costs. The study concludes that while insecurity remains a critical constraint, freight operators demonstrate notable resilience. It recommends coordinated efforts among government agencies, security institutions, and transport stakeholders to develop integrated security frameworks and communication systems to enhance safety and ensure sustainable freight movement.
Keywords: Security, Disruptions, Resilience, Freight Transport

Introduction

For decades now, disruption of transportation on the highways has become a vital part of procurement and supply chain disturbances that worries organisations (Albertzeth et al., 2020). In this direction, a study conducted by Business Continuity Institute (2021) shows that about 84.0%, 70.0%, 65%, and 63.0% of enterprises faces interruptions both on the country's land, nations sea, air space and as well as the borderlines of various countries. Therefore, disruptions affecting transport systems can be viewed as unpredictable and unforeseen interruptions, suspensions, or check-points in moving resources as well as goods from buyers place to the place the goods and products are required (Paul et al., 2019). These types of disruptions often lead to substantial expenses to firms, institutions and the community at large (Safitri & Chikaraishi, 2022). For example, when the United Kingdom railway staff embarked on a strike, this challenged make the country to loss about £1.5 billion in December 2022 (Kiely, 2022; Kollewe, 2022).

Likewise, a similar disruption that affect various jobs and more importantly the procurement and supply chains globally recently was the disruption that affected the Suez Canal (Leonard, 2021) and this further led to a huge loss of nearly $6 billion to $10 billion weekly (Reuters, 2021). As such, the impact of disruptions on transportation cannot be overemphasised, as it practically creates a gap in smooth delivery and transfer of supply chain activities, affect profits of organisations and disrupts the entire market structure and availability of goods, resources and products (Albertzeth et al., 2020). From September 11, 2001 to date, the security of goods and products have change globally. This situation can be attributed to the bombing of the Word Trade Centre during the attack carried about by Al-Qaeda, popularly referred to as the 9/11 attack. The event changes the position and perception of countries and the international communities on the modes and safety of the transportation types available in the world. Decades after, various methods and strategies have been embraced and utilised to enhance the available security of the transportation types from attacks carried or motivated by terrorism (Szyliowicz et al., 2016).

Furthermore, to limit terrorism attacks and the the ability of the systems to withstand these disruptions and attacks, lowering their impacts and to recover swiftly, and to be "resilient" have begun to gather better momentum and global attention by countries and international communities (Besino-vic, 2020). Unfortunately, majority of these measures adopted and use to protect the transportation system have continued to be futile (Rozhkov., 2020; Ram & Zhang, 2020). For decades, Nigeria has been witnessing numerous issues of insurgency on her roads both in the rural communities and urban locations, south and north, east and west (Ugwuoke, 2023). These activities of insurgent in the North Central Geo-political zone and Niger State in particular. The sequence of attacks on the highways has influenced the swift movement of freights, especially agro-food products; individuals and the economy of Niger State significantly particularly for a state with largest land area throughout the country (Ajiboye, Iheanancho & Soomiyol, 2025).

Regardless of the determination of the governments and commercial transport service workers across the world in battling with all the challenges that is affecting the well-organised and effective provision of transport systems such as high rate of accidents, highway armed robbery, rural banditry; kidnapping for ransom, terrorism, militancy and insurgency (Ajiboye, 2023; Ajiboye, Iheanancho & Soomiyol, 2025). It is against this backdrop that this study is designed to investigate security-induced disruptions and resilience of road freight transportation along the Minna-Kontagora corridor with the aim of proffering suitable solutions towards the reduction of road freight delays in the study area.

Literature Review

Resilience Theory begins with C.S. Holling, an ecologist who in 1973 announced the concept to define the capacity of ecosystems to absorb instabilities without failing into qualitatively diverse states. Holling asserts that ecosystems do not continuously return to a single equilibrium after a blow, but rather display fluctuating extent of ability to rearrange while preserving primary responsibility (Holling, 1973). This argument signified an important movement from traditional equilibrium-based thought, which anticipated that systems normally return to a pre-disturbance phase. For many decades now, the idea of resilience has changed above ecological setting, outspreading into disciplines such as engineering, organisational research, psychology, and the management of major infrastructure. Researchers such as Folke (2006) stressed its usage in social-ecological systems, however supply chain and transport scholars adopted it to comprehend how networks endure shocks and uphold operations under ambiguity (Ponomarov & Holcomb, 2009). In research conducted on transport and logistics, resilience now assists as a theory for investigating adaptive methods, redundancy, and systemic flexibility, making it predominantly appropriate for

examining transport corridors affected by insecurity in Niger State. The basic assumptions of resilience theory are as follows. The theory believes that systems are dynamic and non-linear, signifying that reactions to shocks are frequently not predictable and can cause new arrangements instead of merely returning to a previous form (Walker, Holling, Carpenter, & Kinzig, 2004). Also, the adaptive capability is very important to resilience, acknowledging the system's capacity to study, innovate, and execute survival methods to remain working under pressure (Linnenluecke, 2017). The use of resilience theory to investigate the Minna–Kontagora corridor, security threats which comprises of banditry attacks, the theft and hijacking of vehicles on the roads, and mounting of security checkpoints can be placed under external instabilities to the freight transport system along the study area. Traditional transport theories repeatedly laid emphasis on cost, effectiveness, or route optimisation, but they do not characteristically explain the adaptive reactions that commercial transport networks used during insistent insecurity. Resilience theory, nevertheless, view these disturbances as essential to appreciating the system's productivity level, stressing the methods and capabilities that assist freight operations to remain notwithstanding risks. For example, modifying travel periods and hours to evade high-risk periods proves proactive adaptation, but using various available roads and building an effective partnership with vigilante group's shows redundancy diversity of the entire system (Ponomarov & Holcomb, 2009).

There are numerous studies conducted globally on security and transportation of freight. In this direction, Ataburo, Ampong, Essuman (2024) study adopted the theory of constraints to argue that competence priority reduces the chances of enhancing operational resilience, and safeguarding and spanning methods decrease this restriction by allowing organisations to bring into line efficient priority with functioning resilience target. The research argues that these approaches positively reduce the negative impact of efficiency priority on working resilience to transportation disruptions. Their assertions are tested based on the field data collected from a selected respondent of 199 firms in Ghana utiliisng moderated regression analysis and the Johnson Neyman technique. Their findings show that effective priority is adversely connected to the interference absorption dimension of operational resilience but unconnected to its recoverability aspect. Furthermore, the research reveals that under little circumstances of safeguarding and bridging approaches, efficacy priority has better damaging relations with both dimensions of operational resilience. Contrasting, these connections are encouraging under the high conditions of either approach. The results add to resolve current arguments on the efficiency-resilience link and how it have significant effects on supply chain and business managers, as identified the research.

There are studies conducted on transport disruptions caused by insecurity, particularly in areas affected by banditry and Boko Haram insurgency in Nigeria. Against this backdrop, Ajiboye, Abdullahi and Ohida (2023) studied impacts of insurgency on road travel and freight transportation in Niger state. The study adopted mixed methods to gather data from the primary and secondary sources. The secondary data came from reports concerning insecurity related to transportation in Niger State while data was also collected from the administered questionnaires. 301 copies of questionnaire were administered through a simple random sampling technique to passengers at seven main interstate road transport parks located within Minna metropolis. In addition to the use of questionnaire, the researcher conducted oral interview with selected participants to gather relevant information from park managers and operators of the numerous interstate transport service workers. The findings from the study indicated that the safety and security of lives and goods were some of the significant factors that govern the choice of transportation services. Further findings showed that that increase in fare rates; waiting times and limited patronage were the main impacts of insecurity on interstate road transport service in Minna. The study thus suggested the revamping of the security arms of the nation by employing additional personnel, equipping them with capable weapons and motivations while the roads should be well maintained, lighted at night and equipped with cameras.

In a similar manner, Ajiboye (2023) investigated the level of armed banditry and the effect of armed banditry on the yam supply chain and agricultural communities. The research utilised a survey method and respondents were selected through the use of simple random sampling technique. The research further adopted and use a well-structured questionnaire to gather important data from the participants on the impact of armed banditry on farmers, operators of commercial vehicles, marketers of agro-food in key markets from Garatu, Paiko and Gwada. The research also used interviews to collect data from key stakeholders in government organisations and non-governmental organisations. The data gathered were analysed using descriptive and quantitative methods and the research showed that armed banditry has a adverse effect on agro-food production, road transportation, and trading activities in selected locations of the study, leading to limited agricultural productivity and a huge cost of agricultural produce and transportation. The study suggested that the primary responsibility of government should be on the protection of the lives and properties of her people through the building of centres that will train and equip the local vigilantes and the security personnel with sufficient and more refined tools for the early recognition of armed banditry.

More so, Ajiboye et al. (2024) examined the implications of insurgency on the distribution and marketing of agricultural products in Niger State using Shiroro Local Government Area as a case for analysis. The research adopted the survey research method and data were sourced from the registered farmers, marketers and commercial drivers who are located within the 15 wards of the LGA. The study used a selected sample size of 400 respondents which was arrived at through the use of Taro Yamane formula. Through a stratified sampling technique, the study administered copies of a structured questionnaire to the selected respondents in the study area. The data gathered were analysed through descriptive statistics such as percentage methods, frequency counts and mean. However, Z-test statistics was used to test the hypothesis at 0.05 level of significance. Findings from the field shows that the insurgency bring about low productivity from the people who engages in agricultural activities and have escaped from the hands of the insurgents and by this means causing more extra expenses to recruit manpower and workers from the less numbers of people that are available to take the huge security risk. Also, this affected the prices of farm inputs such as fertilizers, chemicals and other materials needed for farming, this further increases the prices of transportation within the communities affected and lower the extent of supplies made daily as well as reducing the required farm produce from the consumers. All these negatively affects agricultural activities, transportation and supply chain in the affected areas. The work indicated that the Z-Cal value of 0.032 is less than the critical value of 0.05. The null hypothesis is as a result accepted and the alternate hypothesis is rejected. This thus means that there is no statistically noteworthy change between the mean responses of farmers and marketers on the impacts of insurgency on the cost-effectiveness of farm products in Shiroro LGA. The research recommends that the government of Niger state should try harder to reduce the problem of insecurity by utilising all potential means while also making farm inputs such as improved seeds, fertilizers, herbicides and machinery freely available and obtainable at subsidised rates in order to increase their yield.

Research Objectives

The primary aim of this paper is to examine security-induced disruptions and resilience of road freight transportation along the Minna-Kontagora corridor. Specifically, the objectives of the study are:

i. To examine the nature and extent of security-induced disruptions affecting road freight transportation along the Minna–Kontagora corridor.
ii. To assess the resilience strategies adopted by road freight operators in mitigating the effects of insecurity along the Minna–Kontagora corridor.

Methodology

This research was carried out along the Minna–Kontagora corridor in Niger State, Nigeria which is approximately between 191 and 200 kms and taking between 2.5 and 3.5 hours to travel. It is a federal government road, passes through these nodal towns, Zungeru and Tegina and currently under-going rehabilitation work. It is a vital route primarily serving agricultural, trading, and regional administrative functions. The corridors have these major markets. Namely Kure market, Minna, Beje, Zungeru, Tegina, and Kontagora. It is a major route connecting the North West geopolitical zone to North Central and high movement of agro-food products such as beans, maize, millet, wheat, cassava, yams, rice, sorghum, and groundnuts. However, the area has been more and more affected by security problems, making it a suitable area for examining security-induced disruptions and resilience methods among freight transport operators in Niger State. The study used a descriptive survey design because it is most appropriate for research that target to gather large quantitative data on views, behaviours, and surviving methods within a well-defined population (Kothari, 2018; Creswell, 2014). Therefore, the population of the study consist of all freight transport operators along the roads selected, as well as drivers, commercial transport owners, agents involved in freight works, loaders/subordinates, and others. From the list collected from the various professional unions, there are 9,711 persons involved in the safely transportation and distribution of freights in the area. The study adopted Taro Yamane formula to arrive at a manageable sample size of 400. This sample according to Yamane (1967) is seen as adequate for any quantitative research and permitting statistical reliability. The study used a stratified random sampling method to pick relevant participants equally from various road transporters, guaranteeing representation within drivers, commercial vehicle owners. The primary data gathered for the study was through a well-structured questionnaire that comprised a 4 Likert-scale items of strongly agreed, agreed, disagreed and strongly disagreed. The data collected were analysed using descriptive statistics, comprising frequencies, percentages, and tables in order to summarise the demographic characteristics of respondents. Furthermore, each of the 4 Likert-scale items of strongly agreed, agreed, disagreed and strongly disagreed were given the following values: 1.5, 1.0, 0.5 and 0 respectively in order to rank the security-induced disruptions and the resilience strategies adopted by the freight transport stakeholders.

Results

Result from Table 1 reveals that the road freight transportation sector along the Minna–Kontagora corridor is mainly carried out by male respondents (69.6%) and the remaining 30.4% are female. On the age group, 69.6% of the respondents comprises of people between the ages of 26 and 45 years, signifying a labor force that is physically active and economically productive. Most participants are married (58.5%), which may impact their risk perception and carefulness when working in locations that are not secured. Educationally, most of the respondents have secondary education (39.0%), while 23.4% have tertiary education qualification, indicating a reasonable literacy level that enables the approval of resilience strategies such as communication technologies. Drivers constitute the largest occupational group (50.1%), meaning the results basically reflect the experiences of those directly involved in freight movement. Most participants (59.9%) have between 6–15 years of experience, demonstrating considerable industry knowledge that reinforces the reliability of their answers concerning security disturbances and coping approaches. Findings from Table 2 indicates that security-induced disorders considerably impact road freight transportation along the corridor. Armed banditry attacks were acknowledged as the most dangerous challenge and its disrupt transport operations along the corridor. This was ranked first by 410. The high level of kidnapping along the axis were relatively recognised by the respondents and with associated challenges of paying ransom for their release by family, organisation and community as well as the killings of the people who failed to pay the ransom and

even both. This was ranked as second by the respondents with total score of 405. However, this cause a lot of delay in freight transportation along the corridor.

Table 1: Distribution of Respondents by Demographic Variables

Variable	Category	Frequency	Percentage (%)
Gender	Male	250	69.6
	Female	109	30.4
	Total	359	100
Age	18–25	45	12.5
	26–35	120	33.4
	36–45	130	36.2
	46 and above	64	17.8
	Total	359	100
Marital Status	Single	110	30.6
	Married	210	58.5
	Divorced	20	5.6
	Widowed	19	5.3
	Total	359	100
Educational Qualification	No Formal Education	50	13.9
	Primary	85	23.7
	Secondary	140	39.0
	Tertiary	84	23.4
	Total	359	100
Occupation	Driver	180	50.1
	Transport Owner	70	19.5
	Freight Agent	55	15.3
	Loader/Assistant	40	11.1
	Others	14	3.9
	Total	359	100
Years of Experience	1–5 years	90	25.1
	6–10 years	120	33.4
	11–15 years	95	26.5
	16 years and above	54	15.0
	Total	359	100

Source: Field Survey, 2026

The constant stealing and robbing of vehicles of their goods especially the agro-food products including animals such as cows and goats was ranked third with total scored of 400. The general insecurity on Nigeria roads generally and along Minna- Kontagora axis has a total scored of 393.5 and ranked third among the factors. Most of the roads are not safe because of their physical conditions which the armed banditry and robberies take advantage of by blocking the roads around the bad portions (Ajiboye, et al 2024). The issue of fear among the respondents especially the drivers whenever they are on the road also ranked fifth with the score total of 372.5. Most of the drivers and passengers are emotionally down until they reached their final destinations especially if they have witnessed or saw

victims of kidnapping and armed robbery on the road. This act therefore reduces their efficiency while emphasising on the economic and operational consequences of insecurity. The issue of security checkpoints although planned for safety of life and properties but were identified to cause interruptions within the freight movement by delaying the traffic movement through illegal checking including off-loading and loading of goods by the transporters. The scored total is 362.5 and was ranked sixth position. All the above decreases the operational effectiveness of freight transportation along the corridor by calculating the selection of available route, travel timing and readiness to travel or not.

Table 2: Ranking of Security-Induced Disruptions

Type of Disruption	SA (1.5)	A (1)	D (0.5)	SD (0)	Total	Rank
Armed banditry attacks	180	120	40	19	410	First
Kidnapping	165	135	45	14	405	Second
Security checkpoints	136	134	49	40	362.5	Sixth
Poor security	155	140	42	22	393.5	Fourth
Fear among Motorists	140	135	55	29	372.5	Fifth
Cargo thief	170	125	40	24	400	Third

Source: Field Survey, 2026

The result from Table 3 shows that the freight transport operators usually utilised resilience strategies in order to cope with the issue of insecurity on the roads Niger State especially on Minna-Kontagora corridor. For instance, the adoption of communication technologies ranked first with score total of 410 stresses the significance of real-time data for safety. Most of the drivers communicate with each other about the conditions of the road. Similarly, the adjustment of travel schedules was also ranked first with the same score total of 410. This is one of the most commonly adopted strategies adopted by the transporters/ respondents by displaying proactive avoidance of high-risk periods. The use of alternative routes by the respondents was ranked third with the score total of 390, and partnership with security institutions and vigilante groups was ranked fourth which reflect the financial strategies of an individual or corporate organisation taken for security, such as escorts and levies. Furthermore, the increment of transportation fare is another strategy adopted by the respondents with the score total of 307 and ranked fifth. This is the coping strategy of the drivers for their life. Some of these strategic and combined resilience conform with the results of Ajiboye, et al (2024).

Table 3: Resilience Strategies

Resilience Strategy	SA (1.5)	A (1)	D (0.5)	SD (0)	Score Total	Rank
Adjusting travel schedules	175	130	35	19	410	First
Collaboration with security/vigilantes	150	135	45	29	382.5	Fourth
Use of alternative routes	160	125	50	24	390	Third
Use of communication technologies	180	120	40	19	410	First
Increased transport costs as coping strategy	170	135	34	20	307	Fifth

Source: Field Survey, 2026

Discussion

The first finding of the study reveals that security-related disruptions along the Minna–Kontagora corridor significantly undermine road freight transportation. Evidence from the study indicates that incidents such as rural armed banditry, highway kidnappings, and heightened risks to cargo safety have created an unstable operating environment for freight movement. As a result, transport activities along this corridor are frequently interrupted, leading to delays, uncertainty, and increased operational challenges. Although the establishment of security checkpoints is intended to enhance safety, the study finds that these measures also contribute to delays and inefficiencies, further complicating freight operations. Overall, the findings demonstrate that insecurity remains a critical factor constraining the smooth and reliable movement of goods in the region. These results are consistent with existing literature on transport security and resilience. Previous studies have shown that threats such as armed robbery, kidnapping, and general insecurity significantly reduce freight efficiency while simultaneously increasing operational risks and costs (Szyliowicz & Zamparini, 2022; Ajiboye, 2023; Olikagu, Ibe, Ejem & Uzondu, 2024). Similarly, Ajiboye, Abdullahi, and Ohida (2023), as well as Ajiboye et al. (2024), argue that disruptions caused by external threats undermine the reliability, consistency, and timeliness of freight transport operations. The convergence between the present study and earlier research reinforces the conclusion that insecurity is a major barrier to effective transport logistics, particularly in regions prone to conflict and criminal activities.

In response to these challenges, the study further reveals that freight operators have adopted a range of resilience strategies aimed at maintaining operational continuity. Participants reported several adaptive measures, including altering travel schedules to safer periods of the day, using alternative routes to avoid high-risk areas, and collaborating with security personnel or local vigilante groups for protection. These strategies reflect a proactive effort by operators to mitigate risks and sustain their operations despite persistent threats. Such responses demonstrate a high level of situational awareness and adaptability within the freight sector. The identified coping mechanisms align with theoretical perspectives on resilient transport systems, which emphasize the importance of adaptability, redundancy, and flexibility in managing disruptions (Ataburo, Ampong & Essuman, 2024; Patnala, Regehr, Mehran & Regoui, 2024; Ajiboye et al., 2025). By diversifying routes, adjusting operational timing, and leveraging local security networks, freight operators effectively build resilience into their systems. These approaches enable them to absorb shocks, respond to uncertainties, and continue functioning under adverse conditions. Furthermore, the findings highlight that freight operators employ not only strategic but also financial measures to cope with insecurity. Increased spending on security arrangements, higher insurance considerations, and additional logistical costs are often incurred to safeguard goods and personnel. This underscores the economic burden imposed by insecurity on transport operations, while also illustrating the commitment of operators to sustain service delivery. In summary, the study demonstrates that while insecurity significantly disrupts freight transportation along the Minna–Kontagora corridor, operators actively implement a range of adaptive strategies to maintain continuity. This reflects the practical application of resilience theory within real-world transport contexts, where flexibility and innovation are essential for survival.

Conclusion and Recommendations

The research investigated security-induced disruptions and resilience methods in road freight transportation along the Minna–Kontagora corridor. The result shows that insecurity, predominantly in the form of banditry attacks at rural areas, kidnapping of people, and broad threats to cargo safety, pointedly affects freight operations by causing delays, increasing risks, and plummeting operational competence. These problems not only impact delivery time but also impose extra financial problems on commercial transport workers. The research additionally indicates that fear and uncertainty among local drivers affects decision-making, leading to cautious behaviour that may further slowdown freight movement. In the light of above, the study argues that the Niger State Government and the Nigeria Police Force, in partnership with local vigilante groups and transport unions, should create a well-organised corridor security task force along the Minna–Kontagora roads. This task force would offer swift emergency response, supervising major high-risk locations, and implement directed interventions to decrease rural banditry attacks, kidnapping, and cargo risks, guaranteeing safer and more dependable freight operations in the axis. Also, the Ministry of Transport, in collaboration with transport unions and telecommunication workers, should advance a real-time communication and advisory platform for freight transport operators working along the study area. This system would offer important information on safe traveling hours and periods, other available roads, and security alerts, allowing transport workers to plan journeys successfully and sustain continuity of operations regardless of insistent insecurity in Minna-Kontagora corridor.

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