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Citation:

Oke, A and Moradeyo, A (2025) Ensuring firm resilience by navigating the complexity of emergent and context-driven supply chain uncertainties and disruptions in developing economies. *Business Process Management Journal*. pp. 1-22. ISSN 1463-7154 DOI: <https://doi.org/10.1108/bpmj-09-2024-0827>

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Document Version:

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Ensuring firm resilience by navigating the complexity of emergent and context-driven supply chain uncertainties and disruptions in developing economies

Abstract

Purpose

The literature has generally examined supply chain disruptions and mitigation, assuming that resilience capabilities are universal. This assumption undermines the productivity and competitiveness of manufacturing firms in developing economies due to differences in contextual attributes and challenges. In this study, we advance the current knowledge in the literature and explore context-driven disruptions in developing economies to provide a foundational step for disruption-mitigation fit to enhance operational efficiency and business continuity.

Design/methodology/approach

This study adopts a qualitative multi-case study approach and explores the operational environment of manufacturing firms in developing economies to unpack context-driven disruptions and strategies for managing disruptions. An in-depth exploratory multiple case study of eight manufacturing firms was conducted using semi-structured interviews with 31 key informants across the case firms.

Findings

Findings indicate that manufacturing firms in developing economies face operational disruptions and challenges specific to their business environment, contrasting with those experienced in developed countries and documented in the literature. This contrast suggests that mitigation strategies designed for disruptions in developed economies may prove ineffective in addressing emergent and context-driven disruptions in developing countries.

Research limitations/implications

Since this paper is based on an in-depth single case study, its findings may not be empirically generalisable to other sectors and countries beyond Africa.

Originality

With Africa's lack of production contribution to the global manufacturing value-added, this study underscores the need for manufacturing firms in developing economies to be proactive, pragmatic, and strategic in devising planning consistent with their operations and the dynamic business environment.

Practical implications

Considering the interconnectivity of global supply chains, this study highlights the need for firms and managers in developed economies to be cognisant of context-specific disruptions affecting firms in developing economies. The study provides valuable insights into how manufacturing firms can build resilience by embedding context-specific planning practices into their strategic supply chain agenda.

Keywords: Resilience capabilities, Context-driven disruptions, Manufacturing industry, Developing economies.

Introduction

Recent disruptions have reignited the interests of practitioners and businesses in risk (Rashid *et al.*, 2024) and resilience management (Browning *et al.*, 2023). This is so because supply chains (SCs) are linked by complex networks of various operations designed to meet customer needs (Emrouznejad *et al.*, 2023). This makes the traditional approach of planning and managing operations ineffective in addressing modern supply chain (SC) issues (Dittfeld *et al.*, 2022). The increasing complexity of SCs and the ineffectiveness of traditional planning methods have made business operations more vulnerable. This vulnerability highlights the urgent need for innovation and resilience without compromising cost-effectiveness (Browning *et al.*, 2023). As a result, addressing disruptions, especially systemwide, has attracted increasing attention recently (Ivanov, 2024), with studies investigating how businesses can be resilient under uncertainties (Browning *et al.*, 2023; Emrouznejad *et al.*, 2023).

Despite the focus of many studies on resilience, the vulnerability of global SCs is increasing due to the occurrence of many events, influencing how SCs are planned and coordinated. The current planning practices are static and primarily ineffective in addressing the dynamic business

environment (Jonsson *et al.*, 2021). This is more pronounced for businesses in developing economies (Rashid *et al.*, 2024), especially in Africa, due to the lack of resources and technological capabilities to support and enhance their operations and SCs (Jha *et al.*, 2022). While SC practices increase the vulnerability of global SCs (Altay and Pal, 2023; Stecke and Kumar, 2009), many techniques, such as forecasting methods, are not well-equipped and suitable to address contemporary disruptions (Browning *et al.*, 2023). This argument is valid, considering SCs are complex and non-linear, characterised by many circular flows hidden from SC planners and managers, affecting the overall business performance (Park *et al.*, 2022).

The circular flows increase the inability of firms to forecast accurately, which limits the effectiveness of traditional production planning, such as sales and operations planning (S&OP), especially in developing economies. Although SC structure affects firm performance, it is imperative that practitioners and scholars have a better understanding of how contextual factors at the firm level can propagate and amplify disruptions across the network. Understanding the planning environment to build firm resilience is essential as disruptions are perceived as consequences of planned, unplanned, foreseen, and/or unforeseen events (Ali *et al.*, 2022; Dittfeld *et al.*, 2022). Due to the circular linkages of the modern SCs, disruptions, ranging from natural disasters to man-made issues, necessitate innovative and adaptive planning strategies for firms to sustain their operations and remain competitive (Joo *et al.*, 2001).

The global interconnectedness of SC intensifies the impact of disruptions (Park *et al.*, 2022), making supply chain risk management (SCRM) crucial in achieving operations performance objectives (Altay and Pal, 2023; Chaudhuri *et al.*, 2020). While this high-level perception of disruptions is informative, it provides insufficient knowledge of the critical factors causing disruptions, including their relationships and how to manage them (Blackhurst *et al.*, 2015). Therefore, the circular nature of SCs and increasing disruptions necessitate contextualised (i.e., adaptive) mitigation strategies, such as proactive and dynamic planning (Jonsson *et al.*, 2021). This will allow manufacturing firms, especially in developing economies, to anticipate and address disruptions to reduce vulnerability and ensure continuity, profitability, and competitive advantage.

We acknowledged that studies have extensively examined disruptions and mitigation, mostly in developed countries (Aman and Seuring, 2023; Sharma *et al.*, 2020). However, there is limited empirical evidence on emerging and developing economies (Rashid *et al.*, 2024; Sharma *et al.*, 2020; Xu *et al.*, 2020). Despite its vast human and natural resources, evidence (Emrouznejad *et al.*, 2023; Xu *et al.*, 2020) shows that Africa has received less attention in SCRM and SC resilience research, undermining the continent's production capabilities. Also, many available studies on disruptions are based on quantitative mathematical models and simulations to understand SC behaviours and explain the impacts of disruptive events on firm operations, which may not reflect reality. This suggests the need to present a more authentic and robust account of the consequences of disruptions and how they are mitigated by firms (Blackhurst *et al.*, 2015; Xu *et al.*, 2020).

Besides, studies have paid more attention to systemwide disruptions to manage supply network complexity and increase SC surplus, which may diminish efforts to address local or context-specific disruptions affecting firms' production planning. Managing local/context-specific disruptions is vital due to closely knitted global SC (Dittfeld *et al.*, 2022). Context-specific disruptions in one geographic location may propagate faster to distant locations, causing ripple effects across the network (Park *et al.*, 2022) if adaptable and dynamic planning is lacking (Joo *et al.*, 2001). Although dynamic planning can be disruptive, failure to address context-specific disruptions has far-reaching consequences across the network, affecting firms' productivity and performance (Browning *et al.*, 2023).

This study responds to Browning *et al.*'s (2023) calls for more research on mitigating context-driven disruptions and the need for firms to address day-to-day variability, especially in a highly dynamic and disruptive environment. This is crucial in developing economies (Fan and Stevenson, 2018) for manufacturing firms, especially SMEs, to enhance their resilience capabilities and performance (Sharma *et al.*, 2020). While doing business in Africa is challenging, exploring contextual issues affecting businesses allows for a good understanding of how multinational enterprises (MNEs) can manage SC relationships in Africa.

With a particular focus on the manufacturing sector in Nigeria, this study explores disruptions experienced by manufacturing firms and their mitigation, facilitating a better understanding of

the business environment in developing economies. The interconnectivity of businesses underscores the need for manufacturing firms in developed economies to understand disruption types specific to developing countries and how they can impact global SCs. The study's emphasis on the manufacturing sector is rooted in its pivotal role in nations' socioeconomic development and growth (UNIDO, 2023). The study responds to the need for more research on developing economies due to the limited empirical evidence from developing countries (Aman and Seuring, 2023), especially in Africa (Amofa *et al.*, 2023). Also, we focus on the manufacturing sector in Nigeria due to the manufacturing gaps between Africa and the rest of the world and the lack of Africa's contribution to global manufacturing value-added (UNIDO, 2023).

Following Browning *et al.* (2023), this study addresses how manufacturing firms in a complex environment prone to disruptions can be resilient and enhance their operations. To offer actionable strategies for manufacturing firms to be resilient and increase their production performance, the following pertinent research questions are addressed:

RQ1: What context-specific disruptions are experienced in the manufacturing sector in developing economies?

RQ2: What are manufacturing firms' mitigation strategies for managing disruptions in developing economies, including their effectiveness?

RQ3: How can manufacturing firms in developing economies develop a disruption-mitigation fit to achieve proactive planning for operational efficiency and business continuity?

By answering these research questions, this exploratory multi-case study contributes to the existing knowledge on production planning and SC resilience. The intention is to allow SC partners in the manufacturing sector to understand the impacts of context-specific disruptions on their operations and productivity. This study provides firms with the opportunity to leverage Nigeria's pivotal role in international trade (such as the Trade and Investment Framework Agreement (TIFA) and the African Growth and Opportunity Act (AGOA)) and relevance in global SCs (ITA, 2023; Moradeyo *et al.*, 2023). As globalisation heightens the interconnectivity of SCs between developed and developing countries, this study demonstrates the need for MNEs

to be cognisant of specific disruptions prevalent in developing countries and how to mitigate them to enhance trade and attract foreign direct investment (FDI). This will inform continuous and dynamic decision-making by understanding context-specific disruptions and the need for unique production and dynamic planning to promote resilience capabilities in developing economies.

Consistent with previous studies (such as Browning *et al.*, 2023; Dittfeld *et al.*, 2022), this study defines resilience capabilities as firms' ability to sense, adapt to, respond to, and recover from context-specific disruptions to improve and sustain their performance. These capabilities are characterised by redundancy, flexibility, agility, and collaboration, including their trade-offs (Dittfeld *et al.*, 2022) and are driven by the manufacturing context in Nigeria.

In the next section, we provide an overview of the existing literature to provide a theoretical basis for this study. Subsequently, the next section focuses on the adopted research method, including data collection and analysis. This is followed by findings and discussion. The concluding part encompasses the study's conclusions, limitations, and research implications.

Literature Review and Theoretical Background

Supply Chain Risk Management

With resilience attracting increasing interest (Rashid *et al.*, 2024), disparate approaches have been suggested in the literature to mitigate SC disruptions (Ivanov, 2024). These approaches are broadly classified under four fundamental categories: supply, demand, product, and information management (Tang, 2006). These four approaches involve different dimensions: (i) supply network design, (ii) supplier selection, demand shift strategies, (iii) product variety, and (iv) information sharing (Tang, 2006). As a result, SC mitigation strategies, such as robust strategies, proactive strategies, warning strategies, coping strategies, shock absorption capability, and dynamic planning, have been proposed by scholars (Jonsson *et al.*, 2021; Norrman and Wieland, 2020). Other strategies rely on SC coping mechanisms by building redundancy and flexibility, involving extra inventory, alternative sourcing, and product redesign (Dittfeld *et al.*, 2022; Ivanov, 2024).

Many of these strategies follow a similar pattern of assessing the impact and likelihood of events (Browning *et al.*, 2023) for informed structural and infrastructural decisions, such as selecting safe locations, choosing strategic suppliers, and enhancing communication (Norrman and Wieland, 2020). The traditional risk management approach centred on risk categorisation and mitigation strategies has been generally applied in addressing issues in operations and SCs (Norrman and Wieland, 2020; Wicaksana *et al.*, 2022). According to Tang (2006), managing risks is perceived as a coordinated effort among SC partners to ensure the profitability and continuity of firms' operations. Managing SC risk should be strategic, and this strategic risk management approach is crucial to business continuity as it impacts firms' operational, market, and financial performance (Narasimhan and Talluri, 2009).

Risk management follows a generic process of identification, assessment, analysis, mitigation, and reporting using qualitative and quantitative methods (Norrman and Wieland, 2020). The intensity and frequency of events disrupting global SCs indicate that the traditional approach to managing risk may be ineffective in addressing disruptions and production issues (Dittfeld *et al.*, 2022). This is because modern SCs operate in a dynamic environment and experience a higher risk of disruptions, exacerbated by the frequency and scale of disruptions (Browning *et al.*, 2023). The frequency and intensity of disruptive events have changed the business landscape significantly. This evolving and dynamic business landscape calls for a deeper exploration of context-specific strategies by establishing appropriate approaches to managing disruptions.

While SCs are inherently complex, managing SCs is compounded by unexpected and unplanned events, underscoring the need for dynamic planning (Jonsson *et al.*, 2021), information processing capability (Rashid *et al.*, 2024), and effective risk management practices (Ali *et al.*, 2022; Altay and Pal, 2023). A dynamic and proactive approach allows for informed decisions before disruptive events. However, this approach is practically insufficient, suggesting the need for businesses to balance proactive and reactive approaches when managing disruptions (Ivanov, 2024; Norrman and Wieland, 2020).

Acknowledging the nascent stage of SC vulnerability and risk management principles (Munir *et al.*, 2020; Yang *et al.*, 2021), managing risks in operations and SCs has gained prominence due to

the rising trend of disruptive events (Aman and Seuring, 2023). This necessitates collaborative planning and strategic risk management activity (Narasimhan and Talluri, 2009). It also requires a clear understanding of its effectiveness to justify investment and efforts in addressing disruptions (Kern *et al.*, 2012). While several studies have explored business and SC risk management to understand SC resilience (Rashid *et al.*, 2024), there is a need for further insights into the classification of disruptions and the generalisability of mitigation strategies. The goal is to establish whether context-specific mitigation can be more effective (Fan and Stevenson, 2018).

Categorising Supply Chain Disruption

Identifying and categorising SC disruptions should be considered when designing effective mitigation strategies (Kleindorfer and Saad, 2005; Xu *et al.*, 2020), allowing for effective utilisation of resources and capabilities. SC disruptions are broadly categorised into supply-driven and demand-driven disruptions. While many factors contribute to demand-driven disruptions, they mainly originate from the downstream side of the SC and propagate to the upstream side of the chain, similar to bullwhip effects (Kleindorfer and Saad, 2005). The bullwhip effect is a critical factor contributing to disruptions, which amplifies demand volatility from downstream to upstream in the SC (Badraoui *et al.*, 2020). The bullwhip effect demonstrates that small fluctuations in the demand side of the chain can become amplified as they flow to the upstream side of the chain (Dolgui *et al.*, 2020), suggesting the need for SC visibility (Rashid *et al.*, 2024) and effective planning and forecasting methods. Generally, factors contributing to demand-driven disruptions include unanticipated or volatile demand, insufficient or distorted customer information about orders, loss of significant customers, and issues associated with outbound logistics and product demand (Dolgui *et al.*, 2020).

Discrepancies between a firm's projected and actual demand could result in SC disruptions (Browning *et al.*, 2023) and poor coordination of operations processes, leading to costly shortages, obsolescence, and inefficient capacity utilisation. The consequences include intermittent physical product distribution to end customers, uncertainties related to random customer demand, and mismatches between projected and actual demand. Suppose the success of an SC is contingent on market expectations and needs in the downstream side of the SC. In that case, firms should

recognise these needs and how to manage them more appropriately through planning and addressing factors leading to demand-driven disruptions. Supply disruptions encompass uncertainties associated with supplier activities and relationships upstream of the SC (Katsaliak *et al.*, 2021). Supply risk emerges when disruptions in an SC result from a source encompassing purchasing, including supplier activities and relationships.

While demand-driven and supply-driven disruptions can interact to affect firm operations and performance, a better understanding of their features allows firms to plan and mitigate them effectively. Understanding these categories echoes Jonsson *et al.*'s (2021) arguments about the need for businesses to consider numerous environmental factors to enhance operations and SC planning processes. Firms must adopt reactive and proactive risk management strategies to address disruptions and sustain operations (Norrman and Wieland, 2020).

Disruption Mitigation Strategies: Theoretical Underpinning

Studies have shown that efforts to mitigate and reduce disruption's impacts involve proactive strategies, coping strategies, and dynamic planning (Chowdhury and Quaddus, 2021; Rashid *et al.*, 2024). While these strategies and their effectiveness have been explored in research, findings vary in scope and generalisability. This variability undermines the extent to which mitigation can be applied within and between contexts. This could explain the fragmented knowledge of how manufacturing firms in developing economies can plan and respond to disruptions in their operations and SCs (Danese *et al.*, 2020; Jha *et al.*, 2022).

Studies have applied theories and concepts, such as contingency theory and the Resource-Based View (RBV), to gain deeper insights into operations and SCs (Craighead *et al.*, 2020; Donkor *et al.*, 2022). Compared to RBV, contingency theory holds relevance and significance in this context, as it provides an understanding of the notion of fit, which is pertinent in matching mitigation strategies to disruptions (Altay and Pal, 2023; Salimian *et al.*, 2021). The theory challenges the dominant assumption that a particular theory holds universal applicability, which may not address the internal and contextual issues facing manufacturing operations in developing economies. As a result, the theoretical framework employed in this study is grounded in contingency theory.

Contingency Theory

Contingency Theory (CT) provides a valuable theoretical framework for understanding disruptions experienced by manufacturing firms in Nigeria, emphasising that the level of fit among variables predominantly influences firm performance (Romero-Silva *et al.*, 2022; Sousa and Voss, 2008). The theory challenges the universal applicability of many theories and argues that firm performance is determined by the extent to which its structural and internal attributes align with contingencies. Rooted in the concept of organisation as a general and open system, CT views firms as social systems comprising interdependent subsystems. This perspective posits that production should be planned and designed to achieve efficiency, directly enhancing firm performance across the SC (Sousa and Voss, 2008). The interaction approach of CT provides the premise to examine the impact of environmental and response factors on firm resilience and productivity.

According to Kleindorfer and Saad (2005), the chosen approach to mitigate disruptions should align with the characteristics and needs of the decision environment. This provides a valuable lens through which to understand context-specific disruptions and mitigation in the Nigerian manufacturing sector. The case selection approach focuses on understanding how individual contextual factors influence specific response variables, like mitigation planning strategy (Danese *et al.*, 2020; McAdam *et al.*, 2019). Using the lens of CT, this study elucidates the alignment between disruptions and mitigation strategies through a dynamic planning approach. We argue that a dynamic planning approach in developing economies, such as Nigeria, is crucial for manufacturing firms to be resilient and improve productivity in the face of disruptions.

In the selection approach, “fit” is a fundamental assumption, forming congruence propositions between organisational context (internal and external) and response variables (Sousa and Voss, 2008). Unlike examining the impact of context-response relationships on firm or SC performance, this approach assumes fit as the underlying premise for correspondence between context, firm structure, and mitigation (Drazin and Van de Ven, 1985). This approach is often referred to as the matching perspective of fit. Contextual variables represent firms’ internal and external environmental features and the disruption type. The response variables encompass

organisational structure and managerial actions or plans in response to changing firm contextual features (Sousa and Voss, 2008), specifically the mitigation strategy for managing disruptions. The selection of case firms operates on the principle that mitigation strategies should align with specific disruption types and environmental attributes for optimal outcomes (McAdam *et al.*, 2019). Adapting different mitigation strategies based on distinct environmental and disruption characteristics is crucial for effective planning and mitigation in developing economies. This is important as conventional risk management approaches often adopted to address disruptive events are not always effective for unexpected and context-driven disruptions (Dittfeld *et al.*, 2022). We consider CT a valuable theoretical lens for explaining context-specific disruptions in the Nigerian manufacturing industry, where there are limited empirical studies and operations management theory is still in its infancy (Sousa and Voss, 2008).

Methods

Data Collection

This exploratory interpretive study adopts the case-based approach (Creswell, 2011; Yin, 2009) to understand disruptions facing the manufacturing industry in Nigeria, including mitigation strategies adopted by manufacturing firms. The multi-case study approach was adopted due to the paucity of research on the impacts of disruptions on the manufacturing industry in Nigeria and the low production activities in Africa. This provides the opportunity for deeper insights into creating theoretical constructs (Eisenhardt and Graebner, 2007; Yin, 2009) to investigate issues affecting manufacturing firms in developing economies, especially in Africa.

Consistent with the research questions and CT, we selected firms (see Table 1) along different spectrums of Nigeria's manufacturing industry's production operations and stages. The case selection was influenced by the congruence proposition between firms' context, contingency variables, and responses (Sousa and Voss, 2008) and the firms' inclination to participate in the study.

[Insert Table 1 here]

Our focus on a single industry is synonymous with adopting ecosystem perspectives. It allows for theoretical replication of the study and generalisation of findings as disruptions manifest across the industry. Due to the idiosyncratic nature of disruptions facing manufacturing firms, this multiple case study involved eight purposive selected manufacturing firms in the Nigerian manufacturing sector. This approach allowed us to examine different manufacturing operations and disruption responses individually using within-case analysis and the opportunity to compare cases using cross-case analysis.

As Yin (2009) recommended, the data used in this study were collected from multiple sources, including semi-structured interviews with key informants, informal discussion, and observation during site visits, and supplemented by further inquiries through email. The companies' websites provided additional information and the basis for comparing responses. Consistent with the exploratory approach (Creswell, 2011), we conducted face-to-face semi-structured interviews involving 31 key informants from the selected eight manufacturing firms, each lasting about 60 minutes on average.

Using purposive sampling, at least two key informants (see Table 1) in each firm were selected based on their relevance to the research questions and knowledge of their firm's operations processes and strategies. Conducting more than one interview in each of the selected firms allows for triangulation (Yin, 2009) and ensures the validity of our findings. Informed by their job functions/roles, we interviewed participants with sufficient knowledge of their firm's operations, challenges, and response to disruptions.

Ethical issues were addressed before the interviews and included in the interview protocol. The participants' information guide assured participants of anonymity and confidentiality, including their right to withdraw participation at any stage of the research process. This approach helped gain trust and to achieve reliable and quality responses from participants. Each interview focussed broadly on three thematic areas: disruptions, mitigation against disruptions, and operational performance and its indicators. We started interviews with the same open questions to reduce bias and the imposition of our theoretical ideas. For example, at the start of the

interviews, we asked participants questions such as “*Would you please describe disruptions experienced by your organisation and how it responded?*”.

Data Analysis and Findings

Data Analysis

Each interview lasted about 60 minutes and was audio-recorded, transcribed, and thematically analysed (Miles and Huberman, 1994) using within-case and across-case qualitative data analysis approaches (Ayres *et al.*, 2003). The coding and categorising themes were based on participants' perceptions of the impacts of disruptions and the performance of manufacturing operations in Nigeria.

The analysis followed Miles and Huberman's (1994) approach, where the data reduction stage emphasised themes relevant to disruptions facing manufacturing firms. The data display/visualisation stage used tables for comparison within and across cases. The within-case and cross-case approaches were adopted to ensure the systematic analysis of divergent views of participants across manufacturing firms (Miles and Huberman, 1994). Following Sousa and Voss' (2008) arguments, the adopted CT allowed us to (i) identify important contingency variables specific to Nigeria, which are distinguished between the case firms; (ii) group mitigation action plans and responses according to the identified contingency variables; (iii) determine the most effective responses to disruptions experienced in the manufacturing industry in Nigeria; and (iv) identify important performance indicators relevant to the manufacturing industry.

Results

The interview transcripts were coded using firms as a unit of analysis. Table 2 provides an overview of the manufacturing firms selected for this study, providing the basis for within- and cross-case analyses. Results (Table 2) show differences in the operations and processes of the selected firms, which may contribute to their experience of local disruptions and how they plan and respond to them. Consistent with research ethics, we have assigned Pseudonyms to the selected manufacturing firms to protect their identity and manufacturing value.

[Insert Table 2 here]

Contingencies: Manufacturing context

The within-case analysis method allowed us to identify contextual features responsible for operational disruptions in Nigeria's manufacturing industry. Examining each case in depth allows us to identify the unique patterns as they emerge, helps us familiarise ourselves with each case, and positions each case as a stand-alone entity (Eisenhardt and Graebner, 2007; Miles and Huberman, 1994). The thematic categorisation is based on contextual characteristics, determining sources of disruption, mitigation strategies against disruptions, and operational performance indicators. The findings are further explained below.

Case A: *CosLo* Manufacturing Firm

Due to its batch operations and the complexity of its SC with distributors within and outside Nigeria, the company experienced many disruptions. These disruptions include lack of enough storage, port clearing issues, unavailability of raw materials and spare parts, logistics issues, unfavourable weather conditions, demand fluctuation, seasonality of demand, power disruption, corruption, and new product introduction challenges.

Case B: *ConJo* Manufacturing Firm

While the company experienced many disruptions, logistics issues, raw materials stock out, quality issues, and extended supply lead times are prominent sources of disruption affecting **Conjo's** operations and performance. With the company sourcing about 70% of its raw materials from outside Nigeria, its operations are affected by disruptions within and outside Nigeria.

Case C: *PlasticLo* Manufacturing Firm

PlasticLo experienced different sources of disruptions. However, major disruptions include raw materials issues, logistics and warehousing, and power/electricity supply. For example, the company experienced 6-7 hours/day of public electricity supply, which forced the company to rely on diesel generators, leading the company to lose about 20% of production time and about 10% of total output per day.

Case D: *SanLo* Manufacturing Firm

Due to increasing market demand exceeding the firm's production capacity, it imports finished products to complement its production, further exposing the company to increasing vulnerability. Although the company maintains distributorship across 30-32 states in Nigeria to address logistics issues, sourcing entire raw materials (99.9%) from abroad suggests any disruption within and outside Nigeria could adversely affect its operations. While the company experienced several disruptions affecting its productivity and performance, the incessant power supply made the company dependent on the use of generators, which increased the cost of production because of high diesel consumption.

Case E: MetalJo Manufacturing Firm

The company sources raw materials locally and abroad to supplement the supply. Sources of SC disruptions the company faces include bureaucratic bottlenecks, quality issues, manpower issues (industrial actions), sudden and seasonal demand, logistics issues, machine breakdowns and unavailability of raw materials. The company's sourcing method is another issue that affects its operations negatively. For example, the company experiences raw materials stockout from local suppliers because of price instability in the local market. The company also faces the challenge of defective or shortage of raw materials because suppliers often quote low prices, affecting their ability to supply raw materials promptly and according to specifications.

Case F: AgroLo Manufacturing Firm

The firm sources its raw materials (100%) locally, increasing its operations vulnerability. **AgroLo** experienced many SC disruptions, including scarcity and seasonality, fluctuating raw materials prices, power challenges, shortage of raw materials, quality issues, low-capacity utilisation, price escalation, space issues, and machine breakdown. Besides the scarcity of its primary raw material, palm kernel, due to seasonality, quality issues affect the production performance and profit margin.

Case G: ConLo Manufacturing Firm

ConLo experienced many sources of disruption; however, its multiple sourcing strategies allowed the company to sustain its operations. The company experienced raw-material issues

and stockouts, logistics issues, incessant power outages, machine issues/scarcity of spare parts, and erroneous customer orders. Raw material stockouts remain the most significant challenge due to port delays and dependence on sourcing raw materials from abroad, especially when local supplies are lacking. The time wasted clearing raw materials at the port makes raw materials not available on time for production.

Case H: *PharmLo* Manufacturing Firm

Factors affecting the company's operations and productivity are mainly due to government policies and bureaucracy. Others relate to weather issues, corruption and exploitation, demand-related issues, and inconsistent flow of raw materials from supply- and port-related challenges. There is also an issue of equipment and workforce under-utilisation due to the non-availability of raw materials and inconsistent power supply. While the company sources raw materials locally and internationally, the erratic power supply has contributed to the high production costs. Some of the company's products require drying, leading to high energy costs and diesel consumption due to the need to rely on generators.

Categorising contingencies: Main disruptions across firms

The cross-case analysis approach allowed us to examine the commonality of disruption sources (see Table 3) across manufacturing firms in Nigeria, which are unique to the country's business environment. While businesses outside Nigeria are unlikely to encounter similar issues, the global SC's complexity and interconnected nature suggest that these disruptions could cause a trade imbalance.

[Insert Table 3 here]

Table 3 illustrates the severe impacts of context-driven disruptions on firms' operations and SC performance. The findings show that energy supply issues and challenges sourcing raw materials are dominant sources of disruptions common to all the manufacturing firms investigated in this study.

While there are other familiar sources of disruptions in the sector, we observed that these two dominant sources underpinned other disruptions in the Nigerian context, preventing firms from

achieving a sustained competitive advantage. For example, raw materials issues manifest in poor quality or shortage of raw materials, firms' inability to produce the required products to meet customers' needs, and eventual loss of sales. Incessant power outages result in equipment breakdown, low-capacity utilisation, high overhead costs, and reduced profit margins. While energy issues erode profits due to high operational costs, the situation is also responsible for the lack of communication within and across firms in the SC, resulting in ineffective stock control and management.

Porous borders and the behaviour of government officials that fuel corruption not only hamper manufacturing activities in Nigeria but also expose businesses and consumers to counterfeit and substandard products. This underscores the argument that these context-driven disruptions not only interact but also exacerbate the challenges faced by the manufacturing industry in Nigeria.

Adopted mitigation action plans and responses

Manufacturing firms in Nigeria employed many proactive production planning strategies to mitigate issues affecting their operations. As presented in Table 4, these mitigation approaches include coordinated supplier relationship management, outsourcing logistics and transportation operations, multiple sourcing, off-grid energy generation, quality control, dynamic inventory planning and control, and flexible production process. Some mitigation techniques focus on procurement; however, others address issues directly affecting the firms' operations.

[Insert Table 4 here]

Considering the state of Nigerian roads, using multiple distribution channels and rugged packaging could help manufacturing firms in Nigeria retain the quality of their products and ensure they meet customers' expectations and needs.

Operational Performance

The findings show that manufacturing firms use various financial and non-financial indicators to measure the performance of their operations (Table 5). The indicators can be grouped into process-based and product/service-based while measuring effectiveness and efficiency. Process-based indicators, such as capacity (machine and labour) utilisation, inventory turnover,

production costs, and production flexibility, allow manufacturing firms to assess how operations align with their strategic goals by adapting to operational situations in Nigeria. Similarly, product-based indicators, such as daily output, product availability, product quality, and delivery time, are used by firms to assess their performance.

[Insert Table 5 here]

The quantity of products produced daily is assessed against daily targets. The capacity utilisation in production increases when the company uses an alternative energy source, reducing the number of products produced. Product quality is assessed intermittently to minimise defects in the final and work-in-process products and ensure conformity to the industry and global quality standards. In many instances, firms check the quality of raw materials to ensure conformance before commencing production. The delivery performance is measured using the dispatch rate and customer case filled on time (CCFOT). The ability to meet customers' demands promptly improved by adopting the demand-based replenishment method without necessarily producing excess finished goods. A minimum and maximum inventory stock level is maintained so that firms do not understock or overstock, achieved through constant communication between the procurement and production departments. Outsourcing manufacturing operations and logistics, in some instances, allows firms to satisfy the needs of their customers; however, the results (Table 5) show that customer satisfaction is not the priority of many firms.

Discussion

Rather than focusing on global disruptions and/or seeking to match commonly applied resilience capabilities with production processes (Dittfeld *et al.*, 2022), this study explores the impacts of context-specific disruptions on manufacturing operations in emerging economies. It uncovers the intersection of disruptions, mitigation for firm resilience, and operational performance in a developing economy. The results of a multi-case study of eight manufacturing firms in Nigeria reveal that these firms face disruptions specific to their operational environment, undermining their operational performance. While most disruptions are context-driven, they mostly originate from structural and infrastructural attributes of business operations and SCs in Nigeria. Also, we found that disruptions in the SC increase firms' vulnerability due to sourcing strategies employed

by many firms in the Nigerian manufacturing industry. On the other hand, using multiple sourcing strategies, especially relying on suppliers outside the country, ensures a consistent flow of materials as local suppliers face similar context-driven disruptions as manufacturers. This underscores the need for manufacturing firms in Nigeria to understand the interplay between internal and external environmental factors when developing planning response strategies against disruptions.

Developing resilience capabilities in the Nigerian manufacturing sector is contingent on addressing emergent and unknown problems beyond the established disruption mitigation strategies in the literature. While firms are affected by supply-based and demand-driven disruptions, many context-specific events heightened firms' vulnerability in Nigeria, suggesting the need for proactive and dynamic planning across the sector's SC. For instance, all the selected manufacturing firms affirmed that the incessant power outage in Nigeria is one of the major SC disruptions that firms in the manufacturing industry experience. Power outages are a major issue for manufacturing operations in Nigeria and may not be apparent in other countries, especially in developed economies.

Considering that all firms in the SC operate within the same ecosystem, the lack of dynamic planning to address disruptions negatively impacts their ability to acquire resources locally, capacity utilisation, delivery and quality performance, overhead costs, and ability to respond to changes in customers' demands. For example, **CosLo** consumes up to an average of 300 litres of diesel daily and has experienced over \$2 million of equipment breakdown due to inconsistent energy supply, reflecting the challenges facing manufacturing operations in Nigeria. Also, **ConJo** attributed the loss of about 2000-3000 units in output to the fluctuating power supply and the daily consumption of about 5000 litres of diesel (on days without public electricity supply). Some manufacturing firms use alternative power sources, such as gas or diesel generators, with increasing cost implications and unresponsive SCs. Although manufacturing firms attributed defective products to unexpected power outages, the results indicate that firms should manage quality disruption effectively by being proactive and innovative in dealing with quality disruption, including counterfeit products.

Other factors, such as corruption and exploitation, tax regime, terrorism, bad roads, quality issues, adulteration (counterfeit) of materials and products, and porous borders, are many sources of disruption requiring collaborative and hierarchical planning and decision-making within the Nigerian manufacturing sector. This is consistent with Jonsson *et al.* (2021), who argue that collaborative and interactive planning processes using ecosystem perspectives can be more suitable in a more dynamic and complex business environment.

Manufacturing firms in Nigeria experience transportation-driven disruptions, negatively impacting their productivity and key performance objectives of timely delivery, product quality, operational cost, and manufacturing flexibility. All the manufacturing firms analysed in this study confirmed that transportation hurt their operations. The only exception is **AgroLo**, which has a sole supplier that handles the inbound logistics and a significant customer that handles the outbound logistics.

There is a need for more collaboration, transparency, and information sharing across the SC for the sector to be resilient and improve manufacturing outputs and performance in Nigeria. Collaborative planning and information sharing between partners in the SC, including the 3PL companies, can effectively address the issues of frequent truck breakdowns due to lousy infrastructure, such as bad road networks and inadequate alternative routes. Using ecosystem perspectives, dynamic and collaborative planning and decision-making can address obstructions by corrupt government officials when transporting raw materials and products, multiple taxation when moving goods from one state or local government to another, and fuel adulteration.

This study suggests that firms in developing economies must understand their local business environment and socio-economic situation, including the market dynamics and drivers. Also, it is important for manufacturing firms to work collaboratively with local suppliers and other important stakeholders to address issues specific to their jurisdictions through scenario planning and enhanced resilience capabilities.

While the manufacturing sector in developing economies may lack the capacity and capability to cope with systemic disruptions, effective and proactive planning offers strategic advantages in minimising the effects of disruptions. This allows valuable preparation time and capabilities

alignment. This proactive approach may be more effective than contingency strategies involving actions taken only when a disruption occurs (Braunscheidel and Suresh, 2009; Norrman and Wieland, 2020). A robust strategy based on proactive and reactive measures coupled with resilience-oriented maintenance will enable manufacturing firms to plan for and manage regular fluctuations efficiently and sustain operations as they experience persistent disruptions.

Theoretical and Practical Implications

Using the CT perspective, this study answers the research question proposed by Browning *et al.* (2023) on addressing disruptions in highly complex and disruption-prone environments. It provides practical insights for firms to enhance their resilience capabilities by applying dynamic and proactive SC planning. Specifically, this study elaborates on disruptions and mitigation strategies for achieving operational efficiency and resilience in a highly dynamic and complex environment through proactive SC planning. As a result, we define resilience as the ability of firms to utilise and integrate their internal and external resources to sense disruptions, address disruptions and consequences, and improve operations processes and practices to enhance their production capabilities and achieve sustainable competitive advantage. This definition allows manufacturing firms and managers to acknowledge the volatility and vulnerability of their business environment while recognising the value-adding capabilities of their internal and external resources. On the one hand, our study shows that understanding the firm's internal and external environment is critical to resilience. On the other hand, it provides further insights into the need for managers to identify sources of disruption and develop unique resilience capabilities specific to disruption types.

Based on the results of this study, we broadly categorised the sources of disruption facing the manufacturing industry under infrastructural challenges, socio-economic issues, bureaucratic bottlenecks, quality issues, and capacity/capability utilisation (Figure 1). Consistent with McAdam *et al.* (2019), the proposed conceptual model (Figure 1) will allow manufacturing firms to align mitigation strategies to specific disruption types and environmental attributes to achieve optimal outcomes.

[Insert Figure 1 here]

While these disruption sources are contextual, they interact with global or external disruptions and have multiplier effects on Nigeria's manufacturing operations and capabilities. Suppose the thesis of redesigning the SC to address disruptions is valid. In that case, there should be a correspondence between the firms' SC strategy and operating conditions. According to our results, this assumption has significant implications for manufacturing companies regarding SCM. First, the articulated context-specific disruption mitigation, elucidated through CT underpinning this inquiry, effectively complements the two primary types of SC disruptions, indicating the need for proactive planning to develop appropriate mitigation strategies. By assuming that any disruption creates risk on either the supply or demand side, understanding context-specific disruptions enables manufacturing firms to plan against disruptions proactively and enhance their operational performance.

Consistent with Sousa and Voss' (2008) views on applying CT, this study demonstrates the need for manufacturing firms to identify sources of disruption, group these sources according to contexts, and examine the most effective resources and resilience capabilities required in designing practical mitigation. The outlined strategies provide managerial insights into implementing strategic interventions based on understanding the potential impact of firms' internal business structure and environment (Jonsson *et al.*, 2021).

This study raises awareness among multinational manufacturing companies about the disruptions inherent in the rapidly expanding Nigerian market and the need for collaborative planning and proactive decision-making to address context-specific disruptions. By comprehensively examining the characteristics of these disruptions and establishing firms' responses, this study offers manufacturing firms the critical knowledge necessary to effectively navigate the intricacies of planning and strategic alignment to enhance their manufacturing and resilience capabilities. For example, firms could outsource their manufacturing operations to improve productivity or import finished products to meet customers' demands; however, aligning their S&OP to SC partners is critical. This is due to equipment breakdown and the inconsistent electricity supply, as most manufacturing firms depend on the state energy supply to produce their products. Production is halted whenever the energy supply is unavailable,

negatively impacting capacity utilisation and the ability to sustain operations. Outsourcing manufacturing operations or importing finished products may negatively affect Nigeria's production output or contribution to global manufacturing production. However, the approach may provide flexibility and a short-term solution for businesses to meet customers' demands.

Our findings suggest that firms in Nigeria need to build redundancy and collaboration capabilities to ensure operations and SC resilience. While agility has been considered in the literature, our study shows that this is not significant to the Nigerian manufacturing sector due to many contextual infrastructural issues, such as poor road networks and the activities of law enforcement agents. Consistent with Rashid et al. (2024), our study suggests that it is imperative for Nigerian manufacturing firms to buffer their operations with safety stock underpinned by a made-to-stock strategy and collaboration with suppliers within and outside Nigeria.

Contrary to Dittfeld et al. (2022), our results show that collaboration is critical to the SC resilience of manufacturing firms in Nigeria and developing economies. Equally, our study shows that redundancy is important for manufacturing firms to ensure consistent operations but not at the expense of agility. Considering the socio-economic and political issues in developing economies, our study suggests no trade-offs between resilience capabilities, especially redundancy and agility. The results instead emphasise redundancy as a mechanism for agility. This means that manufacturing firms in Nigeria must collaborate to build redundancy, allowing them to be agile and resilient in their operations and SCs.

As globalisation, with the interconnectedness of SCs, intensifies the impact of disruptions, making conventional SCRM mostly ineffective, this study demonstrates the need for firms and managers to address context-specific disruptions. This interconnectedness necessitates a nuanced understanding of mitigation strategies employed by manufacturing firms, especially in developing economies, to sustain firm and SC performance.

Our results have important policy implications. The results show that excessive bureaucracy, corruption, and infrastructural decay are significant sources of disruption in the Nigerian manufacturing sector. The results suggest the need for national policies to address infrastructural challenges and provide an enabling environment for FDI in Nigeria so that manufacturing firms

can be resilient and increase their productivity. Policymakers should, therefore, enact actions to reduce/remove these disruption sources to increase manufacturing productivity and facilitate FDI. While the benefits of investment in supplier development to address disruption have been acknowledged (Dittfeld et al., 2022), our study suggests the need for policy interventions. These will allow suppliers and manufacturers outside Africa to invest in developing the African manufacturing firms' production and resilience capabilities. For example, investing in infrastructure and advanced technology for SC visibility and real-time information sharing can help managers anticipate disruptions and balance responsiveness with efficiency.

If the argument that discrepancies between a firm's projected and actual demand cause SC disruptions (Browning *et al.*, 2023) is plausible. In that case, we argue that SC partners outside Africa, primarily manufacturers and suppliers, must invest in developing manufacturing capabilities in Africa, as the lack of manufacturing activities in Africa may disrupt the entire supply network, expose markets to counterfeit products, and cause trade imbalance. According to our study, specific investment areas include digital capabilities, infrastructural development, and power generation. Businesses pursuing strategic collaboration and emerging opportunities in Africa may gain a first-mover advantage and expand their market share, as Africa is undergoing socio-economic and political transformations.

We, therefore, argue that mitigating SC vulnerability requires proactive and reactive SCRM practices underpinned by collaboration and information sharing between manufacturers and suppliers within and outside Africa. Integrating reactive and proactive measures provides a basis for learning and knowledge sharing between partners in the manufacturing ecosystem, allowing the manufacturing industry in Nigeria to build complex adaptive systems against disruptions. Such preparedness and adaptive recovery response allows the manufacturing industry in Nigeria to develop immune systems against disruptions (Ivanov, 2024). These will allow manufacturing firms to anticipate disruptions, adopt tailored strategies, reconfigure operations processes, enhance production performance, and ensure business continuity and competitive advantage.

Recommendations for Future Research

Focusing on Nigeria's context alone is a key limitation of this research; it limits generalisability to other geographic areas. The role of Nigeria in Africa, its abundant resources, and its potential to contribute significantly to the global economy justify the need to examine the Nigerian manufacturing landscape. This study, however, offers a valuable understanding of Nigerian manufacturing firms' peculiar dynamics and problems, which may assist international firms anticipating partnerships with Nigerian firms to adopt a more pragmatic approach underpinned by collaborative and proactive planning in their operations.

Although this study is limited to the manufacturing sector, the manufacturing sector operates under unique operational mechanisms and characteristics that might not be present in the service industry. However, the knowledge from this study applies to other sectors and jurisdictions similar to the manufacturing firms in Nigeria. Many developing countries, especially in Africa, experiencing socio-economic and political situations similar to Nigeria's may benefit from this study to improve manufacturing productivity by developing resilience capabilities to address context-driven disruptions. Also, this study allows other developing economies facing similar logistics issues to understand the need for businesses to develop logistics capabilities, such as warehousing, inventory management, information, and packaging, and how technological innovation can be applied to build resilience.

Therefore, there is a need to explore manufacturing companies in other contexts to establish the results of this study, and future studies may adopt quantitative methods for validation. The geographical scope of future research should be expanded to include other countries or regions. Comparative studies involving multiple countries in developing economies can increase the generalisability of results and provide a more comprehensive understanding of the impacts of context-specific disruptions. With the complexity and interconnectivity of global SCs, studies could explore context-specific disruptions in developed economies to establish how they compare to those reported in this study for businesses to design a complex adaptive system. The research should be broadened to businesses in various sectors, including manufacturing and service. This diversification will make it easier to determine whether the patterns and conclusions observed are unique to the manufacturing context in developing economies and how supply networks can

be resilient and responsive. Such a study will allow businesses seeking opportunities in Africa to understand and address the challenges facing manufacturing operations and productivity in Africa.

The adopted cross-sectional design, which captures data at a single point in time, may restrict the understanding of how specific environmental variables and outcomes could change with time since they cannot be analysed by tracking changes or developments over time. Adopting a longitudinal research design in future studies would allow researchers to monitor changes and progress over time, establishing the effectiveness of mitigation responses. This method can provide insights into causal relationships and the long-term impact of specific variables by providing a more dynamic and temporal perspective on the interaction between context-driven and global disruptions.

Future studies could examine contextual variables such as technological advances, the regulatory environment, market dynamics and organisational culture. A better understanding of these broader contextual elements may enhance the knowledge of the phenomenon under study. Future research can extend the current study's results by addressing these recommendations, thereby overcoming its limitations and contributing to a more generalisable and nuanced body of knowledge on operational planning and firm resilience capabilities.

Data Availability

Data is available on request from the authors.

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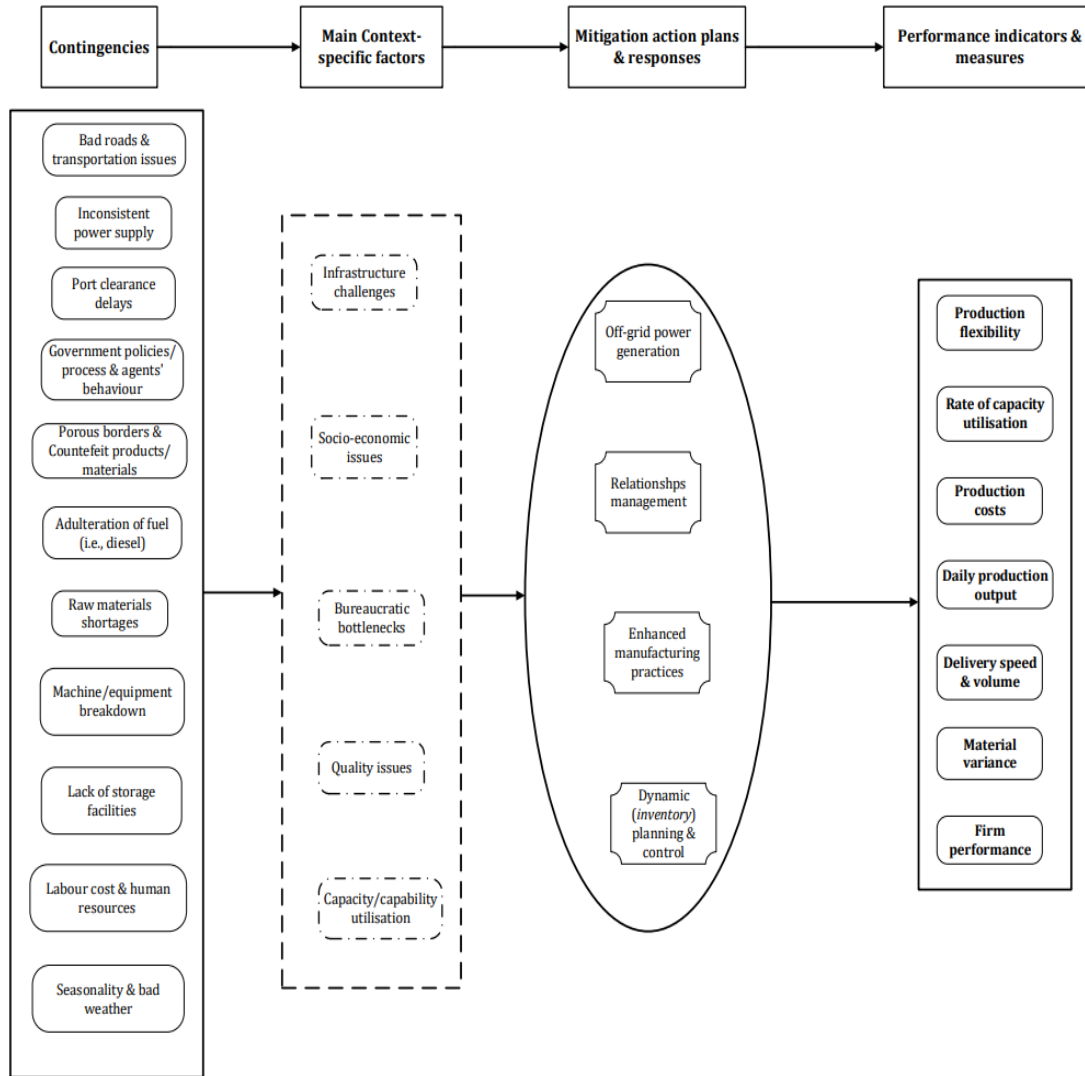


Fig. 1: Contingencies-Performance Interaction Conceptual Model for Manufacturing Firms (Source: **Authors**)

List of Tables

S/N	Firms	Sub-sector	Number of participants interviewed
1.	ConLo	Conglomerate	2
2.	CosLo	Cosmetics	4
3.	SanLo	Personal Care	5
4.	ConJo	Conglomerate	4

5.	AgroLo	Agro-allied	3
6.	PharmLo	Pharmaceutical	4
7.	PlasticLo	Plastic	4
8.	MetalJo	Metal	5
Total			31
Source: Authors			

Firms	Description
CosLo	CosLo started operating in January 1992. The company produces cosmetic products of different sizes, with eleven products in its portfolio. The products include pomade, shampoos, relaxers, and hair oil. The company has distributors within and outside Nigeria, such as Cameroon, Liberia, Tanzania, Gabon, Cote d'Ivoire, South Africa, the UK, Canada, and the USA. The company produces in batches. While the company sources most raw materials internationally, packaging materials are sourced and produced locally.
ConJo	ConJo is a multinational company with over 500 employees, jointly owned by Nigerians (49%) and foreign investors (51%). The company is one of the oldest surviving manufacturing companies in Nigeria, started in Nigeria in 1923. The company has production plants in Ogun state and Lagos state. The firm applies a technology-based inventory management system, SAP (Systems, Applications and Products), to facilitate its Material Requirement Planning (MRP) system. Production is on a continuous basis. This company sources about 70% of its raw materials from outside Nigeria.
PlasticLo	PlasticLo is an indigenous company that started operations nine years ago and operates only in Nigeria as a subsidiary of a conglomerate. However, the Group has existed for the past twenty years with 14 strategic business units. The firm manufactures packaging materials, such as high-quality and durable plastic containers. The firm adopts a just-in-time (JIT) production strategy for an average of 60% of its customised products and material requirement planning (MRP) for an average of 40% in the open market. It uses the batch system based on the LPO received from customers.
SanLo	SanLo , with about 150 staff members, is an indigenous manufacturing company that started operations in Nigeria in 1982. The manufacturing firm is involved in producing women's and baby products. The firm produces locally but outsources some production to companies abroad. Some products include sanitary pads, baby lotion, baby powder, baby oil, maternity pads, diapers, baby wipes, underpads and underlays. Due to increasing market demand than the firm's production capacity, it imports finished products to complement its production. The company maintains distributorship across 30-32 states in Nigeria. 99.9% of raw materials are sourced from abroad.
MetalJo	MetalJo is a subsidiary of a conglomerate that is a pioneering leader in aluminium products across West African countries. The group was established in 1959 by the British, but India and Nigeria own it. The Group has five major subsidiaries that produce rolling, roofing, kitchenware, extrusion, and flexible packaging products. The company sources raw materials locally and abroad to complement the supply, such as China, Hong Kong, India, and Thailand.
AgroLo	AgroLo , an indigenous manufacturing firm, was established in 2003 but incorporated in 2010. It is a small firm that mainly produces crude palm kernel oil. Raw materials are sourced 100% locally.

ConLo	ConLo was registered and incorporated in 1988 and is 100% owned by Nigeria. It manufactures consumer goods. The firm, with about 500 employees, is involved in the marketing and distributing well-tested medication and energy drinks manufactured in Indonesia, Italy, India, Germany, the United States of America, and Nigeria. Subsequently, it joined the beauty care industries by importing soaps, creams, and other beauty products. By 2006, the company commenced the local production of different brands of soaps in Lagos, boosting the Nigerian manufacturing sector and creating jobs for the people. Raw materials are sourced both locally and internationally.
PharmLo	PharmLo International is a locally owned public liability company formed by a multi-international pharmaceutical company in 1997 – PharmLo in West African countries such as Ghana, Sierra Leone, and Liberia. The firm has eleven depots across Nigeria. The company started production operations in animal medications but now produces human medications, including antiseptics and creams for infections – PharmLo sources for raw materials locally and internationally.
Source: Authors	

SC disruptions	Reference from cases
Power disruption	[<i>Energy/power supplier</i>] brings exorbitant bills, and still, the electricity is not supplied. The company has both small and big diesel generators to manage the crisis. Sometimes for the whole working hours (8a.m-7p.m), we might not have public electricity - CosLo
Equipment or Machine breakdown	Fluctuating power supply has also damaged one of our machines. We used a stabiliser for the machine, but because the fluctuation in the electricity supply was too much, the machine was packed up. It cost us 2 million dollars to bring this machine from Italy in 1998. It is the machine we were using for the diaper line - SanLo .
Transportation disruption	The transportation system in Nigeria is very poor, and it has an adverse effect on the distribution of our finished products . . . Our transportation system in Nigeria is not good at all. There are lots of gullies and potholes which affect the electric parts of the truck. A journey that is supposed to take 1 hour may end up being 5 hours - PlasticLo
Multiple taxation	When we move from one part of the country to the other, we pay all sorts of fees despite the fact that we have already paid for the Lagos State fees. We pay all sorts of fees and levies such as [<i>government agency</i>] fees, environmental pollution levies, radio fees and so on. In short, we experience multiple taxation issues - PharmLo
Corruption	We also face issues with government officers such as policemen, Vehicle Inspection Officers (VIOs) on the road, etc. They all have targets to make returns to their offices, and their focuses are targeted particularly on company vehicles – CosLo Police exploit us on the road. . . Custom officials also look for excuses to exploit us - PharmLo

SC disruptions	Reference from cases
Terrorism	<p>We face certain issues that are mainly a result of operating in the Nigerian business environment. Some of these issues include insecurity (Boko Haram insurgency), which mainly affects the distribution of our products to the northern parts of Nigeria - <i>PlasticLo</i></p> <p>The issue of terrorism (Boko haram) also affects the distribution of our products in the North - <i>SanLo</i></p> <p>From the point of view of transportation, the supply of products to the northern states has been made difficult to some extent due to the issue of terrorism (Boko haram sect). This has affected the sales of our products in the northern parts of Nigeria. Even our drivers are afraid of going to the Northern Nigeria - <i>ConLo</i></p>
Adulteration	<p>The issue of adulteration of diesel, which affects the injection system (can pack up within 6 months) of trucks and generators, is devastating - <i>CosLo</i></p> <p>We face adulteration issues with our products - <i>PharmLo</i></p>
Issues with raw materials	<p>“The importation of raw materials takes about 80% of the total raw materials sourced; the remaining 20% of raw materials are usually sourced locally. Usually, the papers or documents that are required before the ship carrying the raw materials gets to the final destination may not be presented on time or cleared online, therefore causing delays – <i>ConLo</i></p> <p>“The company experiences issues with the pricing of raw materials. For instance, suppliers that are desperate to get orders from us quote unreliable prices and will not be able to deliver to us as when due” - <i>MetalJo</i></p>
Porous borders / fierce competition	<p>This is followed by the fact that Nigerian borders are open to all sorts of counterfeit products. Our products will have to face fierce competition with sub-standard products. The impact of this is that we produce less, the cost of production increases, and our market share reduces - <i>ConJo</i></p>
Labour issue	<p>The kinds of machines that we use are high-tech, so they require competent people to operate them. We have a shortage of technical people. . . Another factor considered to be a Nigerian factor affecting our operation includes the issues related to human capital. Most people in the workforce are not loyal; you recruit them today, and they resign tomorrow. Apart from this, from the technical and competence point of view, to get people that will work for you the way you want them is usually difficult - <i>ConLo</i></p>
Source: Authors	

Mitigation	Reference from cases
Off-grid power sources	<p>“We resort to using our own independent power supply. The power supply issue prevents branches from promptly updating their stock level schedules to the head office because they cannot give us accurate records, which stops our work at the head office. We run our activities on generators. We try to manage the cost of production, but because of the need to purchase diesel, the cost remains high, and this impacts our overhead costs” - <i>ConLo</i>.</p>

Mitigation	Reference from cases
Dynamic inventory planning & control	<p>“To ease the challenge we face at the port, we resorted to using local raw materials manufacturers to supply us. This saves us some money, especially if the product is low-cost and of good quality. Some of the products that we used to source from China are now sourced locally, such as rivets, mop, and polishing compound” - <i>MetalJo</i>.</p> <p>“We plan in advance for 1-2 months so that before the stock on hand finishes, we already have a new stock in place, especially for our critical components. Because of the price dynamism, we make sure we usually have 1-3 months of stock available. Our raw materials do not have storage life (they are not perishable) and are not susceptible to pilferage. Therefore, we do not incur so much inventory holding cost. We also source our raw materials from more than one supplier so that if one fails, we have others to leverage on” - <i>PlasticLo</i>.</p>
Multiple sourcing	<p>“We use many suppliers, so we are not at the mercy of any single supplier. We have a maximum of 5 suppliers and a minimum of 3 suppliers in order to allow for competition between them. We ration the amount of raw materials among the different suppliers. This is done based on the history of the supplier’s performance, time, and quality of performance” - <i>PharmLo</i>.</p>
Flexible production	<p>“Our products are standard products that we supply to the open market. On rare occasions, we do supply customised products to customers. Our ability to be flexible in changing designs and allocating a particular line for such production helps us accommodate unexpected demand. In managing our demand-related issues since we do not have the production capacity to meet all the demands, we do a lot of product mixing” - <i>MetalJo</i>.</p>
Transloading and Trans-hooking	<p>“When we experience truck breakdowns on the road, what we do is either trans-hooking or trans-loading. In actual sense, a truck is made up of a tractor and a trailer. For trans-hooking, if a tractor is faulty, we transport a good one to the place where the breakdown occurred, detach the faulty tractor and fit in the good one. For trans-loading, a faulty trailer, for instance, would need to be offloaded entirely into a new truck for prompt delivery to be ascertained” - <i>PlasticLo</i>.</p>
Outsourcing	<p>“We have suppliers who have warehouses and store our raw materials. The advantage here is that we can concentrate on other things, and there is less space usage. We also encourage suppliers to hold stock of raw materials on our premises. We take from the raw materials as needs arise, but the holding cost does not accrue to us; the supplier is solely responsible. Currently, we have two tanks of raw materials with a 200-tonne capacity each” - <i>ConJo</i></p> <p>“We import diapers from abroad on a 100 percent basis because we do not have the capacity to meet the demand even if we have two machines to produce. It is cheaper for us to outsource” - <i>SanLo</i>.</p>
Source: Authors	

Table 5: Cross-Case Analysis for Different Operational Performance Indicators

Manufacturing firms / Operational performance indicators	<i>CosLo</i>	<i>PharmLo</i>	<i>AgroLo</i>	<i>ConLo</i>	<i>SanLo</i>	<i>PlasticLo</i>	<i>ConJo</i>	<i>MetalJo</i>	<i>Frequency</i>
Production flexibility	√			√	√	√			4
Capacity utilisation		√			√	√		√	4
Labour efficiency	√	√					√		3
Machine efficiency	√	√	√				√		4
Daily Output reliability	√	√	√	√				√	5
Cost of production	√	√	√	√	√	√	√	√	8
Quality	√	√	√	√	√	√	√	√	8
Material variance							√		1
Delivery				√		√	√	√	4
Product availability				√					1
Customer service/ satisfaction							√		1
Source: Authors									