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Outsourcing risk management and supply chain resilience in the Nigerian manufacturing sector: Lessons from the covid-19 pandemic

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Abstract
The unprecedented disruptions generated by the COVID-19 pandemic exposed significant vulnerabilities in global and domestic supply chains and reinforced the strategic importance of effective outsourcing risk management. Manufacturing firms in emerging economies such as Nigeria were particularly affected by supplier interruptions, transportation restrictions, input shortages, operational shutdowns, demand volatility, and uncertainty surrounding outsourced activities. This study examined the relationship between outsourcing risk management and supply chain resilience in the Nigerian manufacturing sector, drawing lessons from firms' experiences during the COVID-19 pandemic. Specifically, the study assessed the effects of outsourcing risk identification, risk mitigation, risk monitoring, and contingency planning on supply chain agility, robustness, recovery capability, and overall supply chain resilience. The study adopted a quantitative cross-sectional research design using a dataset of 340 observations drawn from manufacturing firms of different sizes and industrial sectors. Outsourcing risk management was operationalised through four dimensions: risk identification, risk mitigation, risk monitoring, and contingency planning, while supply chain resilience was measured through agility, robustness, recovery capability, and an overall resilience index. Firm size, sector, and level of COVID-19 impact were incorporated into the analytical framework. The results show a consistently positive relationship between outsourcing risk-management capability and supply chain resilience. Risk monitoring and contingency planning display exact positive linear relationships with the resilience measures in the supplied dataset, while risk identification and mitigation show positive construct-level patterns. The findings underscore the need for Nigerian manufacturing firms to move beyond cost-driven outsourcing toward resilience-oriented supplier governance incorporating systematic supplier assessment, diversified sourcing, continuous risk monitoring, contingency protocols, business continuity planning, and collaborative relationships with strategic suppliers. The study concludes that outsourcing risk management constitutes an important organizational capability for developing resilient manufacturing supply chains, while the deterministic structure of several measures requires caution in interpreting the magnitude of individual effects.

Keywords: Outsourcing risk management, supply chain resilience, covid-19 pandemic, risk identification, risk mitigation, risk monitoring, contingency planning, supply chain agility, manufacturing sector, Nigeria

Introduction

Outsourcing has become an important feature of contemporary manufacturing strategy because firms increasingly rely on external suppliers and specialized service providers for raw materials, components, logistics, information technology, maintenance, warehousing, distribution, and other activities. By concentrating internal resources on core capabilities and obtaining complementary resources from external partners, manufacturing organizations can improve flexibility, reduce selected operating costs, access specialized expertise, and respond more rapidly to market requirements. Yet outsourcing also relocates part of the firm's operational dependency beyond its direct hierarchical control. As the number and strategic importance of external relationships increase, the organization becomes exposed to supplier failure, logistics disruption, quality problems, capacity shortages, information asymmetry, financial instability, geopolitical shocks, and other risks that can interrupt production and customer service.

The COVID-19 pandemic made these vulnerabilities exceptionally visible. Restrictions on movement, factory closures, port congestion, shortages of transport capacity, workforce disruption, border controls, abrupt shifts in demand, and shortages of critical materials simultaneously affected supply networks across countries. The crisis demonstrated that supply chains designed primarily around cost efficiency and lean operating principles may lack sufficient redundancy, visibility, and flexibility when disruption is systemic. Ivanov and Dolgui (2020) [7] consequently emphasized the importance of supply-network viability and survivability, while El Baz and Ruel (2021) [4] showed that supply chain risk-management practices can strengthen resilience and robustness during severe disruption.

Manufacturing firms were particularly exposed because production continuity depends on the timely availability of interdependent materials, components, services, energy, transportation, and information. A disruption involving one critical outsourced input can stop an entire production process even where most other resources remain available. The pandemic therefore shifted managerial attention from the conventional question of how efficiently a supply chain operates to the additional question of how effectively it can

anticipate, absorb, respond to, and recover from major shocks. This shift has strengthened interest in supply chain resilience as a strategic capability rather than merely an emergency response mechanism.

Supply chain resilience generally refers to the capacity of a supply chain to prepare for unexpected events, respond effectively to disruption, maintain or adapt critical functions, and recover to an acceptable state of performance. Ponomarov and Holcomb (2009) [10] conceptualized resilience as an adaptive capability that prepares for unexpected events, responds to disruptions, and recovers while maintaining continuity. Christopher and Peck (2004) [2] similarly emphasized the capacity of supply networks to return to desired states after disturbance. Subsequent literature has expanded the concept to include anticipation, resistance, adaptation, recovery, learning, and transformation (Tukamuhabwa *et al*., 2015) [14].

For the present study, resilience is represented by agility, robustness, recovery capability, and overall resilience. Agility concerns the speed and flexibility with which a firm responds to unexpected supply conditions. Robustness reflects the capacity to withstand disruption while preserving essential performance. Recovery capability concerns the restoration of operations following a disruption. These dimensions are especially relevant to outsourcing because external dependency can simultaneously affect the firm's ability to detect a problem, switch suppliers, maintain output, and recover from a failure.

Outsourcing risk management provides a structured mechanism for addressing these vulnerabilities. In this study it comprises four interrelated activities: risk identification, risk mitigation, risk monitoring, and contingency planning. Risk identification concerns the systematic recognition of potential failures and vulnerabilities associated with suppliers, contractors, logistics providers, and other outsourced relationships. Without adequate identification, managers may remain unaware of concentrated dependencies or lower-tier vulnerabilities until a disruption has already affected production.

Risk mitigation converts identified threats into preventive action. It may include supplier diversification, dual sourcing, inventory buffers, contractual safeguards, supplier development, geographic diversification, alternative logistics channels, and closer collaboration with strategically important suppliers. El Baz and Ruel (2021) [4] provide empirical evidence that risk-management practices contribute to resilience and robustness, reinforcing the proposition that proactive risk reduction is central to disruption preparedness.

Risk monitoring recognizes that outsourcing risk is dynamic rather than static. Supplier financial health, delivery performance, quality, production capacity, transport conditions, political exposure, and other indicators can change after a contract has been awarded. Continuous monitoring, therefore, enables firms to detect deterioration and activate responses before a vulnerability becomes a severe interruption. Industry 4.0 technologies, analytics, enterprise systems, supplier portals, and logistics tracking increasingly support this visibility. Spieske and Birkel (2021) [11] identify visibility and velocity as important resilience capabilities and show how digital technologies can support proactive supply chain risk management.

Contingency planning addresses the reality that not all disruptions can be prevented. It establishes predetermined responses for situations in which primary suppliers, transport routes, inputs, or outsourced services become unavailable. Backup suppliers, alternative routes, substitute materials, emergency inventories, crisis teams, and business-continuity procedures can reduce the time required to respond. Hohenstein (2022) [6] demonstrates the importance of proactive preparation, learning, and risk-management strategies among logistics service providers during the COVID-19 crisis.

The Nigerian manufacturing environment provides a particularly important setting for examining these relationships. Manufacturers operate within supply networks influenced by infrastructure constraints, import dependence for selected inputs and equipment, logistics bottlenecks, exchange-rate pressures, energy challenges, financing conditions, and policy uncertainty. The World Bank's assessment of Nigeria during COVID-19 documented severe economic disruption affecting manufacturing and services, while the Manufacturers Association of Nigeria represents a broad industrial base spanning multiple manufacturing sectors. Under these conditions, a disruption originating outside the focal firm can interact with domestic structural constraints and amplify operational consequences.

The relevance of outsourcing risk management in Nigeria extends beyond the pandemic itself. Future disruptions may arise from geopolitical conflict, currency instability, cyber incidents, supplier insolvency, extreme weather, transport failures, energy interruptions, trade restrictions, and other sources. The strategic lesson from COVID-19 is therefore not simply that firms should prepare for another pandemic, but that they should institutionalize capabilities for managing a wide range of external dependencies under uncertainty.

Despite growing international research on supply chain resilience, important gaps remain. Much of the literature examines broad supply chain risk management, digitalization, logistics, or resilience without isolating the specific role of outsourcing risk-management practices. Studies conducted in developed and major emerging economies may also not capture the institutional and infrastructural conditions confronting Nigerian manufacturers. Furthermore, resilience is often treated as a single outcome, even though agility, robustness, and recovery represent conceptually different organizational capabilities.

This study addresses these gaps by examining how four dimensions of outsourcing risk management—risk identification, risk mitigation, risk monitoring, and contingency planning—relate to supply chain agility, robustness, recovery capability, and overall resilience in the Nigerian manufacturing sector. The analysis uses 340 firm-level observations and incorporates firm size, manufacturing sector, and COVID-19 impact as contextual variables.

The specific objectives are to determine the relationship between outsourcing risk identification and supply chain resilience; assess the relationship between outsourcing risk mitigation and resilience; examine the relationship between outsourcing risk monitoring and resilience; evaluate the relationship between outsourcing contingency planning and resilience; and assess the overall relationship between

outsourcing risk-management practices and supply chain resilience.

The study contributes theoretically by integrating the Resource-Based View, Dynamic Capabilities Theory, and Organizational Information Processing Theory in explaining outsourcing-related resilience. It contributes managerially by shifting attention from cost-focused outsourcing toward resilience-oriented supplier governance. Empirically, it provides evidence from Nigerian manufacturing firms and draws lessons from COVID-19 for managing future supply disruptions.

Review of Related Literature

1. Concept of Outsourcing

Outsourcing refers to the deliberate transfer or procurement of activities, services, resources, or processes from external organizations rather than performing them entirely within the boundaries of the focal firm. In manufacturing, outsourcing can involve components, raw-material sourcing, maintenance, logistics, warehousing, information systems, distribution, security, and specialized professional services. The strategic rationale is often grounded in cost efficiency, specialization, flexibility, access to capabilities, and managerial concentration on core competencies. However, outsourcing also creates interorganizational dependencies, making supplier performance and external operating conditions integral to the focal firm's performance.

The strategic value of outsourcing therefore coexists with risk. When an external provider controls a critical resource or process, the manufacturer may have less direct authority over capacity, quality, scheduling, labor, technology, and recovery decisions. The benefits of specialization can consequently be offset by dependence, information asymmetry, coordination complexity, opportunism, and disruption exposure. This duality makes risk governance central to sustainable outsourcing strategy.

2. Outsourcing Risk and Outsourcing Risk Management

Outsourcing risk is the possibility that reliance on an external provider or outsourced arrangement will generate adverse consequences for cost, quality, delivery, continuity, reputation, compliance, information security, or strategic performance. Risk can originate from the supplier, the relationship between the parties, the broader supply network, or the external environment. COVID-19 demonstrated that risks previously treated as isolated supplier problems can become correlated across regions and tiers of a supply network.

Outsourcing risk management is the systematic process through which firms identify, assess, mitigate, monitor, and prepare responses to risks arising from outsourced relationships. It moves supplier governance beyond contract administration toward continuous resilience management. In the present study, the construct is operationalized through risk identification, mitigation, monitoring, and contingency planning.

3. Outsourcing Risk Identification

Risk identification is the process of recognizing events, dependencies, vulnerabilities, and conditions capable of disrupting outsourced activities. It includes identifying critical suppliers, single-source dependencies, geographic concentration, long lead times, weak supplier finances, quality instability, logistics exposure, cyber vulnerabilities, and lower-tier dependencies. Effective identification improves managerial visibility and provides the informational foundation for mitigation and contingency decisions.

Organizational Information Processing Theory is particularly relevant because outsourcing increases uncertainty and therefore increases information requirements. Firms that systematically map and update supplier risks are better positioned to reduce information gaps and make timely decisions. The resilience literature likewise emphasizes visibility as a prerequisite for rapid response (Spieske & Birkel, 2021) [11].

4. Outsourcing Risk Mitigation

Risk mitigation encompasses actions intended to reduce either the probability of disruption or its consequences. Common approaches include dual or multiple sourcing, geographic diversification, supplier development, safety stock, flexible contracts, alternative transport arrangements, collaborative planning, insurance, and selective internalization of critical activities. The appropriate portfolio depends on the cost of mitigation relative to the expected operational consequences of disruption.

El Baz and Ruel (2021) [4] found that supply chain risk-management practices positively foster resilience and robustness during the COVID-19 era. This suggests that firms that translate risk awareness into preventive capabilities are better equipped to absorb severe shocks. In manufacturing, mitigation is particularly important for bottleneck inputs whose absence can halt an otherwise functional production system.

5. Outsourcing Risk Monitoring

Monitoring involves the continuous or periodic observation of risk indicators associated with outsourced providers and supply conditions. It includes supplier scorecards, delivery and quality metrics, financial-health assessment, capacity monitoring, logistics visibility, audits, compliance review, and early-warning systems. Monitoring is necessary because supplier risk profiles evolve over time and can deteriorate rapidly under external stress.

Digital technologies can enhance monitoring through real-time data, predictive analytics, connected logistics, and integrated enterprise systems. Spieske and Birkel (2021) [11] show that Industry 4.0 capabilities can improve supply chain resilience by strengthening visibility, information processing, and response velocity. Monitoring therefore connects risk sensing to timely managerial action.

6. Outsourcing Contingency Planning

Contingency planning establishes predefined courses of action for disruptions that cannot be fully prevented. Typical measures include prequalified backup suppliers, alternative logistics routes, substitute inputs, emergency inventory, crisis teams, alternative production arrangements, and business-continuity procedures. Its strategic value lies in reducing decision delay during a crisis.

Hohenstein (2022) [6] shows that the COVID-19 pandemic generated important empirical lessons concerning proactive risk management and organizational learning among global logistics service providers. Contingency planning converts

such learning into institutional preparedness and can improve the speed with which organizations reconfigure resources after disruption.

7. Supply Chain Resilience

Supply chain resilience has developed into a major concept in operations and supply chain management. Christopher and Peck (2004) [2] associated resilience with the ability of a system to return to its desired state after disturbance, while Ponomarov and Holcomb (2009) [10] emphasized preparedness, response, and recovery. Tukamuhabwa *et al.* (2015) [14] synthesized the literature and highlighted adaptive capability, preparedness, response, and recovery as recurring elements.

The COVID-19 crisis expanded the resilience discussion toward viability and survivability. Ivanov and Dolgui (2020) [7] argued that intertwined supply networks must be capable not only of recovering but also of maintaining their existence and critical functions under prolonged disruption. This broader perspective is particularly relevant where shocks affect multiple suppliers and regions simultaneously.

7.1 Supply Chain Agility

Agility is the capacity to respond quickly and flexibly to changes in supply, demand, logistics, or operating conditions. Agile supply chains shorten the time between disruption recognition and corrective action. Alternative sourcing, rapid decision making, information visibility, flexible production, and responsive logistics contribute to agility.

7.2 Supply Chain Robustness

Robustness refers to the ability to maintain acceptable performance despite disruption. Whereas recovery focuses on what happens after performance deteriorates, robustness emphasizes resistance and continuity. Redundancy, strategic buffers, diversified supply, modular processes, and alternative capacity can improve robustness. El Baz and Ruel (2021) [4] specifically distinguish and empirically examine resilience and robustness in the context of COVID-19.

7.3 Supply Chain Recovery Capability

Recovery capability concerns the speed and effectiveness with which operations return to an acceptable level after disruption. Recovery depends on available alternatives, coordination, resource mobilization, supplier collaboration, and the severity of damage. Measures such as time-to-recovery and time-to-survive can help firms evaluate the resilience of critical nodes.

8. Outsourcing Risk Management and Supply Chain Resilience

The conceptual relationship between ORM and SCR rests on the proposition that external dependency creates vulnerability, while structured risk-management capability reduces the likelihood, duration, or severity of disruption. Identification improves awareness; mitigation reduces exposure; monitoring supports early detection; and contingency planning accelerates response and recovery. Together these practices can improve agility, robustness, and recovery capability.

Laari *et al.* (2024) [9] examined firm resilience through responsiveness and logistics outsourcing in the COVID-19 era and found that responsiveness improves resilience, while increasing logistics outsourcing can weaken the relationship under some conditions. This finding is important because outsourcing itself is neither inherently resilient nor inherently fragile; its consequences depend partly on how external relationships are governed and how quickly firms can respond to disruption.

9. COVID-19 and Manufacturing Supply Chain Resilience

COVID-19 created simultaneous supply, demand, workforce, transportation, and policy shocks. Kapoor *et al.* (2024) [8] reviewed how the pandemic altered the manufacturing landscape and identified a range of challenges and management interventions. The crisis exposed the vulnerability of geographically concentrated sourcing, limited visibility, long supply chains, and insufficient contingency capacity, while accelerating interest in digitalization, local sourcing, flexibility, and resilience.

The pandemic also demonstrated that risk-management practices must address systemic rather than merely idiosyncratic disruption. When many organizations simultaneously seek alternative suppliers and logistics capacity, contingency options that appear adequate under ordinary conditions may become scarce. Resilience therefore requires prior preparation, strategic relationships, and the capacity to adapt under competition for constrained resources.

10. Nigerian Manufacturing Context

Nigeria's manufacturing sector operates within a complex institutional and infrastructural environment. Firms may depend on imported machinery, spare parts, raw materials, and specialized inputs while also confronting domestic logistics, energy, financing, and policy constraints. The World Bank (2020) [15] documented substantial economic disruption during the pandemic, including effects on manufacturing and services. These conditions make resilience particularly salient because external supply shocks can interact with domestic operating constraints.

The Nigerian setting also provides an opportunity to extend resilience research beyond the economies most frequently represented in the international literature. The Manufacturers Association of Nigeria encompasses a broad range of manufacturing companies and subsectors, illustrating the diversity of supply-chain configurations within the national industrial base. Evidence from this environment can therefore contribute to understanding how outsourcing risk is managed in an emerging economy.

11. Theoretical Framework

11.1 Resource-Based View

The Resource-Based View argues that sustained performance differences can arise from valuable, rare, difficult-to-imitate, and organizationally embedded resources and capabilities (Barney, 1991) [1]. Applied to this study, supplier intelligence, risk-management routines, alternative sourcing networks, continuity systems, and experienced personnel can constitute organizational capabilities that help firms preserve operations under

disruption. ORM is therefore treated not merely as an administrative process but as a strategic capability.

11.2 Dynamic Capabilities Theory

Dynamic Capabilities Theory emphasizes the ability of firms to sense changes, seize opportunities or responses, and reconfigure resources under changing conditions (Teece *et al*., 1997; Teece, 2007) [12, 13]. Risk identification and monitoring represent sensing activities; mitigation represents the mobilization of preventive responses; and contingency planning supports rapid reconfiguration when established arrangements fail. The theory therefore provides a strong explanation for the ORM–resilience relationship.

11.3 Organizational Information Processing Theory

Organizational Information Processing Theory proposes that organizations facing greater uncertainty require greater information-processing capacity (Galbraith, 1974) [5]. Outsourcing expands interorganizational uncertainty because critical activities occur beyond direct managerial control. Risk identification, supplier monitoring, integrated information systems, and collaborative communication increase the information available for managing this uncertainty and can thereby improve response quality and resilience.

12. Empirical Review

El Baz and Ruel (2021) [4], using survey evidence collected during the COVID-19 outbreak era, found that supply chain risk-management practices can mitigate disruption impacts and foster resilience and robustness. Their work provides direct empirical support for treating proactive risk management as an antecedent of resilience.

Spieske and Birkel (2021) [11] conducted a systematic literature review on Industry 4.0 and supply chain resilience under the impressions of COVID-19. Their synthesis highlights the role of digital technologies, visibility, velocity, and proactive risk management in strengthening resilient supply networks.

Hohenstein (2022) [6] used multiple-case evidence from international logistics service providers to examine supply chain risk management during COVID-19. The study identifies strategies and lessons for improving performance, emphasizing proactive preparation, adaptation, and organizational learning.

Laari *et al*. (2024) [9], using data from 286 manufacturing firms, evaluated firm resilience through responsiveness and logistics outsourcing in the COVID-19 era. They found that responsiveness supports resilience but that greater logistics outsourcing can weaken the relationship, underscoring the importance of governing outsourcing carefully rather than assuming that externalization automatically improves flexibility.

Kapoor *et al*. (2024) [8] reviewed the manufacturing challenges and management interventions associated with COVID-19. Their analysis reinforces the need for firms to reconsider supply-network design, digital capability, flexibility, and preparedness in response to large-scale disruption.

13. Gap in the Literature

Three gaps motivate the present study. First, much resilience research focuses on broad supply chain risk management rather than outsourcing-specific risk-management practices. Second, relatively limited evidence examines these relationships within Nigerian manufacturing, where institutional and infrastructural conditions can amplify supply vulnerability. Third, studies frequently aggregate resilience into a single construct, whereas the present framework explicitly considers agility, robustness, recovery capability, and overall resilience. The study therefore provides a focused examination of four ORM dimensions and their relationship with multidimensional SCR in the Nigerian manufacturing sector.

14. Conceptual Framework and Hypotheses

The conceptual framework proposes that outsourcing risk identification, risk mitigation, risk monitoring, and contingency planning are positively related to supply chain resilience. Firm size, sector, and COVID-19 impact provide organizational and contextual controls. The following null hypotheses guided the analysis:

H01: Outsourcing risk identification has no significant effect on supply chain resilience in the Nigerian manufacturing sector.

H02: Outsourcing risk mitigation has no significant effect on supply chain resilience in the Nigerian manufacturing sector.

H03: Outsourcing risk monitoring has no significant effect on supply chain resilience in the Nigerian manufacturing sector.

H04: Outsourcing contingency planning has no significant effect on supply chain resilience in the Nigerian manufacturing sector.

H05: Outsourcing risk-management practices jointly have no significant effect on overall supply chain resilience in the Nigerian manufacturing sector.

Methodology

1. Research Design

The study adopted a quantitative cross-sectional survey research design to examine the relationship between outsourcing risk management and supply chain resilience in the Nigerian manufacturing sector, with particular emphasis on lessons arising from the COVID-19 pandemic. The quantitative design enabled the study to measure outsourcing risk-management practices and supply chain resilience using numerical indicators and to determine statistically the magnitude and direction of relationships among the variables. The explanatory dimension of the study established whether outsourcing risk identification, risk mitigation, risk monitoring, and contingency planning influenced supply chain resilience.

2. Study Population and Unit of Analysis

The target population comprised manufacturing firms operating in Nigeria and involved in outsourcing one or

more components of their production or supply chain activities. The firm constituted the primary unit of analysis. Respondents were organizational representatives occupying positions that provided adequate knowledge of outsourcing, procurement, operations, logistics, risk management, and supply chain activities.

3. Sample Size and Sampling Procedure

The empirical analysis was based on a final sample of 340 observations (N = 340). The study employed a multistage sampling procedure. Manufacturing firms were classified according to sector and firm size to ensure representation across organizational categories, after which knowledgeable managerial personnel served as respondents. Each observation was assigned a unique identification code ranging from ID 1 to ID 340.

4. Data Collection and Measurement

The study relied primarily on quantitative firm-level data obtained through a structured questionnaire. The instrument collected organizational characteristics, COVID-19 impact, outsourcing risk-management practices, and supply chain resilience. ORM was operationalized through ORM_ID, ORM_MIT, ORM_MON, and ORM_CONT. SCR was represented by SCR_AGIL, SCR_ROB, SCR_REC, and SCR_OVERALL. Firm size, sector, and COVID-19 impact served as contextual/control variables.

Variable	Code	Role	Measurement
Firm size	FIRM_SIZE	Control	1 = Small; 2 = Medium; 3 = Large
Manufacturing sector	SECTOR	Control/Categorical	Categories 1–5
COVID-19 impact	COVID_IMPACT	Contextual/Control	1 = Low; 2 = Moderate; 3 = High
Risk identification	ORM_ID	Independent	Five-point metric
Risk mitigation	ORM_MIT	Independent	Five-point metric
Risk monitoring	ORM_MON	Independent	Five-point metric
Contingency planning	ORM_CONT	Independent	Five-point metric
Supply chain agility	SCR_AGIL	Dependent	Five-point metric
Supply chain robustness	SCR_ROB	Dependent	Five-point metric
Recovery capability	SCR_REC	Dependent	Five-point metric
Overall resilience	SCR_OVERALL	Principal dependent	Five-point metric

5. Validity and Reliability

The study established content and face validity through expert review of the research instrument and alignment of the measures with established literature. Internal consistency was assessed using Cronbach's alpha, with 0.70 adopted as the threshold for acceptable reliability. Reliability is appropriately assessed from the original questionnaire items underlying the composite variables rather than fabricated from aggregate construct scores.

6. Model Specification

The principal empirical relationship was specified as SCR = f(ORM). The baseline model was: $SCR\_OVERALL_i = \beta_0 + \beta_1 ORM\_ID_i + \beta_2 ORM\_MIT_i + \beta_3 ORM\_MON_i + \beta_4 ORM\_CONT_i + \varepsilon_i$. An expanded specification incorporated firm size, COVID-19 impact, and sector dummy variables. Separate outcome specifications were defined for agility, robustness, and recovery capability.

7. Methods of Data Analysis

The dataset was screened for missing values, coding errors, duplicate observations, outliers, and inconsistencies. The repeated header between observations 170 and 171 was removed because it did not Constitute a valid observation. Frequencies and percentages summarized categorical variables, while descriptive statistics summarized metric variables. Pearson correlation analysis examined bivariate relationships. Multiple linear regression was specified for hypothesis testing, with t-statistics and p-values for individual predictors, the F-statistic for overall model significance, and R^2 and adjusted R^2 for explanatory power. All hypotheses were evaluated at $\alpha = .05$. Regression diagnostics included multicollinearity, residual normality, homoscedasticity, linearity, and independence of errors.

8. Ethical Considerations

Participation was voluntary, confidentiality was maintained, and information was used solely for academic purposes. No personally identifying information was included in the analytical dataset; observations were represented by numerical identification codes.

Results and Discussion

1. Sample Characteristics

Sector	Frequency	Percentage
Sector 1	68	20.0
Sector 2	68	20.0
Sector 3	68	20.0
Sector 4	68	20.0
Sector 5	68	20.0
Total	340	100.0

The sample was evenly distributed across the five manufacturing-sector categories, with each sector contributing 68 observations or 20.0% of the total sample.

Firm Size	Frequency	Percentage
Small	68	20.0
Medium	136	40.0
Large	136	40.0
Total	340	100.0
COVID-19 Impact	Frequency	Percentage
Low	68	20.0
Moderate	136	40.0
High	136	40.0
Total	340	100.0

The results indicate that 80.0% of the observations represented firms experiencing moderate or high COVID-19 impact.

2. Descriptive Results

Variable	Minimum	Maximum	Interpretation
ORM_ID	3.40	4.70	High
ORM_MIT	3.50	4.80	High
ORM_MON	3.20	4.40	Moderate–High
ORM_CONT	3.40	4.60	High
SCR_AGIL	3.30	4.50	Moderate–High
SCR_ROB	3.50	4.70	High
SCR_REC	3.10	4.30	Moderate–High
SCR_OVERALL	3.30	4.50	Moderate–High

The observed values indicate relatively strong ORM and SCR capabilities among the manufacturing firms. Robustness occupied the highest resilience range, while recovery capability occupied the lowest. Because several resilience measures differ by fixed constants, these differences are descriptive rather than evidence of independent empirical variation.

3. Inferential Statistical Analysis

Detailed examination of the 340 observations established exact structural relationships among several variables: ORM_MON = ORM_CONT − 0.20; SCR_OVERALL = ORM_CONT − 0.10; SCR_OVERALL = ORM_MON + 0.10; SCR_AGIL = SCR_OVERALL; SCR_ROB = SCR_OVERALL + 0.20; and SCR_REC = SCR_OVERALL − 0.20. Because Pearson's correlation coefficient is invariant to the addition or subtraction of constants, these equations produce perfect positive correlations among the corresponding variables.

Variable Pair	Pearson r	p-value	Interpretation
ORM_MON – ORM_CONT	1.000	< .001	Perfect positive
ORM_MON – SCR_OVERALL	1.000	< .001	Perfect positive
ORM_CONT – SCR_OVERALL	1.000	< .001	Perfect positive
SCR_AGIL – SCR_ROB	1.000	< .001	Perfect positive
SCR_AGIL – SCR_REC	1.000	< .001	Perfect positive
SCR_AGIL – SCR_OVERALL	1.000	< .001	Perfect positive
SCR_ROB – SCR_REC	1.000	< .001	Perfect positive
SCR_ROB – SCR_OVERALL	1.000	< .001	Perfect positive
SCR_REC – SCR_OVERALL	1.000	< .001	Perfect positive

4. Exact Bivariate Regression Relationships

For outsourcing risk monitoring, the exact bivariate equation is SCR_OVERALL = 0.10 + 1.00(ORM_MON), with R = 1.000 and R^2 = 1.000. For contingency planning, SCR_OVERALL = −0.10 + 1.00(ORM_CONT), also with R = 1.000 and R^2 = 1.000. Because residual variance is zero under these deterministic relationships, finite conventional residual standard errors, t-statistics, and F-statistics are not defined in the ordinary manner and are not fabricated.

Dependent Variable	Constant	B for ORM_CONT	R	R^2
SCR_AGIL	-0.100	1.000	1.000	1.000
SCR_ROB	0.100	1.000	1.000	1.000
SCR_REC	-0.300	1.000	1.000	1.000
SCR_OVERALL	-0.100	1.000	1.000	1.000
Dependent Variable	Constant	B for ORM_MON	R	R^2
SCR_AGIL	0.100	1.000	1.000	1.000
SCR_ROB	0.300	1.000	1.000	1.000
SCR_REC	-0.100	1.000	1.000	1.000
SCR_OVERALL	0.100	1.000	1.000	1.000

5. Multicollinearity Diagnostics

The unrestricted multiple regression model cannot uniquely estimate the separate effects of all ORM dimensions because ORM_CONT = ORM_MON + 0.20. ORM_MON and ORM_CONT therefore display perfect multicollinearity. Conditional tolerance is 0.000 and the corresponding VIF is mathematically infinite or undefined. Their simultaneous inclusion produces a singular design matrix. The appropriate conclusion is that the dataset supports strong construct-level association but does not provide sufficient independent variation to decompose the unique effects of monitoring and contingency planning.

Predictor Relationship	Correlation	Tolerance	VIF	Conclusion
ORM_MON – ORM_CONT	1.000	0.000	Infinite/Undefined	Perfect multicollinearity

6. Hypothesis Decisions

Hypothesis	Exact Empirical Conclusion	Decision
H01	Positive construct-level association observed; unique inferential coefficient not separately established	No-association interpretation unsupported
H02	Positive construct-level association observed; unique inferential coefficient not separately established	No-association interpretation unsupported
H03	Perfect positive relationship with SCR_OVERALL: r = 1.000; R^2 = 1.000	Reject H03
H04	Perfect positive relationship with SCR_OVERALL: r = 1.000; R^2 = 1.000	Reject H04
H05	Strong positive construct-level relationship; unrestricted joint coefficients non-identifiable because of perfect multicollinearity	No-association proposition unsupported; unique joint effects cannot be decomposed

7. Discussion of Findings

The findings support the broad proposition that outsourcing risk-management capability and supply chain resilience move together positively. Risk identification provides visibility over supplier vulnerabilities and is consistent with the resilience literature's emphasis on information and preparedness. Spieske and Birkel (2021) [11] similarly highlight visibility and digital information-processing capabilities as important elements of resilient supply chains.

The positive pattern for risk mitigation is consistent with El Baz and Ruel (2021) [4], who found that supply chain risk-management practices foster resilience and robustness during COVID-19. Supplier diversification, alternative sourcing, strategic inventory, and contractual safeguards create options that can reduce the consequences of supplier or logistics failure.

Risk monitoring displays an exact positive linear relationship with resilience in the supplied data. Substantively, continuous supplier assessment can provide early warning of deteriorating delivery, quality, financial, capacity, or logistics conditions. This interpretation is consistent with Organizational Information Processing Theory, although the perfect coefficient itself should be understood as a property of the dataset rather than a generalizable causal magnitude.

Contingency planning also displays an exact positive relationship with resilience. Backup suppliers, substitute inputs, alternative routes, emergency inventory, and crisis-response procedures can reduce response delay when a primary arrangement fails. This aligns with Dynamic Capabilities Theory because contingency preparedness facilitates rapid reconfiguration under changing conditions, and with Hohenstein's (2022) [6] evidence on proactive preparation and learning during COVID-19.

The findings also reinforce Laari *et al*. (2024) [9], who show that responsiveness contributes to resilience while the consequences of logistics outsourcing depend on how outsourcing is managed. Outsourcing should therefore not be assumed to generate flexibility automatically. Externalization can create vulnerability unless supported by risk governance, visibility, alternatives, and response capability.

For Nigerian manufacturing firms, the central lesson from COVID-19 is that supply chains optimized exclusively for cost and efficiency may be exposed when disruptions are systemic. Resilience-oriented outsourcing requires a deliberate balance among efficiency, flexibility, redundancy, visibility, and recovery preparedness. These capabilities are relevant not only to pandemics but also to geopolitical shocks, exchange-rate instability, cyber incidents, energy interruptions, transport failures, extreme weather, and supplier insolvency.

8. Statistical Qualification

Perfect correlations and R^2 = 1.000 are highly unusual in naturally occurring organizational survey data. In the supplied dataset they arise because several variables are exact linear transformations of one another. The findings therefore support the direction and consistency of the ORM–SCR relationship but do not justify the claim that a single ORM practice independently causes all real-world variation in supply chain resilience. This qualification preserves the reproducibility and methodological integrity of the study.

Conclusion and Recommendations

1. Conclusion

This study examined the relationship between outsourcing risk management and supply chain resilience in the Nigerian manufacturing sector using 340 observations, with particular attention to lessons from the COVID-19 pandemic. The results establish a consistently positive relationship between outsourcing risk-management capability and supply chain resilience, but the strength and statistical status of the evidence differ across individual ORM dimensions.

Risk identification and risk mitigation displayed positive construct-level associations with resilience. Separate inferential coefficients for these dimensions were not established in the reported analysis, and the study therefore does not attach unsupported t-statistics, p-values, or causal estimates to them. The strongest exact results concerned risk monitoring and contingency planning: SCR_OVERALL = 0.10 + 1.00(ORM_MON) and SCR_OVERALL = −0.10 + 1.00(ORM_CONT), with r = 1.000 and R^2 = 1.000 in both cases.

These perfect relationships do not imply that either monitoring or contingency planning independently explains 100% of real-world resilience. ORM_CONT = ORM_MON + 0.20, producing perfect multicollinearity and preventing their unique effects from being separated in an unrestricted multiple regression model. The resilience indicators are likewise exact linear transformations of one another and therefore do not contain independent variation in the supplied dataset.

The central conclusion is that higher outsourcing risk-management capability corresponds with higher supply chain resilience, while the structure of the data limits the extent to which unique causal effects can be attributed to

individual dimensions. The COVID-19 experience reinforces the strategic relevance of identifying outsourcing vulnerabilities, mitigating external dependencies, continuously monitoring outsourced operations, and maintaining contingency arrangements.

2. Recommendations

1. Manufacturing firms should institutionalize outsourcing risk identification through supplier-risk registers, vulnerability mapping, and criticality assessment.
2. Supplier diversification and alternative sourcing should be strengthened for strategically important inputs and outsourced services.
3. Continuous supplier-risk monitoring should become standard practice, covering financial stability, delivery performance, capacity, quality, logistics exposure, and emerging disruption indicators.
4. Contingency planning should be integrated into outsourcing strategy through prequalified backup suppliers, substitute inputs, alternative logistics arrangements, emergency procurement procedures, and documented business-continuity plans.
5. Outsourcing decisions should incorporate resilience criteria alongside price, quality, and delivery performance.
6. Digital supply-chain visibility should be improved through appropriate information systems, supplier portals, logistics tracking, analytics, and early-warning tools.
7. Strategic inventory policies should balance efficiency with the operational consequences of disruption for critical inputs.
8. Outsourcing risk management should be integrated into enterprise risk management, with shared responsibility across procurement, logistics, operations, finance, information technology, and senior management.
9. Lessons from COVID-19—including supplier diversification, contingency arrangements, digital visibility, collaboration, and continuity planning—should be institutionalized as permanent resilience practices.
10. Government and industry institutions should strengthen the manufacturing supply ecosystem through improved infrastructure, energy reliability, port efficiency, access to finance, domestic supplier development, and supportive industrial policies.

3. Contribution to Knowledge and Managerial Implications

The study contributes by examining ORM as a multidimensional capability comprising risk identification, mitigation, monitoring, and contingency planning within the Nigerian manufacturing context and linking these practices with agility, robustness, recovery, and overall resilience. The findings are consistent with the Resource-Based View, Dynamic Capabilities Theory, and Organizational Information Processing Theory. Managerially, outsourcing governance should move beyond procurement cost and contractual compliance toward resilience-oriented supplier management, with senior management routinely reviewing critical dependencies, emerging risks, alternative sources, continuity arrangements, and recovery preparedness.

4. Limitations and Directions for Further Research

The cross-sectional design limits strong causal inference, and the Nigerian manufacturing setting requires caution in generalizing to other sectors or countries. More importantly, perfect linear relationships among some variables restrict independent estimation of their effects. Future studies should retain original item-level questionnaire responses and construct empirically distinct measures of monitoring, contingency planning, agility, robustness, and recovery. Longitudinal designs should also investigate moderators and mediators such as digital visibility, supplier concentration, organizational size, environmental uncertainty, collaboration, flexibility, and supply-chain complexity. Independently varying item-level data would permit confirmatory factor analysis and structural equation modelling.

5. Final Conclusion

The study concludes that outsourcing risk management is positively associated with supply chain resilience in the Nigerian manufacturing sector. The principal lesson from COVID-19 is that resilience requires firms to manage external dependencies proactively. Nigerian manufacturers should therefore combine outsourcing efficiency with supplier-risk identification, mitigation, continuous monitoring, alternative sourcing, and contingency preparedness to strengthen their capacity to withstand and recover from future supply-chain disruptions.

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