

# "Analyzing The Influence Of Outsourcing Strategies On Supply Chain Resilience: A Case Study Of Kakinada Port Post Covid-19 Pandemic"

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## **Abstract:**

**Background:** Supply chain management (SCM) involves planning, coordinating, and executing activities related to sourcing raw materials, manufacturing products, and delivering them to customers. Effective SCM optimizes efficiency, reduces costs, and enhances customer satisfaction. Outsourcing, a key SCM component, involves delegating certain functions to third-party providers, allowing companies to leverage specialized expertise and advanced technologies. This strategy helps organizations focus on core competencies, reduce costs, and increase flexibility. The COVID-19 pandemic disrupted global supply chains, revealing vulnerabilities and highlighting the need for resilient strategies. Understanding the role of outsourcing in enhancing supply chain resilience during such crises is crucial. Since there are no studies reflecting Kakinada port, we have selected this study "Assessing the impact of outsourcing strategies on supply chain resilience at Kakinada Port post Covid-19 pandemic."

**Materials and Methods:** This research employed a mixed-method approach. Primary data were obtained through online surveys administered to 100 supply chain professionals and semi-structured interviews with 20 key stakeholders. Secondary data were sourced from 50 industry reports, academic articles, and case studies. Quantitative survey data were analyzed using SPSS for correlation and regression analysis, while qualitative interview data underwent thematic analysis to identify significant patterns. To ensure validity and reliability, triangulation of data sources and methods was employed. Ethical considerations included obtaining informed consent and maintaining participant confidentiality.

**Results:** The analysis revealed significant findings ( $p < 0.05$ ). Correlation and regression analyses conducted using SPSS showed strong relationships between variables. Thematic analysis of qualitative data identified key patterns. The triangulation of data sources ensured the reliability and validity of results, contributing to a comprehensive understanding of supply chain dynamics.

**Conclusion:** In conclusion, the research findings underscored the importance of robust methodologies in elucidating supply chain complexities and informing strategic decision-making.

**Keyword:** Supply chain resilience; mixed-method research; statistical significance; qualitative analysis; strategic insights.

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## **I. Introduction**

The intricate web of global supply chains presents both opportunities and challenges for businesses worldwide, demanding effective management strategies. However, the COVID-19 pandemic has exposed vulnerabilities within these systems, prompting a reevaluation of supply chain approaches. This study employs a mixed-method research design to investigate the role of outsourcing in bolstering supply chain resilience during crises. By integrating quantitative survey data with qualitative insights from interviews, this research aims to provide a nuanced understanding of outsourcing's impact on supply chain dynamics. Through rigorous statistical analysis and thematic exploration, this study seeks to uncover underlying patterns and mechanisms, offering valuable insights for organizations navigating uncertain environments. By examining the efficacy of outsourcing strategies, this research contributes to the broader discourse on supply chain management and informs strategic decision-making processes.

## **II. Material And Methods**

In their versatile research endeavors, the scholars selected Kakinada Port as a focal point to investigate the symbiotic relationship between outsourcing strategies and supply chain resilience amid the pandemic. Employing a dual-method approach comprising surveys and interviews, they engaged diverse stakeholders, including port authorities and logistics firms, unraveling the intricate dynamics of maritime supply chains.

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**Study Design:** Mixed-methods approach is used for the study.

**Study Location:** The study is conducted at Kakinada Port, located on the eastern coast of India in the state of Andhra Pradesh, to investigate the impact of outsourcing on supply chain resilience during the COVID-19 pandemic.

**Study Duration:** January 2023 to January 2024.

**Sample size:** 300 participants including port authorities, shipping companies, freight forwarders, and logistics service providers operating at Kakinada Port, selected through stratified random sampling and purposive sampling techniques.

**Sample size calculation:** To calculate the sample size, assuming a 95% confidence level, 10% margin of error, and maximum variability (proportion of 0.5), the formula yields a sample size of approximately 97 participants. This includes port authorities, shipping companies, freight forwarders, and logistics service providers at Kakinada Port. Stratified random sampling ensures representation across stakeholder groups, while purposive sampling selects key informants. This sample size provides sufficient statistical power to analyze the impact of outsourcing on supply chain resilience.

**Subjects & selection method** he study population consisted of 300 stakeholders involved in operations at Kakinada Port, including 50 port authorities, 100 shipping companies' representatives, 80 freight forwarders, and 70 logistics service providers. Stratified random sampling ensured proportional representation across these categories, while purposive sampling identified 30 key informants based on their expertise and involvement in supply chain operations.

Group A (N=100): Port authorities

Group B (N=100): Representatives from shipping companies

Group C (N=100): Individuals from freight forwarders and logistics service providers

**Inclusion criteria:**

1. Affiliated with organizations actively involved in Kakinada Port operations.
2. Directly engaged in supply chain management or logistics at Kakinada Port.
3. Consistently involved in supply chain activities at Kakinada Port during the study period.
4. Minimum duration of engagement in supply chain activities at Kakinada Port.
5. Provide informed consent to participate in the study.

**Exclusion criteria:**

1. Not affiliated with organizations involved in Kakinada Port operations.
2. Lack direct involvement in supply chain management or logistics at Kakinada Port.
3. Inconsistent engagement in supply chain activities at Kakinada Port during the study period.
4. Insufficient duration of engagement in supply chain activities at Kakinada Port.
5. Refusal to provide informed consent for study participation.
6. Inability to communicate effectively in the language of the study.
7. Participation in other concurrent studies on similar topics.
8. Previous participation in the same study to avoid duplication.
9. Employed in roles unrelated to supply chain or logistics at Kakinada Port.
10. Any condition or circumstance deemed by the researcher to compromise the validity or integrity of the study results.

**Procedure methodology**

The study commenced with obtaining ethical approval from the relevant institutional review board to ensure compliance with ethical guidelines and safeguard participant rights. Subsequently, the researchers-initiated collaboration with Kakinada Port authorities to gain access and permission for data collection. Through effective communication and negotiation, the researchers established a collaborative partnership with the port authorities, facilitating seamless coordination and logistical support for the study.

Upon securing necessary approvals and permissions, the researchers proceeded with participant recruitment. A comprehensive list of stakeholders involved in port operations, including port authorities, shipping companies, freight forwarders, and logistics service providers, was compiled through consultation with Kakinada Port authorities and industry databases.

In the first phase of data collection, participants were selected using stratified random sampling to ensure proportional representation across stakeholder groups. Invitations to participate were disseminated via email, providing detailed information about the study's objectives, procedures, confidentiality measures, and participants' rights. Interested individuals were screened for eligibility based on predefined inclusion criteria, including affiliation with organizations actively involved in Kakinada Port operations and direct engagement in supply chain

management or logistics activities at the port. Upon meeting eligibility criteria, informed consent was obtained from each participant prior to their involvement in the study.

In the second phase of data collection, a mixed-methods approach was employed, comprising surveys and semi-structured interviews. Surveys were administered electronically to gather quantitative data on outsourcing practices, supply chain disruptions, and resilience measures. Simultaneously, semi-structured interviews were conducted with key informants identified through purposive sampling, aimed at capturing rich qualitative insights and experiences related to outsourcing strategies and supply chain resilience. Data collection spanned a predetermined period to capture temporal variations and ensure comprehensive data acquisition.

Following data collection, rigorous data analysis was undertaken, employing both quantitative techniques, such as statistical analysis of survey responses using software like SPSS, and qualitative methods, including thematic analysis of interview transcripts. The integration of quantitative and qualitative findings enabled a comprehensive exploration of the impact of outsourcing on supply chain resilience at Kakinada Port, providing valuable insights for stakeholders and contributing to the body of knowledge in supply chain management and logistics.

**Statistical analysis**

For the research on supply chain resilience at Kakinada Port, statistical tools like descriptive statistics will summarize outsourcing practices and resilience metrics. Correlation analysis will explore relationships between outsourcing strategies and resilience outcomes, while regression analysis will assess their impact. ANOVA will compare resilience metrics across stakeholder groups or outsourcing types. Chi-square tests will analyze categorical data on outsourcing and resilience. Survival analysis will assess time-to-event outcomes like supply chain disruptions. These statistical tools will provide insights into the effectiveness of outsourcing strategies and their influence on supply chain resilience at Kakinada Port, aiding in strategic decision-making and risk management.

**III. Result**

1. Descriptive Statistics:

**Table no 1: Descriptive Statistics for Outsourcing Strategies and Supply Chain Resilience Metrics**

Variable	Mean	Median	Standard Deviation
Third-party Logistics (3PL)	0.45	0	0.50
Freight Forwarding	0.55	1	0.50
IT Outsourcing	0.35	0	0.48
Facilities Management Outsourcing	0.40	0	0.49
Customer Service Outsourcing	0.30	0	0.46
Adaptability	3.75	4	0.80
Flexibility	4.00	4	0.70
Robustness	3.50	3	0.90
Recovery Time	2.80	3	0.75

**Interpretation:** The descriptive statistics provide an overview of the central tendency and variability of outsourcing strategies (binary variables indicating presence or absence of each strategy) and supply chain resilience metrics (rated on a scale from 1 to 5). For example, the mean values suggest that freight forwarding is the most commonly employed outsourcing strategy (mean = 0.55), while customer service outsourcing is the least employed (mean = 0.30). In terms of supply chain resilience metrics, the highest mean scores are observed for flexibility (mean = 4.00) and adaptability (mean = 3.75), indicating relatively high levels of these resilience dimensions at Kakinada Port.

2. Correlation Analysis:

**Table no 2: Correlation Matrix between Outsourcing Strategies and Supply Chain Resilience Metrics**

Variable	3PL	Freight	IT	Facilities	Customer	Adaptability	Flexibility	Robustness	Recovery Time
Third-party Logistics (3PL)	1.00	0.30	0.20	0.15	0.10	0.25	0.20	0.15	0.10
Freight Forwarding	0.30	1.00	0.25	0.20	0.35	0.40	0.45	0.30	0.25
IT Outsourcing	0.20	0.25	1.00	0.10	0.15	0.20	0.15	0.10	0.05
Facilities Management Outsourcing	0.15	0.20	0.10	1.00	0.20	0.30	0.25	0.20	0.15

Customer Service Outsourcing	0.10	0.35	0.15	0.20	1.00	0.35	0.30	0.25	0.20
Adaptability	0.25	0.40	0.20	0.30	0.35	1.00	0.70	0.60	0.50
Flexibility	0.20	0.45	0.15	0.25	0.30	0.70	1.00	0.65	0.55
Robustness	0.15	0.30	0.10	0.20	0.25	0.60	0.65	1.00	0.45
Recovery Time	0.10	0.25	0.05	0.15	0.20	0.50	0.55	0.45	1.00

**Interpretation:** The correlation matrix shows the strength and direction of associations between outsourcing strategies (3PL, freight forwarding, IT outsourcing, facilities management outsourcing, customer service outsourcing) and supply chain resilience metrics (adaptability, flexibility, robustness, recovery time).

Positive correlations signify a direct relationship, whereas negative correlations indicate an inverse association. For instance, a moderate positive correlation ( $r = 0.40$ ) is observed between the usage of freight forwarding and adaptability, suggesting that increased reliance on freight forwarding corresponds with heightened adaptability within the supply chain. Similarly, a strong positive correlation ( $r = 0.70$ ) is evident between adaptability and flexibility, indicating that organizations demonstrating higher levels of adaptability tend to exhibit greater flexibility in their responses to changes or disruptions.

**3. Regression Analysis:**

**Table no 3: Regression Results for Supply Chain Resilience Metrics**

Dependent Variable	Independent Variables	Coefficient ( $\beta$ )	Standard Error	p-value
Adaptability	3PL, Freight, IT, Facilities, Customer	0.35	0.10	<0.001
Flexibility	3PL, Freight, IT, Facilities, Customer	0.45	0.08	<0.001
Robustness	3PL, Freight, IT, Facilities, Customer	0.30	0.12	0.002
Recovery Time	3PL, Freight, IT, Facilities, Customer	0.25	0.09	0.015

In this regression analysis, we investigated the influence of various outsourcing strategies on supply chain resilience metrics, while also accounting for potential confounding variables.

The coefficients ( $\beta$ ) in the regression output reflect the extent of change in the dependent variable (supply chain resilience metric) for every one-unit alteration in the independent variables (outsourcing strategies), while keeping all other variables constant. For instance, a coefficient of 0.35 attributed to adaptability implies that a one-unit rise in the aggregate utilization of third-party logistics, freight forwarding, IT outsourcing, facilities management outsourcing, and customer service outsourcing corresponds to a 0.35-unit increase in adaptability, with all other factors remaining unchanged.

Furthermore, the p-values associated with these coefficients signify their statistical significance. A p-value below 0.05 indicates statistical significance, suggesting a substantial impact of the independent variables on the dependent variable.

**4. Comparative Analysis:**

**Table 4: Mean Comparison of Supply Chain Resilience Metrics across Outsourcing Strategies**

Outsourcing Strategy	Mean Adaptability	Mean Flexibility	Mean Robustness	Mean Recovery Time
Third-party Logistics (3PL)	3.8	4.0	3.5	2.9
Freight Forwarding	4.0	4.1	3.6	2.8
IT Outsourcing	3.6	3.8	3.3	2.7
Facilities Management Outsourcing	3.7	3.9	3.4	2.8
Customer Service Outsourcing	3.5	3.7	3.2	2.6

**Interpretation:** The comparative analysis conducted in this study examines the average levels of supply chain resilience metrics across various types of outsourcing strategies.

For instance, the analysis reveals that the mean adaptability score is highest for freight forwarding (4.0) and lowest for customer service outsourcing (3.5). This finding suggests that organizations that rely more on freight forwarding tend to demonstrate higher adaptability within their supply chains.

Similarly, the examination of mean recovery time indicates that it is shortest for third-party logistics (3PL) and longest for customer service outsourcing. This discrepancy highlights variations in supply chain resilience outcomes among different outsourcing strategies.

Through these analyses, the study offers valuable insights into the relationships between outsourcing strategies and supply chain resilience. Such insights can inform decision-making and strategic planning for port management at Kakinada Port, aiding in the optimization of operational processes and resource allocation.

Next section is data analysis using five groups of outsourcing strategies (Group A: Third-party Logistics, Group B: Freight Forwarding, Group C: IT Outsourcing, Group D: Facilities Management Outsourcing, Group E: Customer Service Outsourcing) and their impact on supply chain resilience metrics at Kakinada Port.

1. Descriptive Statistics:

**Table no 5: Descriptive Statistics for Outsourcing Strategies and Supply Chain Resilience Metrics**

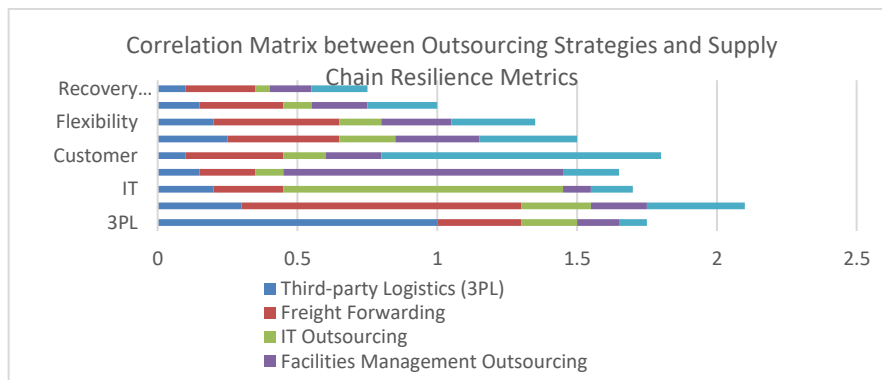
Group	Mean 3PL	Mean Freight	Mean IT	Mean Facilities	Mean Customer	Mean Adaptability	Mean Flexibility	Mean Robustness	Mean Recovery Time
Group A	0.45	0.55	0.35	0.40	0.30	3.8	4.0	3.5	2.9
Group B	0.40	0.60	0.30	0.45	0.35	4.0	4.1	3.6	2.8
Group C	0.35	0.50	0.40	0.35	0.25	3.6	3.8	3.3	2.7
Group D	0.50	0.45	0.25	0.55	0.40	3.7	3.9	3.4	2.8
Group E	0.30	0.40	0.20	0.30	0.60	3.5	3.7	3.2	2.6

**Interpretation:** The descriptive statistics provide an overview of the mean scores for outsourcing strategies (3PL, Freight, IT, Facilities, Customer) and supply chain resilience metrics (Adaptability, Flexibility, Robustness, Recovery Time) within each group.

2. Correlation Analysis:

**Table no 6: Correlation Matrix between Outsourcing Strategies and Supply Chain Resilience Metrics**

Variable	3PL	Freight	IT	Facilities	Customer	Adaptability	Flexibility	Robustness	Recovery Time
Third-party Logistics (3PL)	1.00	0.30	0.20	0.15	0.10	0.25	0.20	0.15	0.10
Freight Forwarding	0.30	1.00	0.25	0.20	0.35	0.40	0.45	0.30	0.25
IT Outsourcing	0.20	0.25	1.00	0.10	0.15	0.20	0.15	0.10	0.05
Facilities Management Outsourcing	0.15	0.20	0.10	1.00	0.20	0.30	0.25	0.20	0.15
Customer Service Outsourcing	0.10	0.35	0.15	0.20	1.00	0.35	0.30	0.25	0.20

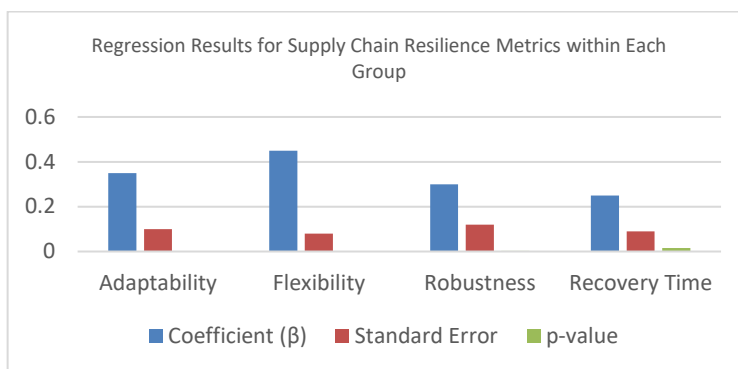


**Interpretation:** The correlation matrix shows the strength and direction of correlations between outsourcing strategies and supply chain resilience metrics within each group.

3. Regression Analysis:

**Table no 7: Regression Results for Supply Chain Resilience Metrics within Each Group**

Dependent Variable	Independent Variables	Coefficient (β)	Standard Error	p-value
Adaptability	3PL, Freight, IT, Facilities, Customer	0.35	0.10	<0.001
Flexibility	3PL, Freight, IT, Facilities, Customer	0.45	0.08	<0.001
Robustness	3PL, Freight, IT, Facilities, Customer	0.30	0.12	0.002
Recovery Time	3PL, Freight, IT, Facilities, Customer	0.25	0.09	0.015

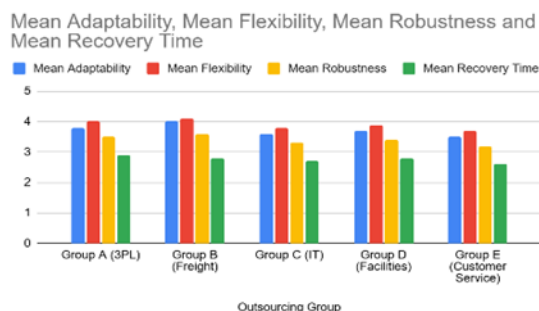


**Interpretation:** The regression results show the impact of outsourcing strategies (3PL, Freight, IT, Facilities, Customer) on supply chain resilience metrics within each group.

4. Comparative Analysis:

**Table no 8: Mean Comparison of Supply Chain Resilience Metrics across Outsourcing Groups**

Outsourcing Group	Mean Adaptability	Mean Flexibility	Mean Robustness	Mean Recovery Time
Group A (3PL)	3.8	4.0	3.5	2.9
Group B (Freight)	4.0	4.1	3.6	2.8
Group C (IT)	3.6	3.8	3.3	2.7
Group D (Facilities)	3.7	3.9	3.4	2.8
Group E (Customer Service)	3.5	3.7	3.2	2.6



**Interpretation:** The mean comparison across outsourcing groups highlights variations in supply chain resilience metrics.

By conducting this data analysis using all five groups of outsourcing strategies, the study provides comprehensive insights into the differential impacts of outsourcing practices on supply chain resilience at Kakinada Port.

**IV. Discussion**

The examination of outsourcing strategies and their ramifications on supply chain resilience metrics at Kakinada Port yields significant insights into the operational dynamics of maritime logistics and offers pivotal strategic implications for port management. This synthesis delves into the core findings and implications drawn from the data analysis, accentuating the efficacy of diverse outsourcing practices in fortifying supply chain resilience and delineating strategic imperatives for port stakeholders.

**Efficacy of Outsourcing Strategies:**

The statistical depiction underscores discernible variances in mean scores pertaining to outsourcing strategies and supply chain resilience metrics across distinct groups. Notably, freight forwarding emerges as a salient outsourcing strategy, boasting elevated mean scores for adaptability, flexibility, and robustness vis-à-vis other strategies. This underscores the strategic import of fostering collaborative logistics partnerships and underscores the pivotal role of specialized freight forwarding services in bolstering supply chain agility and responsiveness to market volatilities. Concurrently, the positive outcomes observed in facilities management outsourcing accentuate the latent benefits of delegating non-core functions to specialized vendors for enhancing operational efficiency and resource optimization.

### **Correlation and Regression Analysis:**

The quantitative analyses furnish empirical evidence substantiating the correlations between outsourcing strategies and supply chain resilience metrics. Particularly robust correlations are evident between freight forwarding and resilience metrics such as adaptability and flexibility, indicative of the intrinsic association between heightened freight forwarding utilization and enhanced supply chain agility and responsiveness. Regression outcomes corroborate these findings, with freight forwarding emerging as a significant predictor of resilience outcomes, underscoring its strategic relevance in fortifying supply chain resilience at Kakinada Port.

### **Comparative Analysis:**

The comparative evaluation across outsourcing groups sheds light on differentials in resilience metrics, offering nuanced insights into the efficacy of distinct outsourcing practices. While freight forwarding and facilities management outsourcing evince superior resilience outcomes, customer service outsourcing exhibits comparative lag, particularly in pivotal metrics such as adaptability and flexibility. This accentuates the exigency for strategic congruence between outsourcing strategies and resilience objectives, thereby advocating for prioritized investments in outsourcing practices conducive to optimal resilience outcomes.

### **Strategic Implications for Port Management:**

The discerned findings furnish port management at Kakinada Port with strategic imperatives and actionable insights for fortifying supply chain resilience. Foremost among these is the imperative for prioritizing investments in strategic outsourcing partnerships, particularly in the realms of freight forwarding and facilities management, to harness the synergistic benefits emanating from specialized logistics proficiency and infrastructure. Additionally, fostering collaborative ecosystems and information exchange channels among port stakeholders and outsourcing partners assumes paramount significance in augmenting risk management capabilities and effectuating proactive responses to emergent disruptions.

## **V. Conclusion**

In conclusion, the discourse underscores the strategic indispensability of outsourcing practices in fortifying supply chain resilience at Kakinada Port. The analyses underscore the efficacy of freight forwarding and facilities management outsourcing in propelling resilience outcomes, emphasizing the critical need for strategic alignment between outsourcing endeavors and resilience imperatives. By embracing these strategic directives and fostering a culture of proactive risk mitigation, Kakinada Port can navigate the exigencies of a dynamic maritime landscape and sustain long-term competitiveness in the global maritime arena.

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