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Analysis and Prediction of Delivery Lead Time and Operational Delays Using Supply Chain Analytics

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Abstract

This study examines the key factors influencing delivery lead time and operational delays in supply chain systems using a data driven approach. In today's competitive business environment, timely delivery has become essential for maintaining customer satisfaction and operational efficiency. The research focuses on important operational factors such as transportation efficiency, inventory availability, supplier performance, warehouse operations and order processing time.

A quantitative research design was used, and primary data was collected through a structured questionnaire from 104 respondents with knowledge of supply chain operations. Secondary data from industry reports and academic studies was also used to support the analysis. Statistical techniques including descriptive analysis, correlation, regression and Random Forest modelling were applied to identify relationships and key predictors of delivery delays.

The results show that transportation efficiency and inventory availability have the strongest impact on delivery lead time. Warehouse operations and order processing have a moderate effect, while supplier performance shows limited influence in this study. The findings also highlight the importance of supply chain analytics in improving decision making and enabling predictive insights.

The study contributes by combining analytical and predictive approaches and provides practical suggestions for improving delivery performance. It emphasizes the need for data driven strategies, better logistics planning and efficient inventory management to reduce delays and improve overall supply chain efficiency.

INTRODUCTION

In the current business environment, supply chain management plays a crucial role in organizational success. Companies are no longer competing only based on product quality or pricing, but also on how efficiently they deliver products to customers. Timely delivery has become a key factor in customer satisfaction and delays can directly affect both customer trust and organizational performance.

One of the most important elements in supply chain operations is delivery lead time, which refers to the total time taken from order placement to final delivery. A shorter and more reliable lead time helps organizations build customer confidence and maintain a competitive advantage. On the other hand, delays in delivery can lead to dissatisfaction, increased operational costs and loss of business opportunities.

Delivery lead time is influenced by multiple interconnected factors within the supply chain. These include transportation efficiency, inventory availability, supplier performance, warehouse operations and order processing time. Even small inefficiencies in any of these areas can result in significant delays. For example, traffic issues, stock shortages, poor coordination or delays in internal processes can disrupt the entire delivery cycle.

With the increasing complexity of supply chain operations, organizations are focusing more on identifying the causes of delays and improving efficiency. In this context, supply chain analytics has become an important tool. It involves the use of data and analytical techniques to understand performance, identify patterns and support

decision-making. By analyzing historical data organizations can identify the reasons behind delays and take corrective actions.

Predictive analytics plays a significant role in modern supply chains. It allows organizations to estimate future delivery timelines and identify possible delays in advance. This helps in better planning, resource allocation and risk reduction. Instead of reacting to problems after they occur, companies can take proactive steps to improve performance.However, many organizations still face challenges in effectively using data for decision making. In some cases, data is available but not properly analyzed, while in others, there is a lack of coordination between different supply chain functions. As a result delays are often managed reactively rather than prevented in advance.

In addition to data analysis, it is also important to consider the practical insights of individuals involved in supply chain operations. Employees and stakeholders often have valuable experience based knowledge that may not be captured through data alone. Combining analytical insights with practical perspectives provides a more complete understanding of delivery delays.

This study focuses on analyzing and predicting delivery lead time and operational delays using supply chain analytics. It aims to identify the key factors influencing delays and examine how analytical techniques can be used to improve performance. By using both primary and secondary data, the study provides a balanced and practical approach.

Overall, this research addresses a real world problem faced by many organizations. Improving delivery performance not only enhances operational efficiency but also strengthens customer satisfaction. The findings of this study can help organizations adopt data driven strategies to reduce delays and improve overall supply chain effectiveness.

RESEARCH PROBLEM

In today's fast moving business environment, organizations are under constant pressure to improve their supply chain performance. Customers expect quick and reliable delivery and even small delays can reduce their satisfaction and trust. Despite this, many organizations still face challenges in maintaining consistent delivery timelines.

One of the major problems in supply chain operations is the variation in delivery lead time. The actual time taken to deliver products often does not match the planned schedule. This creates uncertainty and makes it difficult for organizations to manage inventory, plan resources and meet customer expectations effectively. As a result, delays not only increase operational costs but also affect overall performance.

The issue becomes more complex because delivery lead time is influenced by several interconnected factors. These include transportation efficiency, inventory availability, supplier reliability, warehouse operations and order processing time. A delay in any one of these areas can affect the entire process. Due to this interdependence, it becomes difficult for organizations to identify the exact cause of delays. Another important concern is that many organizations still follow a reactive approach. In most cases, action is taken only after delays occur, instead of identifying and preventing them in advance. This reduces efficiency and increases the chances of repeated delays.

With advancements in technology, supply chain analytics has emerged as an important tool for improving operations. It helps organizations analyze past data,

identify patterns and understand the reasons behind delays. Predictive analytics further supports this by allowing companies to estimate future delivery timelines and take proactive measures. However, the use of such analytical tools is still limited in many practical situations.

In addition, many studies focus mainly on theoretical models or secondary data, without considering real-world inputs from individuals involved in supply chain operations. This creates a gap between theoretical understanding and practical application. Considering these challenges, there is a need for a structured study that identifies the key factors affecting delivery lead time and examines how supply chain analytics can be used to improve performance.

Therefore, the problem addressed in this study is:

"To analyze the key factors affecting delivery lead time and operational delays and to examine how supply chain analytics can be used to predict and improve delivery performance."

REVIEW OF LITERATURE

Ivanov and Dolgui (2020) : This study explains how disruptions like transportation delays and supply shortages increase delivery lead time. It highlights that predictive models help organizations prepare for such disruptions and improve performance.

Ivanov (2020) : The research shows that global events such as pandemics cause major delays in supply chains. It suggests that simulation models can help organizations predict and manage such disruptions.

Queiroz et al. (2022) : This study found that organizations using digital technologies and analytics can better manage uncertainty and maintain delivery performance.

Dubey et al. (2021) : The study highlights that strong data analytics capabilities help organizations identify risks and reduce operational delays.

Gunasekaran et al. (2017) : This research shows that big data analytics improves forecasting and decision making, helping organizations reduce inefficiencies in supply chains.

Wamba et al. (2020) : The study explains that analytics improves visibility and supports real-time decision making, which helps in reducing delays.

Hofmann and Rüsch (2017) : This research focuses on Industry 4.0 technologies and shows that automation and data integration improve logistics efficiency.

Kamble et al. (2020) : The study highlights that digital systems improve coordination, transparency and overall supply chain efficiency.

Alnahhal et al. (2021) : This study shows that machine learning models can predict delivery lead time accurately using historical data.

Johnson et al. (2021) : The research explains that operational efficiency and coordination directly affect delivery performance.

Raj et al. (2024) : This study identifies transportation issues such as traffic and route inefficiencies as major causes of delivery delays.

Lorenzo-Espejo et al. (2024) : The study highlights that poor coordination between different supply chain stages leads to delays.

Guerrazzi et al. (2024) : This research shows that warehouse operations

like picking and dispatch significantly impact delivery performance.

Jebbor et al. (2024) : The study explains that machine learning helps in identifying risks and improving decision-making in supply chains.

Khedr and Rani (2024) : This research highlights the role of artificial intelligence in improving forecasting and operational efficiency.

Huo et al. (2021) : The study shows that better communication and information sharing improve flexibility and reduce delays.

Schroeder and Lodemann (2021) : This research explains that machine learning improves risk prediction and helps in proactive decision making.

Stamelou et al. (2024) : The study concludes that delivery delays are caused by multiple interconnected factors like transportation, inventory and warehouse efficiency.

Gabellini et al. (2024) : This research shows that deep learning models can accurately predict delivery delays and improve planning.

Leung (2025) : The study highlights that proper coordination across supply chain functions is essential for timely delivery.

The overall literature indicates that delivery delays are influenced by multiple factors and that analytics and technology play a major role in improving supply chain performance.

IDENTIFICATION OF RESEARCH GAPS

- Limited focus on delivery lead time as a key variable : Most existing studies look at overall supply chain performance, resilience or digital transformation. However, delivery lead time is often treated as a secondary outcome rather than the main focus. Since delivery time directly affects customer satisfaction and operational efficiency, it needs more detailed and focused analysis.
- Lack of integration between analysis and prediction : Many studies either focus on identifying factors that cause delays or on building predictive models separately. Very few studies combine both approaches in a structured way. Because of this, there is limited understanding of how analytics can be used both to explain delays and to predict them in real situations.
- Limited use of primary data : A large number of studies depend mainly on secondary data, simulations or theoretical models. While useful, these may not fully reflect real world challenges. The absence of practical inputs from people working in supply chain operations reduces the real applicability of findings.
- Less attention to operational level factors : Several studies focus on broader concepts like digital transformation and supply chain resilience. However, specific operational factors such as transportation, inventory management, warehouse efficiency and order processing are not always studied in detail. These factors have a direct impact on delivery performance and need deeper analysis.
- Gap in practical applicability : Many research studies provide strong theoretical models but do not clearly explain how organizations can apply these ideas in practice. This creates a gap between academic research and real-world implementation.
- Focus of the present study : To address these gaps, the present study gives importance to delivery lead time as a central variable. It combines analytical

techniques with real-world data to provide both practical insights and theoretical understanding. This approach helps in better analyzing and predicting delivery delays.

RESEARCH OBJECTIVES

The main objectives of this study are as follows:

1. To identify the key factors affecting delivery lead time, including transportation efficiency, inventory availability, supplier performance, warehouse operations and order processing time.
2. To analyze the relationship between operational factors and delivery delays in order to understand which factors have the strongest impact.
3. To evaluate the role of supply chain analytics in improving operational efficiency and decision making.
4. To develop a predictive understanding of delivery lead time using analytical techniques.
5. To provide practical recommendations that can help organizations reduce delays and improve supply chain performance.

RESEARCH HYPOTHESES

Hypothesis 1: Relationship between Operational Factors and Delivery Lead Time

Null Hypothesis (H0):

There is no significant relationship between operational factors (transportation, inventory, supplier performance, warehouse operations and order processing) and delivery lead time.

Alternative Hypothesis (H1):

There is a significant relationship between operational factors and delivery lead time.

Hypothesis 2: Impact of Supply Chain Analytics on Delivery Performance

Null Hypothesis (H0):

Supply chain analytics does not have a significant impact on predicting and improving delivery lead time and operational delays.

Alternative Hypothesis (H1):

Supply chain analytics has a significant impact on predicting and improving delivery lead time and operational delays.

SCOPE OF THE STUDY

This study focuses on analyzing and predicting delivery lead time and operational delays in supply chain management. In today's competitive environment, timely delivery is important for customer satisfaction and business performance. The study examines how different operational factors influence delivery timelines and how analytics can be used to improve efficiency.

The scope is limited to key operational factors such as transportation efficiency, inventory availability, supplier performance, warehouse operations and order processing time. These factors are selected because they directly affect the movement of goods and overall delivery performance.

Both primary and secondary data are used in this study. Primary data is collected through a structured questionnaire from individuals with knowledge of supply chain operations, including employees and students. This helps in capturing practical insights and real world challenges. Secondary data is collected from reliable sources such as industry reports and research papers to support the analysis. The study also focuses on the use of supply chain analytics to understand and predict delivery

performance. Simple and practical analytical techniques are used so that the findings can be easily applied in real-world situations.

The study is not limited to a specific region, as responses are collected from a wider group. However, due to time and data limitations, the sample size is restricted. Despite this, the study provides meaningful insights into delivery delays and supply chain efficiency.

RESEARCH DESIGN

The study follows a descriptive and analytical research design. The descriptive approach helps in identifying and explaining the key factors affecting delivery lead time. The analytical approach is used to examine the relationship between these factors and delivery performance.

A quantitative research approach is adopted, as the study involves the collection and analysis of numerical data. Primary data is collected through a structured questionnaire using a Likert scale, which allows responses to be measured and analyzed statistically.

Secondary data from research articles and reports is also used to support the study and provide a broader understanding of supply chain practices.

The study uses a cross-sectional design, where data is collected at a single point in time. This approach is suitable for analyzing current trends and relationships within limited time.

Overall, the research design ensures that the study is systematic, reliable and aligned with the research objectives.

DATA COLLECTION METHODS

Primary Data Collection : The primary data for this study has been collected through a structured questionnaire. The questionnaire is designed to gather responses from individuals who have knowledge or experience in supply chain operations, such as employees, interns and professionals working in logistics and related fields. This approach helps in capturing practical insights and real-world experiences related to delivery delays.

The questionnaire consists of statements related to key operational factors affecting delivery lead time. A Likert scale and open ended questions are used to measure responses, where participants indicate their level of agreement or disagreement. This method allows the data to be quantified and analyzed statistically. A total of 104 responses were collected for the study. This sample size provides a sufficient base for analysis and helps in identifying meaningful patterns and relationships between variables. The responses were collected through online distribution, ensuring convenience and wider reach.

The use of a questionnaire ensures uniformity in data collection, as all respondents are asked the same set of questions. It also enables efficient data collection within a limited time. The responses collected help in understanding how different operational factors contribute to delivery delays.

Secondary Data Collection: In addition to primary data, the study also uses **secondary data sources** to support the research. Secondary data has been collected from reliable and authentic sources such as:

- **Statista** - for industry trends, logistics performance data and global supply chain insights
- **World Bank Logistics Performance Index (LPI)** - for benchmarking logistics efficiency and delivery performance across countries

- **Government of India – Ministry of Commerce & Industry** - for reports related to logistics and supply chain development in India
- **NITI Aayog** - for policy insights and infrastructure-related data affecting supply chains
- **ResearchGate** and **Google Scholar** - for accessing academic research papers and previous studies

These sources provide relevant background information, existing research findings and industry-level insights related to supply chain analytics and delivery performance. The use of multiple sources ensures that the data is reliable and up-to-date

VARIABLES OF THE STUDY

The study includes both independent and dependent variables.

Independent Variables:

- Transportation Efficiency - reflects the reliability of transportation systems
- Inventory Availability - represents stock availability at the required time
- Supplier Performance - indicates the consistency of suppliers
- Warehouse Operations - refers to efficiency in storage and dispatch
- Order Processing Time - includes time taken to process and confirm orders

Dependent Variable:

- Delivery Lead Time - represents the total time from order placement to final delivery

These variables are selected because they directly influence delivery performance. The relationship between independent and dependent variables helps in identifying the main causes of delays.

DATA ANALYSIS TECHNIQUES

The study uses simple and effective analytical techniques to examine the data:

- Descriptive analysis to understand overall response patterns
- Correlation analysis to identify relationships between variables
- Linear regression to measure the impact of operational factors
- Random Forest model to identify the importance of variables
- Data visualization techniques to improve interpretation

These techniques help in providing clear and practical insights into delivery delays and supply chain performance.

DATA ANALYSIS

Data Analysis Techniques

The study uses statistical and analytical techniques to examine delivery lead time and operational delays. Since the data collected is quantitative, appropriate methods are applied to ensure accurate results.

The analysis includes descriptive statistics to understand response patterns, correlation analysis to examine relationships between variables and regression analysis to measure the impact of operational factors on delivery delay. In addition, a Random Forest model is used to identify the importance of variables. Data visualization tools such as charts and graphs are also used to improve clarity and interpretation.

Hypothesis 1: Relationship Between Operational Factors and Delivery Lead Time

The first hypothesis examines whether operational factors influence delivery lead time.

H0: There is no significant relationship between operational factors and delivery lead time.

H1: There is a significant relationship between operational factors and delivery lead time.

Correlation Analysis

Correlation analysis is used to understand the relationship between operational factors and delivery delay. The results show that most variables have a positive relationship with delivery delay.

- Inventory (r = 0.22) shows the strongest relationship
- Transportation (r = 0.18) also has a significant impact
- Warehouse operations (r = 0.16) show moderate influence
- Order processing (r = 0.05) has a weak relationship
- Supplier performance (r = 0.00) shows almost no relationship

These results indicate that delivery delay is influenced by multiple factors, with inventory and transportation playing a more important role.

Regression Analysis

Regression analysis is used to measure the impact of each factor on delivery delay.

- Transportation (B = 0.27) has the highest impact
- Inventory (B = 0.21) is the second most important factor
- Order processing (B = 0.11) has moderate influence
- Warehouse operations (B = 0.09) show a smaller effect
- Supplier performance (B = -0.02) has minimal impact

These results suggest that internal operational factors, especially transportation and inventory, are the main causes of delivery delays.

Conclusion of Hypothesis 1

Based on the results, the null hypothesis is rejected. There is a significant relationship between operational factors and delivery lead time.

Hypothesis 2: Impact of Analytics on Delivery Performance

This hypothesis examines whether supply chain analytics improves delivery performance.

H0: Supply chain analytics does not have a significant impact on predicting and improving delivery performance.
H1: Supply chain analytics has a significant impact on predicting and improving delivery performance.

Descriptive Results

The mean values show strong agreement among respondents:

- Predictive analytics (4.69)
- Analytics usage (4.67)
- Data analysis helps identify delays (4.50)

This indicates that respondents strongly believe analytics improves delivery planning and performance.

Interpretation : The results show that analytics helps organizations:

- Identify causes of delays
- Improve planning
- Reduce uncertainty
- Support better decision-making
- Enable proactive management

These findings highlight the importance of data-driven approaches in supply chain operations.

Conclusion of Hypothesis 2 : The null hypothesis is rejected. Supply chain analytics has a significant impact on improving delivery performance.

Demographic Profile of Respondents

Interpretation:

The majority of respondents belong to the 20 - 29 age group, showing that the sample is mainly composed of young individuals. These respondents are likely to be students or early career professionals who are familiar with modern technologies and current supply chain practices.

Gender Distribution of Respondents

Interpretation:

The data shows a fairly balanced gender distribution, with a slightly higher percentage of female respondents compared to male respondents.

Occupation Distribution of Respondents

Interpretation:

Most respondents are working professionals, followed by students. This indicates that the data includes both practical industry experience and theoretical knowledge.

Frequency of Delivery or Logistics-Related Issues faces by Respondants

Interpretation:

A large percentage of respondents reported that delivery issues occur often. This clearly shows that delays are not rare but are a regular problem in supply chain operations.

Transportation-Related Issues

Interpretation:

Most respondents agree that transportation problems significantly increase delivery delays. Issues such as traffic congestion, poor route planning and delays in transit directly affect delivery timelines.

Inventory Availability

Interpretation:

The majority of respondents believe that lack of inventory leads to delivery delays. This indicates that poor stock management or unavailability of products can slow down order fulfillment. Effective inventory planning is therefore essential for timely delivery.

Supplier Delays

Interpretation:

Most respondents agree that supplier delays affect delivery performance, but the impact is not as strong as internal operational factors. This suggests that supplier-related issues exist but may be managed to some extent by organizations.

Warehouse Inefficiencies

Interpretation:

A high number of respondents agree that inefficiencies in warehouse operations cause delays. Activities such as picking, packing and dispatch play a key role in delivery performance. Improving warehouse processes can help reduce delays.

Order Processing Delays

Interpretation:

The results show that delays in order processing also affect delivery timelines. Although the impact is moderate, inefficient administrative processes can slow down the entire supply chain.

Delivery Lead Time is Often Longer Than Expected

Interpretation:

The results show that delays in order processing also affect delivery timelines. Although the impact is moderate, inefficient administrative processes can slow down the entire supply chain.

Operational Delays Negatively Affect Customer Satisfaction

Interpretation:

The majority of respondents strongly agree that delivery delays negatively affect customer satisfaction. This shows that timely delivery is critical for maintaining customer trust and loyalty.

Delivery Performance is Often Inconsistent

Interpretation:

The results indicate that delivery performance is not consistent and varies across situations. This suggests a lack of standardized processes and proper coordination in supply chain operations.

Data Analysis Helps Identify Causes of Delivery Delays

Interpretation:

Most respondents agree that data analysis helps in identifying the causes of delivery delays. This shows the importance of using data driven approaches for understanding operational issues.

Organizations Should Use Analytics to Reduce Operational Delays

Interpretation:

The majority strongly believe that organizations should use analytics to reduce delays. This reflects a growing awareness of the importance of data-driven decision-making in supply chain management.

Predictive Analytics Improves Delivery Planning

Interpretation:

All respondents agree that predictive analytics improves delivery planning. This indicates that forecasting techniques can help organizations anticipate delays and take proactive measures.

Linear Regression Model

The models were developed by considering delivery delay as the dependent variable (Y) and operational factors such as transportation, inventory, supplier performance, warehouse efficiency and order processing as independent variables (X).

The Linear Regression results show that transportation has the highest impact on delivery delay, followed by inventory, while order processing and warehouse have moderate influence. Supplier performance shows almost no effect. This means delays are mainly caused by internal operational issues, especially transportation inefficiencies and stock availability. Inventory management also plays an important role in ensuring timely delivery. Although the model gives useful insights, its low accuracy suggests that other external factors also affect delivery performance. Overall, transportation and inventory are the key areas to focus on for reducing delays.

The Random Forest results show that warehouse operations have the highest importance, followed by inventory and order processing, while transportation has a slightly lower impact and supplier remains least important. This indicates that internal processes like picking, packing and coordination play a major role in delivery performance. Inventory management continues to be a critical factor across both models. The model also shows that delays

are caused by multiple interconnected factors rather than a single issue. Compared to Linear Regression, Random Forest gives deeper insights into complex relationships. Overall, improving internal efficiency is key to reducing delivery delays.

FINDINGS

Key Findings of the Study

The findings of this study are based on both primary data (survey and models) and secondary data (reports and research studies). The results provide a clear understanding of delivery delays and supply chain performance.

1. **Delivery issues are frequent** The study shows that delivery related problems occur regularly rather than occasionally. Most respondents indicated that they face delivery issues often, which suggests that delays are a common operational challenge.
2. **Delivery lead time often exceeds expectations** The actual delivery time is usually longer than planned. This indicates a gap between expected and actual performance, which affects customer satisfaction and operational efficiency.
3. **Transportation is a major factor** Transportation is identified as one of the most important causes of delays. Issues such as traffic, poor route planning and delays in transit significantly increase delivery lead time.
4. **Inventory management plays a key role**
   Inventory availability strongly affects delivery performance. Stock shortages or poor planning lead to delays in order fulfillment.
5. **Warehouse efficiency impacts delivery performance**The Random Forest model shows that warehouse operations are a major factor. Delays in picking, packing and dispatch reduce overall efficiency.
6. **Order processing has moderate impact** Delays in order confirmation and processing affect delivery timelines, although the impact is lower compared to transportation and inventory.
7. **Supplier performance has limited impact** Supplier related issues do not significantly affect delivery delays in this study, indicating that internal operations play a bigger role.
8. **Delivery delays reduce customer satisfaction** There is a strong agreement that delays negatively affect customer trust and experience.
9. **Delivery performance is inconsistent** Delivery outcomes are not stable and vary across situations, indicating a lack of standard processes.
10. **Analytics improves delivery performance** Respondents strongly believe that analytics helps identify delays, improve planning and support better decision-making.
11. **Delivery delay is a multi-factor problem** Delays are not caused by a single factor but by a combination of operational issues.
12. **Predictive models provide useful insights** Regression and Random Forest models help identify key factors, but delivery delay is also influenced by external conditions.

RECOMMENDATIONS

Based on the findings, the following recommendations are suggested:

- **Improve transportation planning** Organizations should use route optimization tools and real-time tracking systems to reduce delays caused by traffic and inefficient routing.
- **Adopt better inventory management systems** Using automated systems like ERP and demand forecasting can help maintain proper stock levels and reduce delays.
- **Enhance warehouse efficiency** Automation tools such as Warehouse Management Systems (WMS) can improve picking, packing and dispatch processes.
- **Streamline order processing** Reducing manual work and using digital systems can speed up order confirmation and processing.
- **Improve coordination across departments** Better communication between transportation, inventory and warehouse teams can reduce inefficiencies.
- **Use data analytics for decision making** Organizations should adopt analytics tools to monitor performance and identify bottlenecks.
- **Apply predictive analytics for planning** Forecasting demand and delivery timelines can help reduce uncertainty and improve efficiency.
- **Improve customer communication** Providing real-time updates and tracking can improve customer satisfaction even if delays occur.
- **Standardize processes** Implementing standard operating procedures (SOPs) can improve consistency in delivery performance.
- **Monitor performance regularly** Using key performance indicators (KPIs) helps in identifying problems and improving efficiency.
- **Train employees** Skilled employees can handle operations better and reduce errors.
- **Adopt a data-driven approach** Organizations should move towards analytics based decision making for long term improvement.

CONCLUSION

This study highlights the key factors affecting delivery lead time and operational delays in supply chain systems. The findings show that transportation, inventory management and warehouse efficiency are the most important factors influencing delivery performance.

The study also emphasizes the importance of supply chain analytics in improving decision-making and reducing delays. By using data-driven approaches, organizations can move from reactive to proactive management and improve overall efficiency.

Although the study is limited by sample size and time constraints, it provides useful insights into supply chain operations. Future research can include additional variables and larger datasets to improve predictive accuracy.

Overall, the study suggests that improving operational efficiency and adopting analytics can help organizations achieve better delivery performance and higher customer satisfaction.

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Figure 1: Correlation Matrix of Operational Factors and Delivery Delay

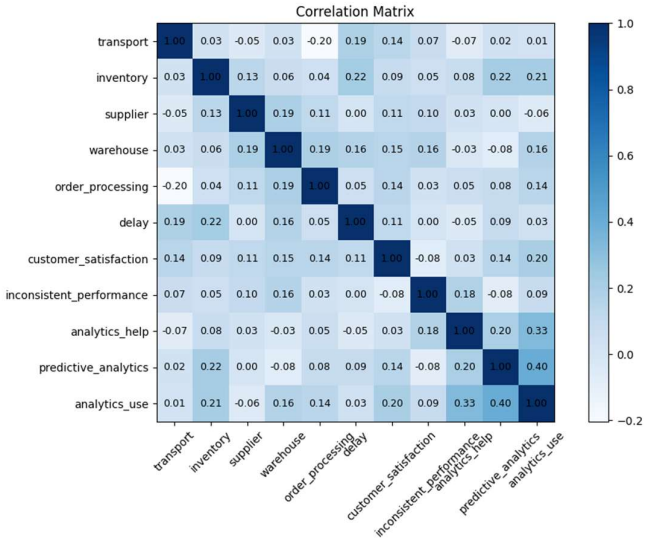
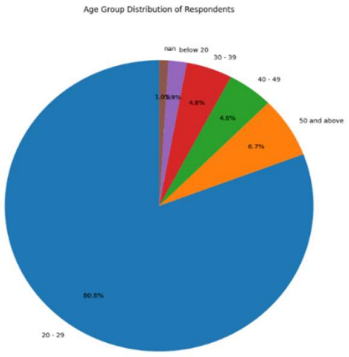
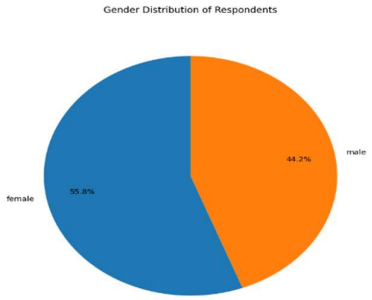


Figure 2: Regression Coefficients of Operational Factors

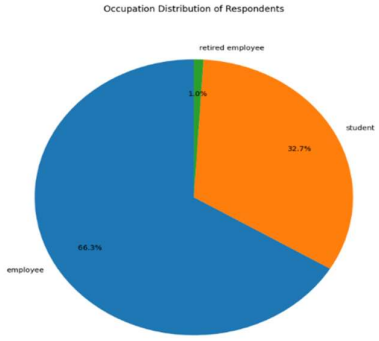
Demographic Profile of Respondents



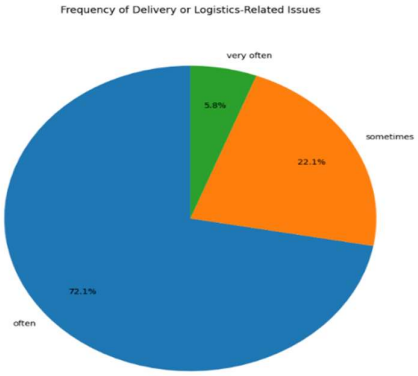
Gender Distribution of Respondents



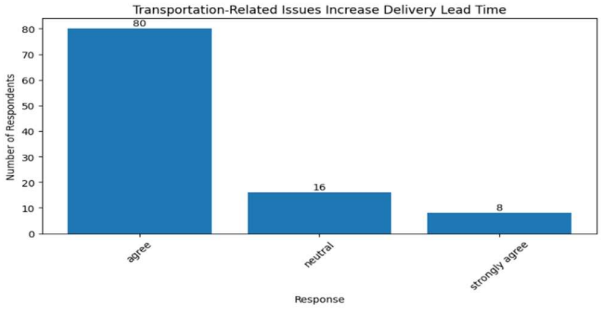
Occupation Distribution of Respondents



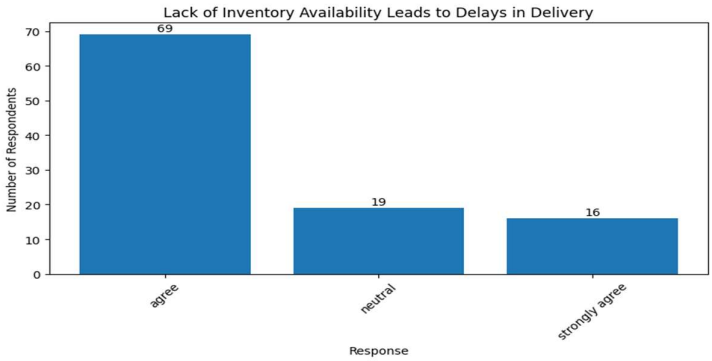
Frequency of Delivery or Logistics-Related Issues faces by Respondants



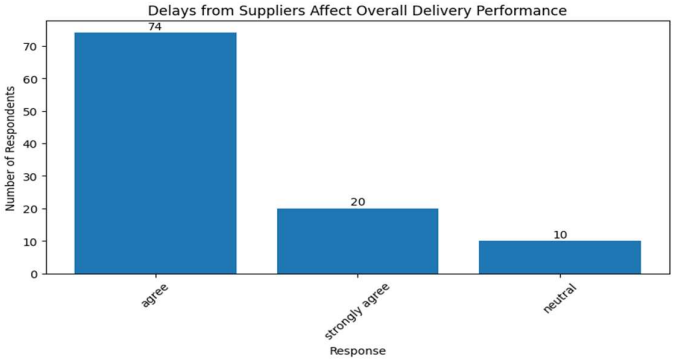
Transportation-Related Issues



Inventory Availability

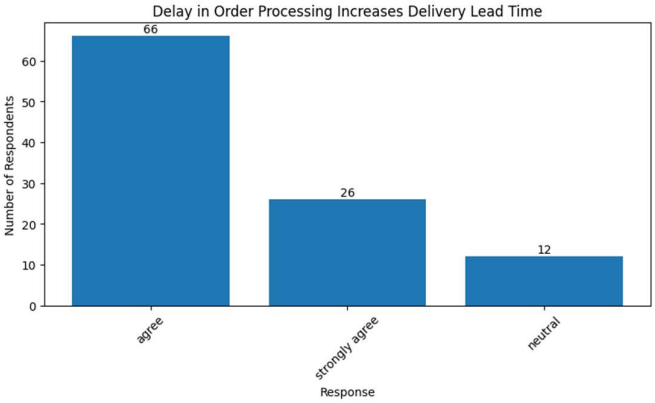


Supplier Delays

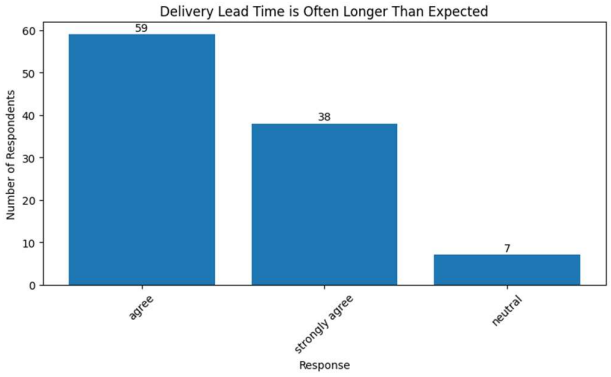


Warehouse Inefficiencies

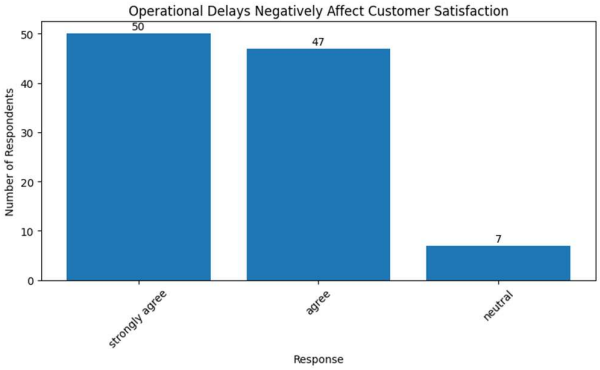
Order Processing Delays



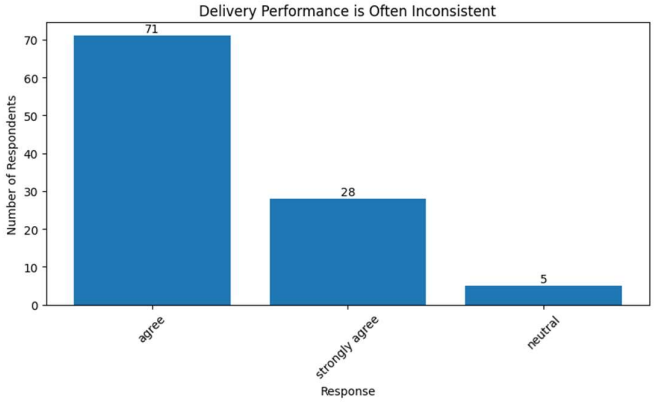
Delivery Lead Time is Often Longer Than Expected



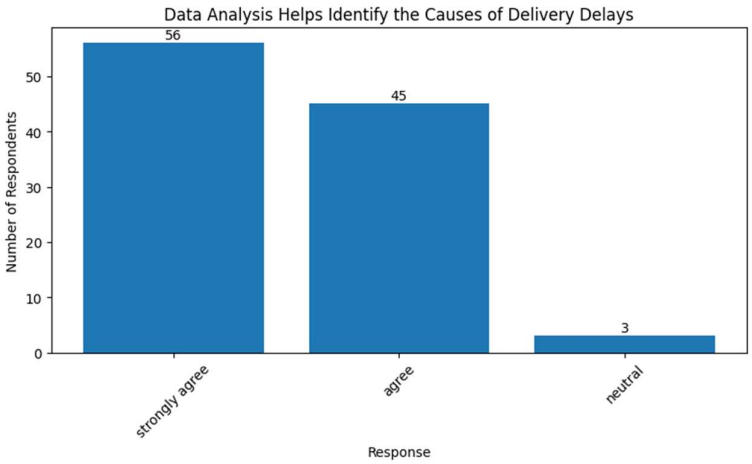
Operational Delays Negatively Affect Customer Satisfaction



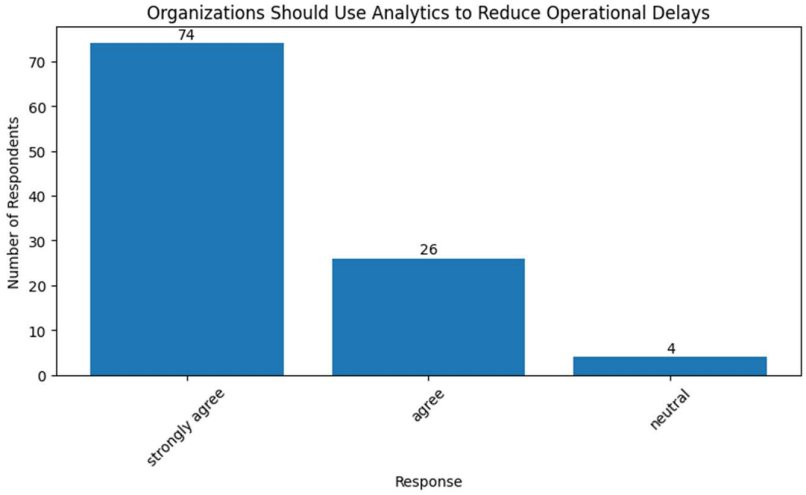
Delivery Performance is Often Inconsistent



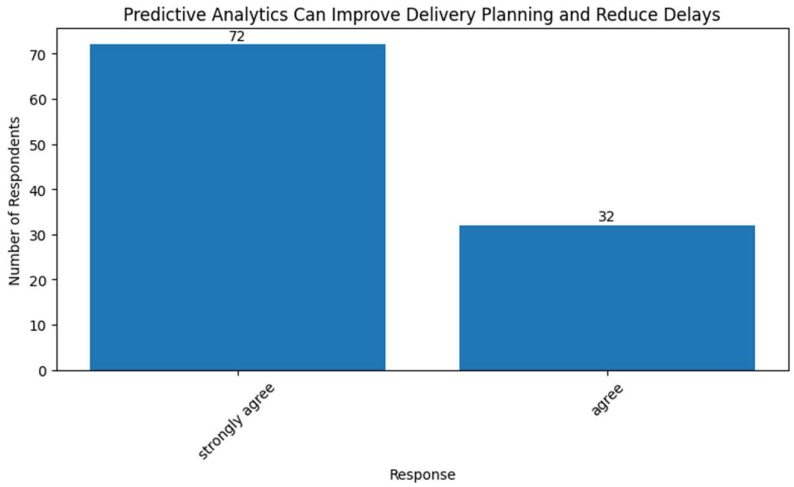
Data Analysis Helps Identify Causes of Delivery Delays



Organizations Should Use Analytics to Reduce Operational Delays



Predictive Analytics Improves Delivery Planning



Linear Regression Model

Variable	Coefficient
Transportation	0.275
Inventory	0.209
Order Processing	0.113
Warehouse	0.094
Supplier	-0.029

Random Forest Model

Variable	Importance
Warehouse	0.265
Inventory	0.232
Order Processing	0.178
Transportation	0.172
Supplier	0.152