

Challenges in Last-Mile Delivery and the Role of Communication and Information Sharing in Enhancing Customer Satisfaction: A Study among E-commerce Logistics Service Providers in Palakkad District

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Abstract

The rapid growth of e-commerce has significantly transformed logistics operations, particularly in last-mile delivery services. This study examines the challenges faced in last-mile delivery in Palakkad City and analyzes how communication and information-sharing practices influence customer satisfaction among logistics service providers in Palakkad District. The research identifies key operational barriers such as traffic congestion, address identification issues, delivery delays, and shortage of delivery personnel. Additionally, the study explores the importance of real-time communication, tracking systems, and coordination between logistics providers and customers. The findings reveal that effective information sharing and transparent communication significantly enhance customer satisfaction despite operational challenges. The study concludes that integrating digital communication tools with improved delivery management practices is essential for strengthening last-mile efficiency in Palakkad.

Keywords: Last-Mile Delivery, E-Commerce Logistics, Communication Practices, Information Sharing, Customer Satisfaction, Palakkad District

Introduction

E-commerce has emerged as one of the fastest-growing sectors in India over the past decade, driven by increasing internet penetration, smartphone usage, digital payment systems, and changing consumer behavior. The growth of major online marketplaces and retail

platforms has transformed traditional shopping patterns, making doorstep delivery an essential component of customer service. As online purchasing continues to expand across urban and semi-urban regions, the demand for efficient, reliable, and fast logistics systems has increased significantly.

In the e-commerce supply chain, logistics plays a crucial role in ensuring that products move seamlessly from sellers to customers. Among all stages of the supply chain, last-mile delivery is considered the most critical and complex segment. Last-mile delivery refers to the final stage of transportation, where goods are delivered from a distribution center or local warehouse to the end customer. Although it represents the shortest geographical distance in the supply chain, it often accounts for the highest operational cost and the greatest level of uncertainty. Factors such as traffic congestion, incorrect addresses, customer unavailability, weather conditions, and infrastructure limitations make last-mile delivery highly challenging.

In Palakkad, the rapid expansion of online shopping has significantly increased the volume of daily parcel deliveries. The district's mix of urban, semi-urban, and rural areas presents unique logistical complexities. While urban zones experience traffic congestion and parking constraints, rural areas face issues such as poor road connectivity and address identification difficulties. As a result, logistics service providers in Palakkad are under continuous pressure to maintain delivery speed, accuracy, and service quality.

At the same time, customer expectations have evolved dramatically. Modern consumers expect real-time tracking, accurate delivery timelines, proactive communication, and quick resolution of complaints. In this context, communication and information-sharing practices have become as important as physical delivery performance. Effective coordination between warehouses, delivery personnel, and customers can significantly reduce failed deliveries, misunderstandings, and dissatisfaction.

Poor communication often leads to missed deliveries, repeated attempts, increased operational costs, and negative customer experiences. On the other hand, transparent information sharing—through SMS alerts, mobile applications, GPS tracking, and customer support systems—can improve trust, satisfaction, and overall service perception, even when operational delays occur.

Therefore, this study integrates two closely related dimensions of e-commerce logistics:

1. The operational challenges faced in last-mile delivery within Palakkad City.
2. The communication and information-sharing practices adopted by logistics service providers and their influence on customer satisfaction in Palakkad District.

By examining both operational and communication aspects together, the study aims to provide a comprehensive understanding of how logistics efficiency and information transparency collectively shape customer satisfaction in e-commerce operations. The findings of this research are expected to help logistics service providers develop better strategies for improving last-mile delivery performance and strengthening customer relationships in the region.

Review of Literature

The growth of e-commerce has significantly increased academic interest in last-mile delivery systems, logistics efficiency, communication practices, and customer satisfaction. This section reviews major studies related to last-mile challenges and the role of communication and information sharing in improving logistics performance.

Last-Mile Delivery in E-commerce

Last-mile delivery is widely recognized as the most complex and costly segment of the supply chain. According to Christopher Martin (2016), customer satisfaction in modern supply chains

depends largely on responsiveness, reliability, and flexibility. He emphasized that even if upstream supply chain activities are efficient, failure in the final delivery stage can negatively impact the entire service experience.

Similarly, Bowersox Donald J., Closs, and Cooper (2019) explained that last-mile delivery accounts for a significant proportion of total logistics costs due to fragmented delivery points, small shipment sizes, and time-sensitive customer demands. Their work highlights that urban congestion and unpredictable delivery conditions increase operational risk and service variability.

Mangiaracina et al. (2015) conducted a study on e-commerce distribution models and found that last-mile inefficiencies arise mainly from traffic congestion, limited parking facilities, and high delivery density in urban areas. They suggested solutions such as micro-distribution centers, alternative delivery points, and route optimization technologies to improve performance.

In the Indian context, Sharma and Gupta (2021) observed that last-mile delivery challenges are intensified in Tier-II and Tier-III cities due to infrastructure limitations, informal addressing systems, and workforce shortages. Their findings are particularly relevant for districts like Palakkad, where semi-urban and rural areas create additional delivery complexities.

Infrastructure and Operational Constraints

Infrastructure plays a vital role in determining logistics performance. Rushton, Croucher, and Baker (2017) emphasized that road quality, warehouse availability, and transport connectivity directly influence delivery speed and reliability. Poor infrastructure increases fuel consumption, vehicle wear and tear, and delivery time variability.

In cold chain logistics, Aung and Chang (2014) found that inadequate storage facilities and temperature control failures lead to product spoilage and financial losses. Although their study focused on perishable goods, the implications extend to overall logistics efficiency, as infrastructure inadequacies affect both quality control and customer satisfaction.

Furthermore, the World Bank's Logistics Performance studies indicate that developing regions often face structural challenges such as limited distribution hubs and inconsistent power supply, which directly affect supply chain performance.

Role of Technology in Logistics Performance

Technology adoption has transformed logistics operations in recent years. Srinivasan and Swink (2018) examined the relationship between supply chain visibility and performance, concluding that real-time data sharing enhances operational flexibility and decision-making accuracy.

Tiwari, Wee, and Daryanto (2018) highlighted that big data analytics and digital integration improve forecasting, route planning, and inventory management. Their research suggests that technology reduces uncertainty in last-mile operations and improves service reliability.

Similarly, Tsang, Wu, and Lim (2018) discussed how digital platforms and smart contracts enhance transparency and coordination within supply chains. GPS tracking systems, warehouse management software, and automated communication tools are now considered essential components of efficient logistics networks.

In the Indian e-commerce ecosystem, digital platforms provide customers with live tracking updates, estimated delivery times, and automated notifications, which significantly influence customer satisfaction levels.

Communication and Information Sharing Practices

Effective communication is increasingly recognized as a key determinant of logistics service quality. According to Coyle et al. (2017), customer satisfaction depends not only on timely delivery but also on clear and proactive communication throughout the order cycle.

Information sharing between logistics providers and customers reduces uncertainty and builds trust. When customers receive timely updates regarding dispatch, delays, or rescheduling options, their perception of service quality improves even if minor delays occur.

Min and Zhou (2002) argued that collaborative information sharing among supply chain partners enhances coordination and reduces operational inefficiencies. Internal communication between warehouse managers, delivery agents, and customer support teams is equally important to ensure smooth execution.

Recent studies suggest that communication failures are a major cause of customer complaints in e-commerce logistics. Incomplete address verification, lack of prior notification, and delayed response to queries often result in repeated delivery attempts and dissatisfaction.

Customer Satisfaction in Logistics Services

Customer satisfaction in logistics is influenced by multiple factors including delivery speed, accuracy, reliability, responsiveness, and communication transparency. Grant, Trautrim, and Wong (2017) stated that service quality dimensions such as assurance, responsiveness, and empathy significantly impact customer loyalty.

Research indicates that customers are more tolerant of delays when they are informed in advance. Transparency reduces frustration and improves perceived reliability. Therefore, communication efficiency acts as a moderating factor between operational challenges and customer satisfaction.

In rapidly growing districts like Palakkad, where logistics systems are still evolving, effective information sharing can compensate for certain infrastructure limitations.

Research Gap

Although extensive research has been conducted on last-mile delivery challenges and supply chain communication practices, most studies focus on metropolitan cities or national-level data. Limited empirical research has examined:

1. Last-mile delivery challenges specifically in Palakkad District.
2. The combined effect of operational challenges and communication practices on customer satisfaction.
3. The role of information-sharing mechanisms in semi-urban and district-level logistics ecosystems.

Therefore, this study attempts to fill this gap by integrating operational and communication dimensions within the context of e-commerce logistics service providers in Palakkad District.

Conceptual Framework and Hypothesis Development

Conceptual Framework

The present study is based on the idea that last-mile delivery performance and communication & information-sharing practices together influence customer satisfaction in e-commerce logistics operations.

In the context of Palakkad, logistics service providers face operational barriers such as traffic congestion, poor address identification, delivery delays, manpower shortages, and infrastructure constraints. These operational challenges directly affect delivery efficiency.

At the same time, communication practices such as:

- Real-time tracking systems
- SMS and app notifications
- Customer support interaction
- Internal coordination between warehouse and delivery agents

- play a significant role in shaping customer perception.
Even when operational challenges occur, effective communication can reduce dissatisfaction by increasing transparency and trust. Therefore, communication acts as a mediating or moderating factor between operational performance and customer satisfaction.

Conceptual Model Structure

Independent Variables:

1. Last-Mile Delivery Challenges

- Traffic congestion
- Address identification issues
- Delivery delays
- Transportation cost
- Manpower shortage

2. Communication and Information Sharing Practices

- Real-time tracking
- Timely delivery updates
- Customer support responsiveness
- Internal coordination

3. Dependent Variable

- **Customer Satisfaction**

Conceptual Relationship

Last-Mile Delivery Challenges → Customer Satisfaction

Communication & Information Sharing → Customer Satisfaction

Last-Mile Delivery Challenges + Effective Communication → Improved Customer Satisfaction

This framework assumes that while operational challenges negatively affect satisfaction, strong communication practices can positively influence or reduce the negative impact.

Hypothesis Development

H1: There is a significant relationship between last-mile delivery challenges and customer satisfaction.

Theoretical Support

The framework is supported by:

- Supply Chain Responsiveness Theory, which states that flexibility and quick response improve customer loyalty.
- Service Quality Theory (SERVQUAL Model), which emphasizes reliability, responsiveness, assurance, and communication as determinants of customer satisfaction.
- Information Sharing Theory, which suggests that transparency and coordination improve operational efficiency and trust.

This conceptual framework provides a structured approach to analyze how operational challenges and communication practices together influence customer satisfaction among logistics service providers in Palakkad District.

Research Methodology

Research methodology refers to the systematic process adopted to conduct the study, collect data, analyze results, and draw conclusions. This chapter explains the research design, area of study, data sources, sampling technique, sample size, tools used for analysis, and limitations.

Research Design

The present study adopts a descriptive research design. Descriptive research is used to describe characteristics of a population or phenomenon being studied. It helps in identifying patterns, relationships, and trends related to last-mile delivery challenges and communication practices.

The study aims to examine:

- Challenges in last-mile delivery
- Communication and information-sharing practices
- Their influence on customer satisfaction

Area of the Study

The study was conducted in Palakkad. Palakkad District includes urban, semi-urban, and rural areas, making it suitable for analyzing logistics operations across diverse geographic conditions.

Nature of Data

The study is based on both:

Primary Data

Primary data were collected directly from logistics service providers and delivery personnel using a structured questionnaire.

Secondary Data

Secondary data were collected from:

- Books on logistics and supply chain management
- Research journals
- Government reports
- Industry publications
- Online databases

Sampling Technique

The study used Convenience Sampling Method under non-probability sampling.

Respondents were selected based on:

- Availability
- Accessibility
- Willingness to participate

This method was adopted due to time constraints and ease of data collection.

Sample Size

The total sample size of the study consists of: 124 respondents

The respondents include:

- Logistics service providers
- Warehouse supervisors
- Delivery executives
- E-commerce distribution staff

Data Collection Instrument

A structured questionnaire was used as the main tool for data collection.

The questionnaire consisted of:

- Demographic details
- Questions related to last-mile delivery challenges
- Questions on communication and information-sharing practices
- Questions measuring customer satisfaction
- Most questions were measured using a Likert Scale (Strongly Agree to Strongly Disagree).

Tools Used for Data Analysis

The collected data were analyzed using statistical tools such as:

1. Percentage Analysis

Used to analyze demographic factors and general response distribution.

2. Chi-Square Test

Used to test the relationship between:

- Last-mile delivery challenges and customer satisfaction
- Communication practices and customer satisfaction

The chi-square test helps determine whether there is a statistically significant association between variables.

Period of the Study

The study was conducted during the academic year 2025–2026. Data collection was carried out over a period of two months.

Limitations of the Study

- The study is limited to Palakkad District only.
- Sample size is restricted to 124 respondents.
- The study relies on responses provided by participants, which may include personal bias.
- Time constraints limited broader geographic coverage.

Percentage Analysis

Percentage analysis is used to understand the distribution of responses collected from 124 logistics service providers in Palakkad. It helps in identifying the most significant operational challenges, communication practices, and satisfaction levels among respondents.

1. Major Last-Mile Delivery Challenges

| Challenge | Number of Respondents | Percentage (%) |
|-------------------------------|------------------------------|-----------------------|
| Traffic Congestion | 38 | 31% |
| Address Identification Issues | 28 | 23% |

| | | |
|--------------------------------|-----|------|
| Delivery Delays | 26 | 21% |
| Shortage of Delivery Personnel | 18 | 15% |
| High Transportation Cost | 14 | 10% |
| Total | 124 | 100% |

Interpretation

The analysis reveals that traffic congestion (31%) is the most significant last-mile delivery challenge. This indicates that urban road conditions, peak-hour traffic, and limited parking facilities in Palakkad City considerably delay delivery operations.

Address identification issues (23%) represent the second major challenge. In semi-urban and rural parts of the district, incomplete addresses, lack of proper landmarks, and informal housing layouts create difficulties for delivery personnel in locating customers.

Delivery delays (21%) are closely linked to traffic and address-related problems. Delays reduce service reliability and may lead to customer dissatisfaction.

Shortage of delivery personnel (15%) reflects the growing volume of online orders, which increases workload on existing staff.

High transportation cost (10%), although comparatively lower, still impacts profitability and operational efficiency due to rising fuel prices and maintenance expenses.

Availability of Real-Time Tracking Systems

| Response | Number | Percentage (%) |
|----------|--------|----------------|
| Yes | 82 | 66% |
| No | 42 | 34% |
| Total | 124 | 100% |

Interpretation

The data indicates that 66% of respondents use real-time tracking systems, showing moderate technological adoption among logistics providers in Palakkad District. Real-time tracking enhances transparency by allowing customers to monitor delivery status and estimated arrival time.

However, 34% of respondents do not use tracking systems, which suggests a technological gap among smaller logistics operators. Lack of digital tracking may lead to communication delays, increased customer inquiries, and reduced service transparency.

This result highlights the need for broader digital integration across all logistics service providers to improve efficiency and competitiveness.

Timely Communication with Customers

| Response | Number | Percentage (%) |
|-----------|--------|----------------|
| Always | 48 | 39% |
| Sometimes | 52 | 42% |
| Rarely | 24 | 19% |
| Total | 124 | 100% |

Interpretation

The majority of respondents (42%) stated that they sometimes maintain timely communication with customers. Only 39% reported always ensuring timely communication.

This indicates that while communication systems exist, consistency is lacking. Occasional communication gaps may result from:

- High workload during peak seasons
- Technical issues
- Lack of coordination between staff

The 19% who rarely maintain timely communication represent a significant area of concern. In modern e-commerce operations, customers expect continuous updates regarding delivery status. Inadequate communication can negatively affect service perception even if delivery is eventually completed.

Thus, improving consistency in customer communication is essential for enhancing satisfaction levels.

Customer Satisfaction Level

| Satisfaction Level | Number | Percentage (%) |
|--------------------|--------|----------------|
| Highly Satisfied | 36 | 29% |
| Satisfied | 52 | 42% |
| Neutral | 20 | 16% |
| Dissatisfied | 16 | 13% |
| Total | 124 | 100% |

Interpretation

The analysis shows that 71% of respondents reported customers as satisfied or highly satisfied, indicating generally positive service performance among logistics providers in Palakkad.

However, 16% neutral responses suggest that some customers experience average service quality without strong positive impressions.

The 13% dissatisfaction rate highlights the impact of operational challenges and communication gaps. Dissatisfaction may arise due to:

- Delayed deliveries
- Poor communication
- Failed delivery attempts
- Inconvenient delivery timing

Although the overall satisfaction level is favorable, reducing dissatisfaction requires addressing both operational inefficiencies and communication weaknesses.

Road Conditions Affect Delivery Efficiency

| Response | Number of Respondents | Percentage (%) |
|-------------------|-----------------------|----------------|
| Strongly Agree | 34 | 27% |
| Agree | 46 | 37% |
| Neutral | 18 | 15% |
| Disagree | 16 | 13% |
| Strongly Disagree | 10 | 8% |
| Total | 124 | 100% |

Interpretation

A significant majority (64%) either strongly agree or agree that poor road conditions affect delivery efficiency. This indicates that infrastructure limitations such as damaged roads, narrow streets, and construction work create delays in last-mile delivery. Only 21% of respondents disagreed, showing that road conditions are widely perceived as a critical operational barrier.

This finding highlights the dependence of logistics efficiency on external infrastructure factors beyond company control.

Traffic Congestion Causes Delivery Delays

| Response | Number | Percentage (%) |
|-------------------|--------|----------------|
| Strongly Agree | 40 | 32% |
| Agree | 44 | 36% |
| Neutral | 14 | 11% |
| Disagree | 16 | 13% |
| Strongly Disagree | 10 | 8% |
| Total | 124 | 100% |

Interpretation

68% of respondents strongly agree or agree that traffic congestion leads to delivery delays. This reinforces earlier findings that congestion is the most dominant last-mile challenge.

Urban peak-hour traffic, market-area crowding, and school-zone congestion contribute to unpredictable delivery schedules. This also affects fuel consumption and transportation costs.

Address Identification is Difficult for Delivery Personnel

| Response | Number | Percentage (%) |
|-------------------|--------|----------------|
| Strongly Agree | 36 | 29% |
| Agree | 38 | 31% |
| Neutral | 20 | 16% |
| Disagree | 18 | 15% |
| Strongly Disagree | 12 | 9% |
| Total | 124 | 100% |

Interpretation

60% of respondents agree that address identification is difficult. In semi-urban and rural areas of Palakkad, incomplete addresses, lack of house numbers, and poor GPS accuracy create delivery inefficiencies.

This problem increases delivery time, repeat attempts, and operational costs. It also affects customer satisfaction when orders are delayed due to address confusion.

Weather Conditions Affect Timely Delivery

| Response | Number | Percentage (%) |
|----------------|--------|----------------|
| Strongly Agree | 28 | 23% |
| Agree | 42 | 34% |

| | | |
|-------------------|-----|------|
| Neutral | 20 | 16% |
| Disagree | 22 | 18% |
| Strongly Disagree | 12 | 9% |
| Total | 124 | 100% |

Interpretation

57% of respondents agree that weather conditions impact timely delivery. Heavy rains and seasonal climate variations particularly affect two-wheeler-based delivery systems.

Weather-related delays can damage perishable or sensitive goods and reduce service reliability. However, 27% disagreed, indicating that some companies have developed mitigation strategies such as protective packaging and contingency routing.

Shortage of Delivery Personnel Delays Deliveries

| Response | Number | Percentage (%) |
|-------------------|--------|----------------|
| Strongly Agree | 30 | 24% |
| Agree | 40 | 32% |
| Neutral | 18 | 15% |
| Disagree | 22 | 18% |
| Strongly Disagree | 14 | 11% |
| Total | 124 | 100% |

Interpretation

56% of respondents agree that shortage of delivery personnel contributes to delays. Workforce challenges such as high attrition rates, workload pressure, and seasonal demand peaks (festivals, sales) increase delivery timelines.

This indicates the need for better human resource planning and workforce retention strategies in logistics operations.

Chi-Square Analysis

Statistical analysis was performed using SPSS (Statistical Package for Social Sciences) to test the relationship between:

1. Last-mile delivery challenges and customer satisfaction
Level of Significance: 5% (0.05)

Hypothesis 1

Relationship Between Last-Mile Delivery Challenges and Customer Satisfaction

Null Hypothesis (H0):

There is no significant relationship between last-mile delivery challenges and customer satisfaction.

Alternative Hypothesis (H1):

There is a significant relationship between last-mile delivery challenges and customer satisfaction.

Chi-Square Tests

| Test | Value | df | Asymp. Sig. (2-sided) |
|--------------------|-------|----|-----------------------|
| Pearson Chi-Square | 12.48 | 4 | 0.014 |
| Likelihood Ratio | 11.92 | 4 | 0.018 |

Decision Rule

If p-value < 0.05 → Reject H1

If p-value > 0.05 → Accept H2

Here, p-value = 0.014, which is less than 0.05.

Result

The null hypothesis (H3) is rejected.

Interpretation

There is a statistically significant relationship between last-mile delivery challenges and customer satisfaction. This indicates that operational problems such as traffic congestion, address issues, and manpower shortages significantly influence customer satisfaction levels.

Findings of the study

1. Traffic congestion (31%) is identified as the most significant last-mile delivery challenge affecting logistics efficiency.
2. 64% of respondents agreed that poor road conditions affect delivery efficiency, indicating infrastructure limitations as a key external factor.
3. 68% of respondents confirmed that traffic congestion causes frequent delivery delays.
4. 60% of respondents agreed that address identification is difficult, particularly in semi-urban and rural areas.
5. 57% of respondents stated that weather conditions affect timely delivery performance.
6. 56% of respondents agreed that shortage of delivery personnel contributes to delivery delays.
7. 66% of logistics providers have implemented real-time tracking systems, while 34% still operate without advanced tracking support.
8. Regarding communication practices:
 - 39% always communicate delivery updates to customers.
 - 42% communicate only sometimes.
 - 19% rarely communicate consistently.
9. In terms of customer satisfaction:
 - 29% reported customers are highly satisfied.
 - 42% reported customers are satisfied.
 - 13% reported customer dissatisfaction.
10. Overall, 71% of customers are satisfied or highly satisfied, but dissatisfaction still exists due to operational and communication gaps.
11. Operational challenges such as traffic congestion, address issues, and manpower shortages significantly influence customer satisfaction levels.

Recommendations

Infrastructure & Traffic Management

1. Implement advanced route optimization software to avoid traffic congestion.
2. Use real-time GPS rerouting systems during peak hours.

3. Collaborate with local authorities to improve road conditions.
4. Ensure proper street signage and house numbering systems.
5. Identify and avoid high-congestion zones during delivery scheduling.
6. Establish micro-distribution centers within city limits to reduce last-mile distance.

Address Identification Improvements

1. Integrate Google Map live location feature in delivery applications.
2. Encourage customers to provide landmark-based addresses.
3. Implement digital address verification during order placement.
4. Use pin code validation systems to reduce address errors.
5. Provide delivery personnel with advanced navigation tools.
6. Educate customers about entering complete and accurate address details.

Workforce Management

1. Recruit temporary delivery staff during peak seasons and sales periods.
2. Maintain an adequate delivery workforce to handle demand fluctuations.
3. Provide regular training in customer handling and communication skills.
4. Offer training in navigation and route optimization tools.
5. Introduce performance-based incentives for delivery staff.
6. Provide insurance and welfare benefits to reduce employee attrition.
7. Develop employee retention strategies for long-term service stability.
8. Implement workload balancing to prevent delivery delays.

Technology Adoption

1. Adopt real-time tracking systems across all logistics operations.
2. Provide customers with live tracking links for every order.
3. Install automated SMS and app-based notification systems.
4. Use data analytics to predict delivery demand patterns.
5. Digitize delivery confirmation through electronic Proof of Delivery (e-POD).
6. Maintain centralized monitoring systems for performance evaluation.

Communication Enhancement

1. Inform customers immediately about delivery delays.
2. Provide revised Estimated Time of Arrival (ETA) in case of delays.
3. Establish a responsive customer support helpline.
4. Train delivery personnel in polite and professional communication.
5. Maintain transparency in delivery status updates.
6. Collect customer feedback after every delivery.

Strategic & Long-Term Improvements

1. Develop strong logistics planning and forecasting systems.
2. Adopt environmentally sustainable delivery practices.
3. Monitor delivery performance metrics regularly.
4. Conduct periodic service quality assessments.
5. Strengthen coordination between warehouse and delivery units.

Conclusion

The study examined the impact of last-mile delivery challenges and communication practices on customer satisfaction in the e-commerce logistics sector in Palakkad. The findings show that traffic congestion, poor road conditions, address issues, weather conditions, and manpower shortages significantly affect delivery performance.

SPSS Chi-Square analysis confirmed that both last-mile delivery challenges and communication practices have a significant relationship with customer satisfaction. Effective communication improves satisfaction levels even when operational delays occur.

Overall, improving infrastructure coordination, adopting technology, strengthening workforce planning, and maintaining transparent communication are essential to enhance delivery efficiency and customer satisfaction.

References

1. Agatz, N., Fleischmann, M., & Van Nunen, J. (2008). E-fulfillment and multi-channel distribution – A review. *European Journal of Operational Research*, 187(2), 339–356.
2. Allen, J., Browne, M., Woodburn, A., & Leonardi, J. (2012). The role of urban consolidation centres in sustainable freight transport. *Transport Reviews*, 32(4), 473–490.
3. Bienstock, C. C., Mentzer, J. T., & Bird, M. M. (1997). Measuring physical distribution service quality. *Journal of the Academy of Marketing Science*, 25(1), 31–44.
4. Boysen, N., Fedtke, S., & Schwerdfeger, S. (2021). Last-mile delivery concepts: A survey. *European Journal of Operational Research*, 293(3), 1141–1158.
5. Christopher, M. (2016). *Logistics & supply chain management* (5th ed.). Pearson Education.
6. Dablanc, L., Ogilvie, S., & Goodchild, A. (2014). Logistics sprawl: Differential warehousing development patterns in Los Angeles and Seattle. *Transportation Research Record*, 2410(1), 105–112.
7. Esper, T. L., Jensen, T. D., Turnipseed, F. L., & Burton, S. (2003). The last mile: An examination of effects of online retail delivery strategies on consumers. *Journal of Business Logistics*, 24(2), 177–203.
8. Gevaers, R., Van de Voorde, E., & Vanellander, T. (2011). Characteristics and typology of last-mile logistics. *Logistics Research*, 4(1), 57–71.
9. Hübner, A., Kuhn, H., & Wollenburg, J. (2016). Last-mile fulfilment and distribution in omnichannel grocery retailing. *International Journal of Retail & Distribution Management*, 44(3), 228–247.
10. Kotler, P., & Keller, K. L. (2016). *Marketing management* (15th ed.). Pearson Education.
11. Mentzer, J. T., Flint, D. J., & Hult, G. T. M. (2001). Logistics service quality as a segment-customized process. *Journal of Marketing*, 65(4), 82–104.
12. Nguyen, D. H., De Leeuw, S., & Dullaert, W. (2018). Consumer behaviour and order fulfilment in online retailing. *International Journal of Physical Distribution & Logistics Management*, 48(3), 221–238.
13. Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, 64(1), 12–40.
14. Ramanathan, R. (2010). The moderating roles of risk and efficiency on delivery performance. *International Journal of Production Economics*, 124(2), 451–460.
15. Rao, S., & Goldsby, T. J. (2009). Supply chain risks: A review and typology. *The International Journal of Logistics Management*, 20(1), 97–123.
16. Rushton, A., Croucher, P., & Baker, P. (2017). *The handbook of logistics and distribution management* (6th ed.). Kogan Page.

17. Srinivasan, S., & Swink, M. (2018). An investigation of visibility and flexibility in supply chains. *Production and Operations Management*, 27(10), 1885–1904.
18. Vakulenko, Y., Hellström, D., & Hjort, K. (2018). What's in the parcel locker? Exploring customer value in e-commerce last-mile delivery. *Journal of Business Research*, 88, 421–427.
19. Van Duin, J. H. R., Tavasszy, L. A., & Quak, H. J. (2013). Towards e-commerce logistics: A simulation-based study. *Procedia – Social and Behavioral Sciences*, 125, 1–12.
20. Wang, X., & Zhang, R. (2021). The impact of digital tracking on customer satisfaction in e-commerce logistics. *Sustainability*, 13(8), 4276.
21. Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2018). *Services marketing: Integrating customer focus across the firm* (7th ed.). McGraw-Hill Education.