

# A Study on Challenges and Optimization of Last Mile Delivery and its Impact on Customer Satisfaction

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## ABSTRACT

The last mile delivery, the final stage of the delivery process from a distribution center to the end user, plays a critical role in the supply chain, significantly influencing customer satisfaction. Against the backdrop of a rapidly growing e-commerce sector, the demand for swift and flexible delivery options has made last-mile delivery a vital determinant of overall customer satisfaction. This study analyzes the impact of optimizing last-mile delivery on customer satisfaction and loyalty, highlighting that efficient last-mile operations can lead to continued use of the delivery service. Key areas contributing to last-mile delivery challenges include timeliness, condition of delivered items, communication during delivery, flexibility of delivery options, and overall customer experience. The study concludes that addressing these challenges and implementing effective strategies is essential for meeting customer expectations and enhancing satisfaction in the competitive e-commerce landscape. The findings and recommendations provide a comprehensive roadmap for businesses aiming to improve their last-mile delivery operations and boost customer satisfaction.

**Keywords:** Last Mile Delivery, Customer Satisfaction, Supply Chain

## INTRODUCTION

The last mile delivery—the portion of the delivery process that takes place between a distribution centre or other facility and the end user's location—is an essential part of the supply chain that significantly affects customer satisfaction. Businesses are investing heavily in improving their last mile delivery operations because this sector directly impacts the timely delivery and condition of the delivered items. Businesses are being forced to innovate and come up with more effective and affordable solutions because of the growing demand for delivery options that are quicker and more convenient. From 2022 to 2030, the global last-mile delivery industry is projected to expand at a compound annual growth rate (CAGR) of 20.6 percent, with a projected valuation of \$121.1 billion (Skyquest, 2024). The dynamics of supply chain management have changed because of the explosive rise of e-commerce, with last-mile delivery emerging as a crucial factor affecting overall consumer satisfaction. The difficulties faced by last-mile delivery providers are becoming more and more obvious as customers want delivery services that are quicker and more dependable. The goal of this study is to investigate these issues, pinpoint optimization techniques, and evaluate how they affect client happiness.

## LITERATURE REVIEW

Prior studies have examined different facets of last-mile delivery, emphasizing difficulties such as delays, traffic jams, and rising customer demands. Research has also investigated optimization strategies like real-time tracking, dynamic routing, and working with nearby companies.

**Capgemini** - The last-mile delivery challenge (**Capgemini, 2019**). Consumer products and retail firms in the food and grocery segment must catch up with consumer demand for better and faster last-mile delivery services while at the same time mitigating associated profitability risks. But, last-mile delivery is the most expensive part of the supply chain. So how can retailers improve their last-mile delivery services without taking a profitability hit?

**Jazemi, R., Alidadiani, E., Ahn, K., & Jang, J.** A review of literature on vehicle routing problems of last-mile delivery in urban areas (**Jazemi, 2023**). Globalization, urbanization, and the recent COVID-19 pandemic have been raising the demand for logistic activities. This change is affecting the entire supply chain, especially the last-mile step.

**M. Suguna, Bhavin Shah, S. Karthik Raj & M. Suresh** - A study on the influential factors of the last mile delivery projects during Covid-19 era. OMR (**M. Suguna, 2021**). The Covid-19 has shifted the face of many markets including e-commerce and online business with many bottlenecks to be cleared. The last-mile delivery project has the greatest effect on all types of e-commerce companies because it has many consumer touchpoints as well as the Covid-19 pain points.

**Nima Pourmohammadreza, Mohammad Reza Akbari Jokar** - A Novel Two-Phase Approach for Optimization of the Last-Mile Delivery Problem with Service Options. Sustainability (**Nima Pourmohammadreza, 2023**). As the growth of e-commerce continues to accelerate, there is a need for new and innovative strategies in last-mile delivery to meet the changing demands of customers. This paper directs managers in selecting the most appropriate delivery method for last-mile delivery, considering environmental, social, and economic factors.

**Sharma, Vijay & Prakash, Surya & Singh, Ranbir & Brar, Ankur.** Decisive Drivers Contributing towards Modern Last Mile Delivery Operations: A Qualitative Analysis using ISM. International Journal of Mathematical Engineering and Management Sciences. (**Sharma, 2023**). This research article investigates the drivers of logistics management for Last-Mile Delivery (LMD) in a contemporary business situation. The research provides valid factors for increasing the LMD efficiency of logistics networks.

**Dr. Priyanka Lal, Dr. Shilpa Narayanswamy** - CHALLENGES IN LAST MILE DELIVERY – CASE OF FMCG INDUSTRY. International Journal of Advanced Research and Review (**Dr. Priyanka Lal, 2022**). This was live case-based research at an FMCG warehouse based in Mumbai, Maharashtra. The area of focus was towards B2B last-mile delivery. The research had two major objectives: Study the last-mile delivery present process to understand the gaps and shortcomings experienced.

**Shamsuzzoha, Ahm & Helo, Petri** - Real-time Tracking and Tracing Systems: Potentials for the Logistics Network. Proceedings of the 2011 International Conference on Industrial Engineering and Operations Management. (**Shamsuzzoha, 2011**). The importance of tracking and tracing of shipments is considered quite high for manufacturing firms in terms of customer service and essential for managing logistics networks efficiently. The main objective of this research is to the management of logistics network through analyzing the new technological opportunities on real-time shipment tracking in dispersed manufacturing environment.

**Bergqvist, Rickard & Monios, Jason** - The last mile, inbound logistics and intermodal high-capacity transport – the case of Jula in Sweden. *World Review of Intermodal Transportation Research* (**Rickard Bergqvist, 2016**). Some of the biggest challenges for intermodal transport competitiveness are the extra handling costs and pre- and post-haulage costs. The total cost saving was significant and potentially eliminates the cost deficit associated with the last mile.

**Sarkis, Joseph & Zhu, Qinghua & Lai, Kee-hung**. - An Organizational Theoretic Review of Green Supply Chain Management Literature. *International Journal of Production Economics*. (**Sarkis, 2011**) Green supply chain management (GSCM) has gained increasing attention within both academia and industry. Additional organizational theories which are considered valuable for future GSCM research are also identified with a conclusion for this review.

**Vakulenko, Yulia & Shams, Poja & Hellström, Daniel & Hjort, Klas** - Online retail experience and customer satisfaction: the mediating role of last mile delivery. *The International Review of Retail, Distribution and Consumer Research* (**Vakulenko, 2019**). For various industries worldwide, recent years have been defined by the remarkable growth of e-commerce. These conclusions provide ground for further thorough investigations of the role of last mile delivery in the e-retail context and support e-retailers in increasing their customer satisfaction.

## STATEMENT OF THE PROBLEM

The last-mile delivery phase presents numerous issues that directly affect the customer experience. Traffic congestion, delivery delays, and growing expectations all lead to customer unhappiness. While optimization solutions exist, their efficacy in tackling these difficulties and increasing customer happiness warrants more examination.

## OBJECTIVES OF STUDY

- To understand the primary challenges faced by last-mile delivery services.
- To assess the direct impact of optimized last-mile delivery on overall customer satisfaction.

## RESEARCH METHODOLOGY

### Type of Study:

A mixed-methods approach, combining quantitative and qualitative analyses. Surveys with customers provided insights into challenges and optimization strategies. Historical delivery data based on customers used to assess the impact of applied strategies on actual delivery performance.

### Area of Study:

The study was primarily focused on urban and suburban and rural areas with a high density of online retail activities.

### Data Collection Tools:

Quantitative Data Collection:

Surveys: Developed a structured questionnaire to collect quantitative data on customer satisfaction and perceptions of last mile delivery.

### Data Analysis & Techniques Applied:

Inferential Statistics: Employed statistical tests (e.g., t-tests) to assess the significance of relationships between variables.

Regression Analysis: Explored the impact of last mile delivery optimization efforts on customer satisfaction through regression modeling.

**ANALYSIS & INTERPRETATION**

In recent years, the importance of efficient last-mile delivery has become increasingly evident, particularly as consumer expectations for faster and more reliable services continue to rise. To gain deeper insights into the challenges and optimization strategies in last-mile delivery and their direct impact on customer satisfaction, we conducted a comprehensive study.

Data for this study was collected through an online survey using Google Forms. A total of **152 respondents** participated, providing valuable perspectives and experiences related to last-mile delivery. The survey focused on identifying key challenges faced by consumers and businesses, evaluating the effectiveness of various optimization techniques, and understanding the correlation between these factors and customer satisfaction.

Age	18-24	25-34	35-44	45-54	55 and above
Percentage	31.6%	29.6%	24.3%	10.5%	3.9%
Region	Rural	Suburban	Urban		
Percentage	15.1%	46.1%	38.8%		
Occupation	Student	Job	Business		
Percentage	32.9%	52%	15.1%		

**Table 1: Demographics Table**

The breakdown of demographic characteristics by age, region, and occupation as follows. The age distribution is as follows: 31.6% of the population is between 18-24 years old, 29.6% are between 25-34 years old, 24.3% are between 35-44 years old, 10.5% are between 45-54 years old, and 3.9% are 55 years old and above. Regarding regional distribution, 15.1% of the population lives in rural areas, 46.1% in suburban areas, and 38.8% in urban areas. In terms of occupation, 32.9% of the population are students, 52% are employed in jobs, and 15.1% are engaged in business.

**1. LINEAR REGRESSION**

**Null Hypothesis (H0):**

There is no significant relationship between the consistency and efficiency of last-mile delivery services and overall customer satisfaction and loyalty, and thus it does not influence the likelihood of continued use of the delivery service.

**Alternative Hypothesis (H1):**

There is a significant positive relationship between the consistency and efficiency of last-mile delivery services and overall customer satisfaction and loyalty, which influences the likelihood of continued use of the delivery service.

**Linear Regression**

Model Fit Measures				
Model		R	R <sup>2</sup>	
1		0.421	0.177	

Model Coefficients - optimized and efficient deliveries				
Predictor	Estimate	SE	t	p
Intercept	1.568	0.2230	7.03	< .001
last-mile delivery experience influencing overall satisfaction with a product or service	0.433	0.0761	5.69	< .001

The R<sup>2</sup> value of 0.177 indicates that approximately 17.7% of the variance in customer satisfaction and loyalty that is explained by the consistency and efficiency of last-mile delivery services. The estimate for the last-mile delivery experience is 0.433, with a standard error of 0.0761. This positive coefficient suggests that as the consistency and efficiency of last-mile deliveries increase, customer satisfaction and loyalty also increase. The t-value for the last-mile delivery experience is 5.69, and the p-value is less than 0.001.

Since the p-value is less than 0.05, **we reject the null hypothesis (H0)**. This indicates that the relationship between the consistency and efficiency of last-mile delivery services and overall customer satisfaction and loyalty is statistically significant. Therefore, optimizing and ensuring efficient last-mile deliveries can positively impact customer satisfaction and loyalty, leading to a higher likelihood of continued use of the delivery service.

## 2. T - TEST

Question: On a scale of 1-5, with 1 being the least challenging and 5 being the most challenging, rate the overall difficulty you face with last-mile delivery services.

Hypotheses:

### Null Hypothesis (H0):

The mean rating of overall difficulty faced with last-mile delivery services is equal to 3 (the midpoint of the scale), indicating that on average, the difficulty level is neutral.

### Alternative Hypothesis (H1):

The mean rating of overall difficulty faced with last-mile delivery services is not equal to 3, indicating that the difficulty level is significantly different from neutral (either more or less challenging).

### One Sample T-Test

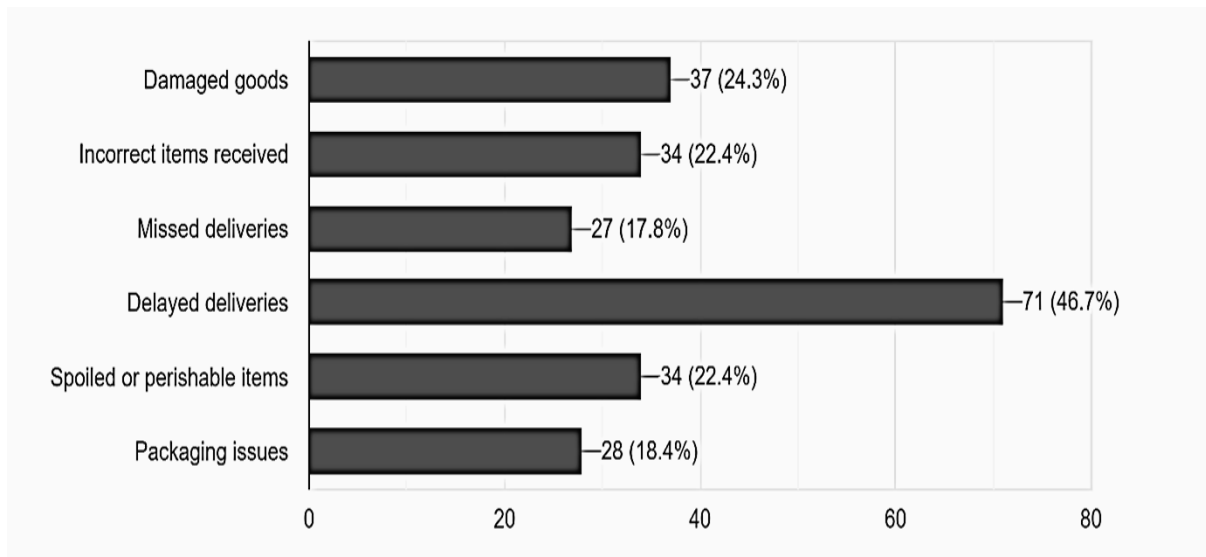
One Sample T-Test				
	Statistic	df	p	
Overall difficulty faced with last-mile delivery services.	Student's t	33.0	151	< .001

One Sample T-Test				
		Statistic	df	p
Note. $H_a \mu \neq 0$				

Since the p-value is less than the chosen significance level, **we reject the null hypothesis (H0)**. There is strong evidence suggesting that the mean rating of overall difficulty faced with last-mile delivery services is significantly different from the hypothesized mean (which we assumed to be 3). Given the context of the t-value being positive and the result being significant, it suggests that the mean rating is likely higher than 3, indicating that respondents find last-mile delivery services more challenging than neutral. Therefore, it's important to address the areas that contribute to these challenges. For e.g., Improve Timeliness of Delivery, Enhance the Condition of Delivered Items, Improve Communication During the Delivery Process, Increase Flexibility of Delivery Options, Enhance Overall Customer Experience. By implementing these solutions, last-mile delivery services can significantly reduce the challenges faced by customers, leading to higher satisfaction and loyalty.

### 3. Graphical Representation

Based on the following question the survey got the following result. *Have you encountered any challenges related to the condition of delivered items? Please select all that apply:*

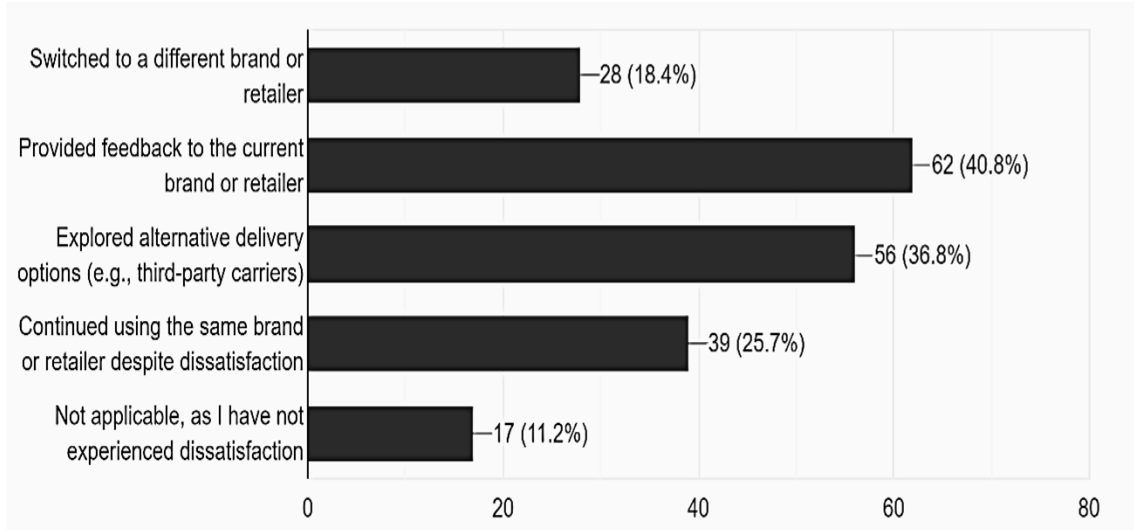


**Figure 1: Challenges related to condition of delivered items**

Since delayed deliveries with 46.7% is the most significant issue, efforts to improve the speed and reliability of delivery services could lead to higher customer satisfaction. Enhancing packaging standards and handling procedures to minimize damage can reduce the number of damaged goods. Ensuring that perishable items are transported under optimal conditions can prevent spoilage. Implementing stricter quality control measures in order processing can help reduce the incidence of incorrect items being sent out. Improving communication about delivery times and providing more flexible delivery options can help mitigate issues related to missed deliveries.



Based on the following question the survey got the following result. *What actions have you taken in response to dissatisfaction with the last-mile delivery experience? Please select all that apply:*



**Figure 2: Response to dissatisfaction with last mile delivery**

The data provides insights into how customers react when dissatisfied with a brand or retailer. A significant 40.8% of respondents chose to provide feedback, indicating that many customers prefer to express their concerns in hopes of improvement. This suggests that feedback mechanisms are crucial for brands to retain customers and address issues. Additionally, 36.8% of respondents explored alternative delivery options, highlighting a willingness to consider other solutions rather than immediately abandoning the brand. This demonstrates the importance of flexible delivery options in customer satisfaction. Meanwhile, 25.7% continued using the same brand despite dissatisfaction, suggesting either brand loyalty or a lack of better alternatives. In contrast, 18.4% of respondents switched to a different brand or retailer, showing that dissatisfaction can lead to a loss of customers. This underscores the competitive nature of the market and the need for brands to maintain high standards. Finally, 11.2% of respondents reported not experiencing dissatisfaction, highlighting that a portion of customers are content with their current experiences.

## FINDINGS

- The majority of customers experience challenges with last-mile delivery services either occasionally or rarely, with occasional challenges being the most common. A smaller proportion encounters these challenges frequently.
- Improving communication about delivery times and providing more flexible delivery options can help mitigate issues related to Last mile delivery.
- The survey result indicates that real-time tracking (40.1%) and integrating technology (32.2%) are key strategies for enhancing last-mile delivery efficiency.
- Delivery notifications (33.6%) and real-time status updates (30.3%) are the most utilized technological features, highlighting the importance of real-time information in managing deliveries.
- The findings suggest that while some customers are content with communication and information updates, there is a significant portion who feel improvements are needed.

- The data indicates that a majority of respondents (62.5%) regard the last-mile delivery experience as either crucial or extremely crucial to their satisfaction with a product or service, highlighting its significant impact on customer satisfaction.
- This data indicates that a majority of respondents actively engage with last-mile delivery services by providing feedback, both positive and negative, underscoring the importance of customer feedback in shaping delivery service quality.

## SUGGESTIONS

- The optimization ensures the efficient last-mile deliveries can positively impact customer satisfaction and loyalty, leading to a higher likelihood of continued use of the delivery service which business need to improve on.
- Implement sophisticated route optimization tools to reduce delivery times and fuel costs. Identify the most efficient delivery routes, considering traffic patterns and delivery windows.
- Use GPS and real-time tracking systems to provide customers with accurate delivery estimates and updates. This transparency can significantly enhance customer satisfaction.
- Track key performance indicators (KPIs) such as delivery time, delivery success rate, and customer satisfaction scores to monitor and improve delivery performance.

## CONCLUSION

The study on last-mile delivery highlights its critical role in the supply chain and its direct impact on customer satisfaction reveals crucial insights into the challenges and potential solutions for enhancing delivery services. With the rapid growth of e-commerce, the importance of last-mile delivery has surged, making it a pivotal element in customer satisfaction.

Statistical analysis from the study supports these findings, indicating a significant positive relationship between the efficiency of last-mile delivery and overall customer satisfaction. Based on these insights, the study recommends several actionable strategies for businesses. Investing in advanced tracking and routing technologies, regularly collecting, and analyzing customer feedback helps identify pain points and areas for improvement.

By addressing identified challenges and implementing effective strategies, companies can achieve significant improvements in delivery performance and customer loyalty. The findings and recommendations from this study provide a comprehensive roadmap for businesses seeking to improve their last-mile delivery operations and enhance overall customer satisfaction.

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