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Assessing Lead Time Variability in Selected Online Grocery Applications

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ABSTRACT

The rapid growth of quick-commerce (q-commerce) platforms such as Zepto, Blinkit, and Swiggy Instamart in Tier II cities like Coimbatore has redefined urban consumption patterns through the promise of near-instant delivery. This study investigates delivery lead time—the interval between order confirmation and physical receipt—as a primary metric for user experience. A significant gap often exists between the Estimated Time of Arrival (ETA) and the actual delivery time, creating variability that threatens customer retention. The research identifies key logistical bottlenecks, including peak-hour demand spikes, urban traffic congestion, dark store capacity constraints, and algorithmic routing challenges. By focusing on the time-sensitive nature of grocery essentials, this paper empirically analyzes how lead time fluctuations drive consumers toward offline alternatives or competing platforms. The findings aim to provide actionable strategies for improving last-mile reliability and enhancing consumer satisfaction in the Indian regional context.

KEYWORDS: *Quick commerce, Delivery lead time, Last-mile delivery, Customer satisfaction, Coimbatore, Lead time variability, Dark stores, E-grocery, Logistics management, Consumer retention.*

INTRODUCTION

Online grocery delivery services like Zepto, Blinkit, Swiggy Instamart, BigBasket, and Jiomart have grown in popularity in the Coimbatore region by promising convenience, speed, and time savings to urban consumers who increasingly rely on just-in-time purchases of daily essentials. In this scenario, the delivery lead time, which is the time period between the confirmation of the order and the actual receipt of the product, has emerged as a key performance metric that influences the overall user experience and retention of the app. However, in reality, there is always a noticeable difference between the actual time of arrival of the product at the customer location and the estimated time of arrival shown in the app, leading to variability in the lead time that may negatively impact customer satisfaction and retention. This variability is generally caused by complex factors such as peak hour demand spikes, traffic in city roads, dark store capacity constraints, batching and routing algorithms, and delivery partner availability. For grocery items, which are often time-sensitive and associated with planned household activities, even moderate variability in delivery times may cause disruptions and drive customers to explore alternative platforms or offline purchases. Though the importance of last mile reliability is well understood in terms of strategy, there is a lack of empirical work specifically on lead time variability in Indian tier II cities such as Coimbatore. This paper

attempts to identify the factors that influence lead time variability in online grocery apps and its effect on customer satisfaction, with the aim of proposing ways to improve last mile reliability.

REVIEW OF LITERATURE

Kumar *et al.* (2025) carried out an empirical analysis on the service quality aspects of Swiggy Instamart, specifically focusing on the Coimbatore city. The research was carried out on the basis of a customer survey and analyzed the impact of technology on facilitating quick grocery delivery services. The results showed that the use of advanced data analytics and AI-

powered logistics networks had a major impact on quick order fulfillment and service quality. Nevertheless, the research pointed out that there are some issues with delivery reliability and inventory management, as customers complained about some delivery delays and inventory shortages. The researchers concluded that even the best quick-commerce services have lead time variability if the logistics networks are not constantly optimized.

Ganapathy and Gupta (2024) carried out an exploratory research on critical success factors of quick-commerce-based grocery delivery services in India. The research focused on hyperlocal grocery delivery services that function through dark stores, which facilitate ultra-fast delivery services in 10 to 60 minutes. The researchers noticed that the traditional online grocery delivery services functioned with a lead time of two to four days, but the quick-commerce services cut down the delivery lead time to minutes. However, the research showed that the quick-commerce services with a delivery lead time of 10 minutes faced difficulties in executing the service. The research concluded that the dark store density, delivery staff availability, and last-mile logistics were critical factors in determining the delivery speed. The research also concluded that the inaccurate demand forecasting and logistics capacity resulted in delivery delays and variability in the lead time.

STATEMENT OF THE PROBLEM

The emergence of online grocery delivery applications in Coimbatore has significantly altered the purchasing behavior of consumers. Despite the convenience and speed provided by online grocery delivery applications, customers often face issues with the difference between the estimated time of delivery shown in the application and the actual time of delivery of the order. This issue of lead time variability affects the service quality and customer satisfaction levels. The factors that cause lead time variability include peak hour demand, traffic, unavailability of products in dark stores, inefficient routes, and a lack of delivery personnel. Since delivery time is an important factor in customer satisfaction levels in online grocery delivery applications, it is necessary to understand the causes and effects of lead time variability in Coimbatore. The current study will thus attempt to determine the operational factors that cause inconsistencies in deliveries and their impact on customer satisfaction levels.

OBJECTIVES OF THE STUDY

- To understand the user perception of lead time in selected online grocery delivery apps.
- To identify the factors influencing lead time variability in online grocery delivery.
- To measure the level of customer satisfaction regarding delivery speed, reliability, and service quality.

RESEARCH METHODOLOGY

The current research work was carried out in the city of Coimbatore, where online grocery apps have

received considerable adoption among the urban population. The research work is empirical in nature and is based on primary data collected from the users of selected online grocery apps. A structured questionnaire was developed to collect information regarding the demographic characteristics, usage behavior, delivery experience, reliability perception, and level of satisfaction. By using the stratified random sampling method, 68 valid responses were gathered during the period of December 2025 to January 2026. The collected data was coded, tabulated, and analyzed by using various statistical tools such as simple percentage analysis and chi-square test. The percentage analysis was used to determine the characteristics and usage behavior of the respondents, while the chi-square test was used to test the association between the categorical variables such as gender, location, occupation, order value, and level of satisfaction.

ANALYSIS AND INTERPRETATION:

Table 1: PERSONAL PROFILE OF THE RESPONDENTS

S.NO	VARIABLES	FREQUENCY	PERCENTAGE
01	**Gender**	**FREQUENCY**	**PERCENT**
	Male	42	61.8
	Female	26	38.2
	TOTAL	68	100.0
02	**Age Group**	**FREQUENCY**	**PERCENT**
	Below 20	15	22.1
	20 - 30	34	50.0
	31 - 40	9	13.2
	41 - 50	7	10.3
	Above 50	3	4.4
	TOTAL	**68**	**100.0**
03	**Educational Qualification**	**FREQUENCY**	**PERCENT**
	School Level	4	5.9
	UG	37	54.4
	PG	20	29.4
	Professional Degree	6	8.8
	Others	1	1.5
	TOTAL	**68**	**100.0**

04	**Occupation**	**FREQUENCY**	**PERCENT**
	Student	33	48.5
	Working Professional	23	33.8
	Business	6	8.8
	Homemaker	6	8.8
	TOTAL	**68**	**100.0**
05	**Monthly Family Income (IN RUPEES)**	**FREQUENCY**	**PERCENT**
	Below Rs.10,000	6	8.8
	Rs.10,000–20,000	13	19.1
	Rs.20,000–40,000	26	38.2
	Rs.40,000–60,000	14	20.6
	Above Rs.60,000	9	13.2
	TOTAL	**68**	**100.0**
06	**Type of Family**	**FREQUENCY**	**PERCENT**
	Joint Family	19	27.9
	Nuclear family	49	72.1
	TOTAL	**68**	**100.0**
07	**Location in Coimbatore**	**FREQUENCY**	**PERCENT**
	North Zone	14	20.6
	South Zone	23	33.8
	East zone	11	16.2
	West Zone	11	16.2
	Central Zone	9	13.2
	TOTAL	**68**	**100.0**

08	**Frequency of Ordering Online**	**FREQUENCY**	**PERCENT**
	Daily	2	2.9
	Weekly	17	25.0
	Bi-Weekly	5	7.4
	Monthly	18	26.5
	Rarely	26	38.2
	TOTAL	**68**	**100.0**
09	**Average Order Size**	**FREQUENCY**	**PERCENT**
	< Rs.300	24	35.3
	Rs.300 - Rs. 500	27	39.7
	Rs.500 - Rs.1000	12	17.6
	> Rs. 1000	5	7.4
	TOTAL	**68**	**100.0**
10	**App Usage**	**FREQUENCY**	**PERCENT**
	Less Than 6 months	27	39.7
	6-12 months	18	26.5
	1-2 years	12	17.6
	2-3 years	5	7.4
	Above 3 years	6	8.8
	TOTAL	**68**	**100.0**

Source: Primary Data

From Table 1, it is seen that out of 68 respondents, the majority of respondents were male, and their age g roup was 20-30 years. The majority of the respondents were under-grad degree holders, and a large numbe r of respondents were students. A large number of respondents had nuclear families with a monthly family income of ₹20,000-₹40,000. The majority of the respondents ordered groceries either monthly or rarely, w ith an average order value of ₹300-₹500. It is also seen that a large number of respondents have been usin g online grocery apps for less than six months.

OTHER FINDINGS

- Online grocery delivery services have lead time variability as most of the respondents have faced delivery delays either frequently or sometimes.
- Traffic congestion and peak hour demand are the major operational factors that cause variation in delivery times.
- Respondents have rated delivery reliability at medium levels, which shows moderate satisfaction but also the need for improvement in delivery times.
- Convenience and fast delivery are the major reasons for using online grocery applications despite concerns about delivery times.

Table 2: Cross tabulation of Chi Square test analysis with Gender and Reliability & Satisfaction
Ho = There is no association between Gender and Reliability & Satisfaction

Gender	Reliability & Satisfaction			Total	Chi Square
	Low	Medium	High		
Male	9	25	8	42	6.062 04(S)
Female	5	21	0	26	
Total	**14**	**46**	**8**	**68**	

Source: Primary Data S/NS: Significant/ Not Significant

Table 2 depicts cross tabulation of Gender and Reliability & Satisfaction during the study period. From the above table it is found that the calculated P = .048 which is statistically significant and lesser than the 0.05 level. Hence, the null hypothesis is rejected and alternative hypothesis is accepted. Hence it can be concluded that there is an association between Gender and Reliability & Satisfaction.

Table 3: Cross tabulation of Chi Square test analysis with Location and Reliability & Satisfaction
Ho = There is no association between Location in Coimbatore and Reliability & Satisfaction

Location	Reliability & Satisfaction			Total	Chi square
	Low	Medium	High		
North zone	0	13	1	14	20.625 08(S)
South zone	5	15	3	23	
East zone	1	6	4	11	
West zone	6	5	0	11	
Central zone	2	7	0	9	
Total	**14**	**46**	**8**	**68**	

Source: Primary Data S/NS: Significant/ Not Significant

The cross tabulation of Location and Reliability & Satisfaction is shown in Table 3. From the above table, it is found that the calculated P = 0.008, which is statistically significant and less than the 0.05 level. Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, it can be concluded that there is a relationship between Location and Reliability & Satisfaction.

Table 4: Cross tabulation of Chi Square test analysis with Order Size and Reliability & Satisfaction

Ho = There is no association between Average Order Size and Reliability & Satisfaction

Order size	Reliability & Satisfaction			Total	Chi square
	Low	Medium	High		
< Rs.300	8	15	1	24	15.772 015(S)
Rs.300 - Rs. 500	0	21	6	27	
Rs.500 - Rs.1000	4	8	0	12	
> Rs. 1000	2	2	1	5	
Total	**14**	**46**	**8**	**68**	

Source: Primary Data S/NS: Significant/ Not Significant

Cross tabulation of Order Size and Reliability & Satisfaction is shown in Table 4. From the above table, it is observed that the calculated P = 0.015, which is statistically significant and less than 0.05. Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, it can be concluded that there is a significant relationship between Order Size and Reliability & Satisfaction.

Table 5: Cross tabulation of Chi Square test analysis with Delivery Delays and Operational Factors
Ho = There is no association between Delivery Delays Faced and Operational Factors

Delivery Delays Faced	Operational Factors			Total	Chi square
	Low	Medium	High		
Frequently (>50%)	2	7	4	13	15.432 017(S)
Sometimes (20-50%)	1	18	4	23	
Rarely (<20%)	0	21	3	24	
Never	3	5	0	8	
Total	**6**	**51**	**11**	**68**	

Source: Primary Data S/NS: Significant/ Not Significant

The cross tabulation of Delivery Delays and Operational Factors is shown in Table 5. From the above table, it has been observed that the calculated P-value is .017, which is statistically significant and less than 0.05. Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, it can be concluded that there is a relationship between Delivery Delays and Operational Factors.

Table 6: Cross tabulation of Chi Square test analysis with App Usage and Delivery Time Accuracy
Ho = There is no association between App Usage Duration and Delivery Time Accuracy & Promises

App usage	Delivery Time Accuracy & Promises			Total	Chi square
	Low	Medium	High		
Less than 6 months	10	14	3	27	22.564 04(S)
6-12 months	0	11	7	18	
1-2 years	1	9	2	12	

2-3 years	0	5	0	5	
Above 3 years	0	6	0	6	
Total	**11**	**45**	**12**	**68**	

Source: Primary Data S/NS: Significant/ Not Significant

The cross tabulation of App Usage and Delivery Time Accuracy is shown in Table 6. From the above table, it is seen that the calculated P-value is .004, which is statistically significant and smaller than the significance level of 0.05. Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, it can be concluded that there is a relationship between App Usage and Delivery Time Accuracy.

Table 7: Cross tabulation of Chi Square test analysis with Order Size and Delivery Time Accuracy

Ho = There is no association between Average Order Size and Delivery Time Accuracy & Promises

Average order size	Delivery time accuracy & promises			Total	Chi square
	Low	Medium	High		
< RS.300	9	14	1	24	18.393 05(S)
RS.300 - RS. 500	1	17	9	27	
RS.500 - RS.1000	1	10	1	12	
> RS. 1000	0	4	1	5	
Total	**11**	**45**	**12**	**68**	

Source: Primary Data S/NS: Significant/ Not Significant

The cross tabulation of Order Size and Delivery Time Accuracy is shown in Table 7. From the above table, it is seen that the calculated P-value = 0.005, which is statistically significant and smaller than the significance level 0.05. Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, it can be concluded that there exists a relationship between Order Size and Delivery Time Accuracy.

Table 8: Cross tabulation of Chi Square test analysis with Occupation and Communication & Support

Ho = There is no association between Occupation and Communication & Real-Time Support

Occupation	Communication & Real-Time Support			Total	Chi square
	Low	Medium	High		
Student	8	22	3	33	14.163 028(S)
Working Professional	0	16	7	23	
Business	0	6	0	6	
Homemaker	1	5	0	6	
Total	9	49	10	68	

Source: Primary DataS/NS: Significant/ Not Significant

The cross tabulation of Occupation and Communication & Support is shown in Table 8. From the above table, it is seen that the calculated P-value is .028, which is statistically significant and less than 0.05.

Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, it can be concluded that there is a relationship between Occupation and Communication & Support.

Table 9: Cross tabulation of Chi Square test analysis with Occupation and Likely to Recommend

Ho = There is no association between Occupation and Likely to Recommend

Occupation	Likely to Recommend				TOTAL	CHI SQUARE
	Very likely	Likely	Neutral	Very unlikely		
Student	8	11	10	4	33	21.222 012(S)
Working professional	15	8	0	0	23	
Business	3	1	2	0	6	
Homemaker	2	4	0	0	6	
Total	28	24	12	4	68	

Source: Primary Data S/NS: Significant/ Not Significant

The cross tabulation of Occupation and Likely to Recommend is shown in Table 9 . From the above table, it is seen that the calculated P-value = 0.012, which is statistically significant and less than the 0.05 level. Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, it can be concluded that there is a significant relationship between Occupation and Likely to Recommend.

RESEARCH GAP

This research on lead time variability in online grocery delivery applications emphasizes a restricted focus on last-mile delivery performance in the context of emerging Indian cities such as Coimbatore. Although existing research has explored customer satisfaction and overall service performance in online grocery applications, there is a restricted focus on the empirical analysis of delivery time variability and its operational determinants. The existing research is primarily focused on consumer behavior, digital adoption, and marketing strategies, with a restricted emphasis on the statistical relationship between demographic variables and delivery performance. There is also a restricted amount of research that focuses on the operational determinants of delivery performance, including peak-hour demand, traffic congestion, dark-store management, and delivery partner availability, and their impact on delivery time accuracy. This research aims to fill this gap by empirically analyzing the relationship between lead time variability and customer satisfaction using statistical analysis.

SCOPE FOR FURTHER RESEARCH

The e-grocery industry is undergoing a paradigm shift with advancements in technology and growing consumer demands. Therefore, the following topics could be explored in future research; Comparative studies can be carried out across various cities to understand regional differences in the performance of delivery lead times. Future research could investigate the role of artificial intelligence and route optimization technology in minimizing delivery time variability. An in-depth operational study can be carried out on dark store management and inventory coordination.

SUGGESTIONS

- Invest in optimized route planning algorithms to reduce delays due to traffic congestion and peak-hour demand.
- Improve dark-store inventory management to minimize stock-out situations and last-minute substitutions that impact delivery time.
- Ensure more delivery partners are available during peak hours through flexible workforce management.
- Ensure accurate real-time tracking and notification of delays to improve transparency and customer trust.
- Provide service recovery options such as discount coupons or credits in case of delivery beyond the promised time window.
- Regularly track delivery performance metrics to improve reliability and customer satisfaction.

CONCLUSION

According to the research, variability in the lead time of deliveries has a significant impact on customer satisfaction with the selected online grocery delivery apps in Coimbatore. While customers appreciate the convenience and time-saving advantages of these online apps, variability in the promised and actual delivery times has a negative effect on the overall trust factor. The results show that operational variables like traffic congestion, peak hour demand, inventory problems, and the availability of delivery personnel cause variability in delivery performance. The results of the statistical analysis suggest that variables like location, order value, app usage time, and occupation have a significant relationship with delivery performance and satisfaction levels.

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