

Evaluating Quick Commerce Delivery Operations with Supply Chain Efficiency and Their Impact on Customer Experience



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Abstract:

This study examines sustainable quick-commerce entrepreneurship in India by analysing how last-mile delivery efficiency, rider welfare, green mobility, and operational reliability influence customer satisfaction and customer loyalty. As platform-based quick-commerce ventures expand across Asian urban markets, their long-term growth depends not only on speed and convenience but also on sustainable logistics, ethical workforce practices, resilient supply chain systems, and customer trust. In India, firms such as Swiggy Instamart, Zepto, Blinkit, and Bigbasket have transformed urban retail through digital platforms, rapid fulfilment models, and dense last-mile delivery networks. However, this model faces challenges related to vehicle maintenance, delivery delays, app reliability, packaging and handling, product receipt failures, rider fatigue, and pressure for ultra-fast delivery. Based on survey responses from 200 last-mile delivery workers, this study uses reliability analysis, exploratory factor analysis, confirmatory factor analysis, and structural equation modelling to examine the effects of vehicle performance and maintenance, delivery logistics, app reliability, packaging and handling, and product receipt issues on customer satisfaction and loyalty. The findings show that vehicle performance, packaging and handling, and product receipt issues significantly affect customer outcomes, while delivery logistics and app reliability show comparatively weaker effects. The study contributes to entrepreneurship, innovation, and sustainable development literature by showing that quick-commerce ventures require green mobility, reliable delivery systems, rider-support practices, and customer-centred operations for sustainable growth in emerging Asian markets.

Keywords: Sustainable entrepreneurship; quick commerce; last-mile delivery; green logistics; customer satisfaction; customer loyalty; India.

1. Introduction

With the growing popularity of quick commerce in India, there is a broader paradigm shift in the way retail business is conducted today, where digital platforms, urban consumer needs, and last-mile logistics innovation are changing the dynamics of the retail industry (Savelsbergh & Van Woensel, 2016; Mangiaracina et al., 2019; Ha et al., 2023). The new breed of entrepreneurship, Quick commerce like Swiggy instamart, Zepto, Bigbasket and Blinkit is dependent on the factors related to speed, convenience, operational efficiency, supply chain responsiveness and user trust. These companies have revolutionized the way consumers go about grocery shopping and buying everyday necessities with their quick delivery service that utilizes technology-based fulfilment systems. But the sustainability of the model depends not only on the acceleration of delivery, but also on sustainable last mile operations, sustainable mobility, responsible rider management, effective packaging and service quality focused on the customer (Viu-Roig & Alvarez-Palau, 2020; Ignat & Chankov, 2020). Last-mile delivery is the most crucial and challenging part of the supply chain in the quick-commerce industry. It has a direct impact on

customers' satisfaction, customers' loyalty, operation cost and sustainable development of platform-based businesses (Florio et al., 2018; Vakulenko et al., 2019; Vasić et al., 2019). Service gaps occur in both rider and customer due to delivery delays, wrong addresses, abrupt changes to customer requests, product damage, packaging problems, vehicle failure, fuel expenses, and app failures. While quick handover is now a key part of customer expectations, delivering such quick turnaround may cause additional challenges for the operation and social productivity. Fatigue, burnout, delivery route stress, vehicle problems and similar issues can impact delivery efficiency, as well as the customer experience (Vakulenko et al., 2019; Mangiaracina et al., 2019).

The Indian quick-commerce market is particularly relevant for the study of sustainable entrepreneurship as the market is in dense urban areas, heavily relies on gig workers and consumers are increasingly expecting instant access to the products. This emerging industry has brought business opportunities, jobs and digital retailing models, but it has also raised sustainability concerns, worker welfare, operational reliability, environmental impact, etc. Electric vehicles,

optimized delivery routes, improved app performance, better packaging systems, and stronger rider-support mechanisms can contribute to more sustainable and inclusive quick-commerce operations (Liu et al., 2024).

Therefore, this study investigates the operational issues faced in quick-commerce delivery and examines their impact on customer satisfaction and customer loyalty. Specifically, the study focuses on vehicle performance and maintenance, delivery challenges and logistics, app reliability and technical issues, packaging and handling, and product receipt issues. By analysing these dimensions, the study highlights how last-mile delivery efficiency contributes to sustainable quick-commerce entrepreneurship in India. The findings are expected to offer useful insights for platform entrepreneurs, quick-commerce managers, logistics professionals, and policymakers seeking to build more sustainable, innovative, and customer-oriented retail ecosystems in emerging Asian markets

2. Literature Review

The phenomenal expansion of the Indian e-commerce market, especially within the quick commerce industry, has resulted in tremendous emphasis on optimization of last-mile delivery processes. This study is essential in determining the existing research on the same. According to research, last-mile delivery is a special challenge in the Indian setting. Research points out such problems as incorrect addresses, poor routes, capacities of delivery trucks, and communication deficiencies. They are the causes of poor deliveries, customer dissatisfaction, and cost increases. There is an increasing literature that highlights the necessity of effective and sustainable last-mile delivery. Frameworks discuss possible optimization, use of technology to keep track of routes in real-time, and sustainable practices, such as electric vehicles. This research emphasizes the necessity to manage the speed and the ecological friendliness of the last-mile logistics. Both the fast growth of e-commerce and evolving consumer demands prove to be the causes of the growing complexity of the last-mile logistics. The primary issues of the existing LMD environment are recognized as timeliness, condition of items, communication, and flexible delivery options (Lim et al., 2018).

As an example, poor logistics, high operation expenses and environmental issues provide an added burden to the delivery operations. The problem of increased delivery fees is especially acute, considering the economic crises resulting in an increase in the cost of fuel. Scheduling and route planning systems must be more advanced to address the need to deliver products within short timeframes and customer preferences of scheduled deliveries within time frames. The compatibility

between profitability and high service levels in a last-mile delivery is one of the critical issues in the sphere of a last-mile delivery, especially in the B2C e-commerce sector. This is especially acute in the areas such as electronic grocery shopping where effective home delivery systems should be developed to be cost-effective. Also, there is another problem, unsuccessful delivery attempts, or failed hits, that remain one of the greatest challenges of the e-commerce companies. Unsuccessful deliveries do not only involve extra expenses, but also affect customer satisfaction. The strategies proposed to improve the success rate of deliveries comprise availability profiling, route design, and revisit planning to optimize last-mile, which is increasing in the cost and inefficiency of last-mile logistics.

Unattended and attended delivery systems are proposed as innovative solutions to overcome the current challenges in last-mile logistics optimization. The use of reception and delivery boxes, unattended delivery has been proven to save as much as 60 percent in the cost of delivery. Such systems are based on the secure boxes being installed at the place of the customer to deliver without the involvement of a human. Though efficient, unattended delivery implementation involves high investments by the customers in terms of infrastructure and trust (Iwan et al., 2016).

Numerous strategies are proposed to address those challenges. The classic vehicle routing problem that is intended to minimize the distance and optimize the delivery paths is not very effective in terms of managing the number of deliveries that have increased. Artificial intelligence and machine learning are new and emerging innovative solutions in the optimization of the last-mile operations. One of them is the autonomous delivery robots with the help of AI that will reduce the workload and speed and accuracy of deliveries. The technological enhancement, in its turn, can also be offered with the implementation of the Internet of Things technologies and big data analytics to optimize the route management and reduce the unnecessary inventory as well as the predictive success of the delivery. Crowd-tasking models have also been suggested as scalable solutions for enhancing last-mile delivery performance (Wang et al., 2016).

In line with the technological advancement, the automation of the delivery process and the electrification of trucks could be considered one of the options to reduce the costs and environmental impact. The autonomous car products can be added to the last-mile delivery systems, which will contribute to the rise in efficiency and allow overcoming the challenges of labor-shortage and the rise in labor costs. Furthermore, end-to-end automation is possible with the support of such innovations as robotical couriers optimized with the help of the AI algorithms, as a result of which, it will be possible to break the issue of operational

uncertainty and customer preferences. Scheduling truck-based autonomous robots has also been examined as a possible solution for improving last-mile delivery efficiency (Boysen et al., 2018).

The current technological advancement has had a significant impact on the last-mile delivery solutions. Interest has been expressed in the use of autonomous vehicles, drones and electric delivery vehicles that could be used to reduce the environmental footprint of last-mile logistics. To give an example, e-vehicles, such as electric cargo bikes and vans are becoming increasingly used to reduce the level of emissions and congestion in city centers. Furthermore, among the potential ways to cope with the problem of traffic jams, the author suggests the usage of drones that will deliver the service much faster. These technologies have shown possible results in the sphere of the improvement of the efficiency of the last-mile delivery as well as the possibility of obtaining environmental sustainability, though some barriers to the implementation are also outlined like the regulatory challenges, the non-availability of the infrastructure, and consumer acceptance. Consumer acceptance and risk perception are therefore important issues in the adoption of autonomous delivery vehicles (Kapser & Abdelrahman, 2020).

As the sustainability issue has gained a burning role in logistics, increased attention is paid to minimizing the environmental footprint of last-mile delivery. There is an increase in the acquisition of green logistics, e.g., the use of electric vehicles and the optimization of delivery routes to reduce the use of fuel. The strategies are not only helping to reduce the carbon footprint of the delivery of e-commerce, but they also correlate with the growing demand of consumers to choose eco-friendly products. The issue of sustainability is growing in the center of the debate on the last-mile delivery. The conventional form of delivery, where trucks are used, adds to the congestion of the city and degrades the environment, such as air pollution and carbon emission. Autonomous air and ground delivery vehicles have been studied for their potential to reduce carbon emissions in grocery and last-mile delivery systems (Figliozzi, 2020).

Adoption of sustainable delivery systems, including electric cars and cargo bikes, has been determined as a good solution to such challenges. Moreover, pinpointing micro-depots as the part of the last-mile delivery process when goods will be accumulated in shorter, decentralized cells would not only be more environmentally friendly but also help to reduce the environmental footprint as smaller and more sustainable delivery vehicles will be deployed into the use in the dense urban settings. The use of shared delivery systems, i.e., the utilization of parcel lockers and urban areas, also is gaining momentum as one of the possible solutions to decrease inefficiencies in urban logistics. Parcel locker

networks have been identified as a practical solution to the logistics last-mile problem because they can reduce repeated delivery attempts and improve delivery consolidation (Deutsch & Golany, 2018).

The flexible needs of the consumers, particularly in the urban centers, are compelling the retailers to more flexible models of delivery. One of these is multi-channel retailing in which the customer receives a choice of delivery locations and timeframes in which they may accept the orders. This flexibility raises the customer level of satisfaction and complicates the planning of routes and logistics organization. The usability of parcel lockers from the customer perspective is also important because customer convenience, accessibility, and acceptance affect the success of alternative delivery systems (Lemke et al., 2016).

Similarly, the emergence of rapid business, particularly the grocery retail business, has introduced the problem of products delivery within the shortest possible time, adding even more pressure to the fact that the efficient and agile logistics systems were needed. Customer satisfaction is very important in improving last-mile deliveries. Last-mile logistics is often a complicated procedure that leads to customer dissatisfaction due to delays, unfavorable delivery experience, and absence of visibility in the logistics procedure. As per some research, artificial intelligence can be utilized to assist in the identification of the delivery time and optimization of the delivery path based on the existing traffic data. Alongside, AI may be utilized in assisting customer satisfaction by providing more accurate delivery time estimates and contacting the customers. Besides, the importance of reliability in the planned delivery can be a critical issue among the customers. It is also determined that flexible delivery services involve the customers modifying the date of delivery or determining when during the day it is most appropriate to obtain the delivery can go a long way in enhancing overall customer experience.

Last-mile logistics is being fundamentally redefined by the increased need to deliver goods within a specific timeframe, same day and express delivery, and associated expenses. The need to supply customers with speedier and dependable delivery solutions is being necessitated by factors including reduced product lifecycle, an augmented assortment of products, and enhanced consumer expectations. Retailers seeking to satisfy these demands must juggle the demand of speedy delivery and make money. One approach to address flexible customer delivery requests and overcome delivery inefficiencies is using routing models with roaming delivery locations (Reyes et al., 2017).

A number of simulation models and multi-agent systems are being considered to forecast demand better and to analyse a number of logistics solutions

which should take into account a wide range of demands from customers. You face other problems in the final mile when you're in a rural area, such as awful infrastructure, not enough transportation options, and higher prices. Another issue with these in developing countries is that they lack the necessary logistical support and so businesses that are currently in the country are not able to get products to faraway places in an effective way. To address these challenges, targeted last-mile delivery models are proposed, which consider the geographic, economic and customer preference characteristics of a particular region. Last-mile logistics research has been paying growing attention to a variety of contexts, sustainability issues, customer expectations, and study directions in logistics and supply chain management (SCM) (Olsson et al., 2019).

While the delivery bikes are being used in the last-mile delivery in India, the health and safety of the delivery executives has emerged as a concern due to the physical nature of their work. The critical piece of research that would add to the development of a sustainable workforce is ergonomics and health risk analysis of the activities of last mile delivery. Last-mile delivery issues in various regions, especially

emerging markets, are very different. Collection-delivery points have been examined as greener last-mile alternatives because they can influence activity-travel patterns and reduce the environmental burden of delivery operations (Liu et al., 2019). Comparing these problems to those faced by e-commerce businesses in more developed nations, such as China and South Africa, could offer helpful information about how to modify the last-mile delivery system to meet local demands.

Objective of Study

- To find the major operational issues in the quick commerce delivery process
- To study the impact of quick commerce delivery issues on customer satisfaction
- To study the impact of quick commerce delivery issues on customer loyalty towards the quick commerce company.

Hypothesis Statements:

- Hypothesis 1 (H1). The quick commerce delivery issues have an impact on customer satisfaction
- Hypothesis 2 (H2). The quick commerce delivery issues have an impact on Customer Loyalty

Conceptual Model:

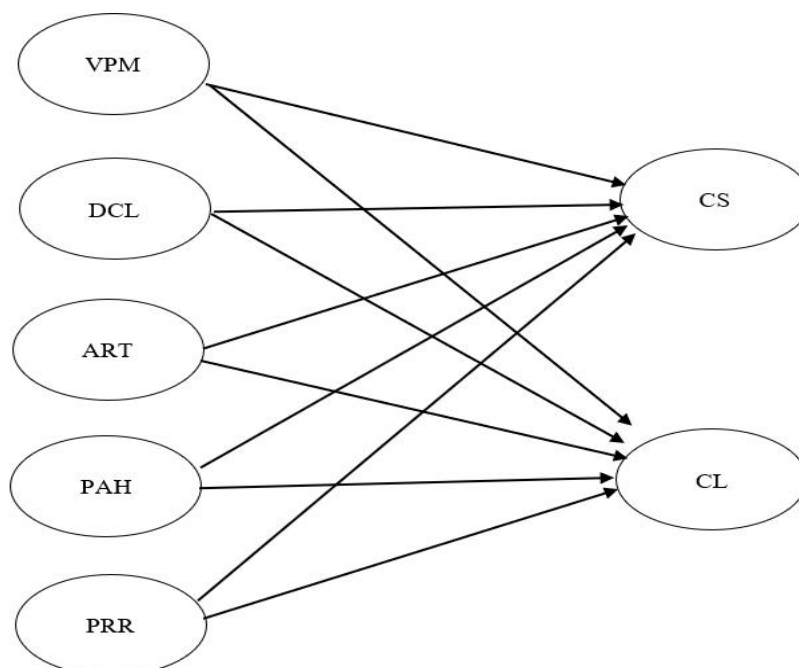


Figure 1: Research Structural Model

3. Research Methodology

3.1 Research Design

The research method used in this study was quantitative with descriptive survey method, which was used to obtain the main quality problems of Q-commerce. The objective was simple: identify the causes of service failures and understand the impact that they have on customer satisfaction and loyalty.

The data was composed of real voices, from last mile workers themselves. After collection, all was subject to many layers of statistical analysis that would convert numbers into meaning.

3.2 Data Collection Instrument

The entire study was based on a structured questionnaire. It contained a set of 24 statements,

with a five-point Likert scale from "Strongly Disagree" (1) to "Strongly Agree" (5). The items were divided into five themes:

- Vehicle Performance and Maintenance (VPM)
- Delivery Challenges and Logistics (DCL)
- App Reliability and Technical Issues (ART)
- Packaging and Handling (PAH)
- Product Receipt (PRR)

3.3 Sampling and Respondents

The research is based on the convenience sample consisting of 200 last-mile delivery employees, who were all neck-deep in Q-commerce operations. They were not added haphazardly, as they were familiar with the grind. A mixed sample was used by design since the population covered workers with diverse demographic and working experiences to broaden the scope of responses.

3.4 Data Collection Procedure

A combination of online and offline surveys were conducted (Google Forms and printed surveys). The purpose of the study was explained to the

participants prior to the study. Everything was voluntary. For the process to be fair, it was strictly observed that the given answers were pure and genuine, hence anonymity was observed.

3.5 Data Analysis

The answers were inputted into IBM SPSS and Microsoft Excel. The initial one was a descriptive statistic mean, standard deviation, and frequency numbers- to describe the surface story. In order to do it one step further, the variables were divided into more specific groups by means of the Exploratory Factor Analysis (Principal Component Analysis with Varimax rotation). The second one was an application of Structural Equation Modelling (SEM) that was used to visualize the interaction among these dimensions and the Customer Satisfaction and Customer Loyalty. Table 1 shows that the respondents were mainly young delivery workers aged 18–34 years, mostly using Yulu bikes and electric vehicles, with the majority having 6–12 months of quick-commerce delivery experience.

Table 1. Demographic Profile of Respondents

Age	Frequency	Percent
18-24	79	39.5
25-34	115	57.5
35-44	6	3.0
Total	200	100.0
Type of Vehicle	Frequency	Percent
Fae bikes	4	2.0
Motorcycle	67	33.5
Scooter	13	6.5
Yulu	116	58.0
Total	200	100.0
Type of Fuel	Frequency	Percent
Electric	120	60.0
Gasoline	80	40.0
Total	200	100.0
Months of experience	Frequency	Percent
0-6	54	27.0
6-12	101	50.5
12-18	39	19.5
18-24	6	3.0
Total	200	100.0

Out of the 200 responses collected, most of them are young adults with 97 percent being aged between 18 and 34. The majority, 57.5, are in the 25-34 range,

which indicates the existence of a workforce that comprises individuals who are in their physical and economical best. The 58 percent major mode of

transport is made of Yulu bikes followed by motor cycles at 33.5 percent. Scooters (6.5) and Fae bikes (2) are significantly less popular, not much more than a handful. Electric vehicles have taken over the old option. Approximately 60 percent of them use them with 40 percent using petrol engines. It is a very slight, but noticeable change towards cleaner movement. There is a difference in the level of experience, however. Approximately half (50.5) have been in business with these vehicles 6-12 months and second group (27) are in the 0-6 months category that indicates a young and still learning delivery workforce. This is how many new ones are to the game as there are only 3 percent with more than 18 months experience.

4. Results and Findings

4.1 Reliability and Validity

The items of the questionnaire were subjected to internal consistency testing by using Cronbach alpha which is usually done when psychometric analysis is conducted. An alpha of 0.842 suggests a high degree of reliability and that the scale is measuring what it is supposed to measure. Correlation between variables was checked for their validity using Pearson coefficient value which was significantly higher than the critical value. Now that they had correct information, that was a good basis to develop the interpretation from. The measurement scale has good internal consistency as seen in Table 2, Cronbach’s alpha for 24 items is 0.842.

Table 2. Reliability Statistics of the Scale

Cronbach's Alpha	N of Items
0.842	24

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is 0.853, which is considered excellent, indicating that the sample size is adequate for factor analysis. Bartlett's Test of Sphericity has a Chi-Square value of 6673.218, with 253 degrees of freedom and a significant p-value of 0.000. This result confirms that the correlation matrix is

significantly different from an identity matrix, suggesting that the data is suitable for factor analysis. Overall, both tests indicate that the data is appropriate for conducting factor analysis. Table 3 shows that the KMO value and Bartlett’s Test results confirm that the data are appropriate for factor analysis.

Table 3. KMO Measure and Bartlett’s Test of Sphericity

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.853
Bartlett's Test of Sphericity	Approx. Chi-Square
	df
	Sig.
	6673.218
	253
	.000

4.2 Exploratory Factor analysis for the Independent Variables:

Exploratory Factor Analysis was used in research to identify the underlying structure of a set of variables and to determine how they group together into latent constructs. The varimax orthogonal rotation method was used in this research to extract the factors. From the factor analysis 5 factors were extracted. The total variance explained by the factors is the sum of the eigenvalues, which is 27.949 % for the first factor. This represents the proportion of total variance in the observed variables explained by the extracted factors. The

first factor has a much higher eigenvalue of 6.428 compared to the other factors. Factors with eigenvalues greater than 1 are typically considered significant in factor analysis. In this case the first factor is the most significant, explaining a substantial amount of variance. The first two factors explain 41.023 % of the variance, and the first three factors explain 52.955%. The five factors cumulatively explain 68.787 % of the variance. Table 4 shows that five factors were extracted, together explaining 68.787% of the total variance in the data.

Table 4. Initial Eigenvalues and Total Variance Explained

Factors	Total	% of Variance	Cumulative %
1	6.428	27.949	27.949
2	3.007	13.074	41.023
3	2.744	11.932	52.955

4	2.044	8.888	61.844
5	1.597	6.943	68.787

The five factors extracted from the factors analysis are also mentioned in table 5. The construct, Vehicle performance and Maintenance Issues, shows a high level of internal consistency, as indicated by the Cronbach's Alpha of 0.823. This suggests that the items within this construct are reliably measuring the same underlying concept. The construct Delivery Challenges and Logistics Issues, also

exhibits a high level of internal consistency (Cronbach's Alpha = 0.771), indicating reliability among the items. The constructs, App Reliability and Technical Issues, show a moderate level of internal consistency (Cronbach's Alpha = 0.728). The other constructs exhibit lower internal consistency, suggesting that these constructs may need further refinement of the items included.

Table 5. Summary of Extracted Factors and Reliability Values

Factor No:	Constructs	Cronbach's Alpha (α)	No of item
Factor 1	Vehicle performance and Maintenance Issues (VPM)	0.823	6
Factor 2	Delivery Challenges and Logistics Issues (DCL)	0.771	6
Factor 3	App Reliability and Technical Issues (ART)	0.728	5
Factor 4	Packaging and Handling Issues (PAH)	0.652	4
Factor 5	Product receival Issues (PRR)	0.549	3

4.3 Confirmatory Factor analysis:

The researcher came up with five constructs to examine the interaction between observed and latent variables in Q-commerce system. Each construct was a group of factors linked to performance in delivering, experience of the worker, and customer outcomes. Transforming to test the accuracy in which these constructs represented the data obtained, Confirmatory Factor Analysis (CFA) was used. Model fit was assessed using various statistical indicators. The CMIN/df ratio was less than 3.00 which proved that the model fitted well to the observed data (Hair et al., 2010). Other complementary indices like AGFI, CFI, NFI, and the Tucker-Lewis Index also exceeded 0.9 which further strengthens the overall strength of the model. The value of RMSEA remained below 0.08, which is another indication that the model was able to

capture the relationships should they exist in the real world among the variables that were studied. All of the items had a factor loading greater than 0.60, which is another indication of strong convergent validity. The Average Variance Extracted (AVE) was above the 0.50 mark which implies that the constructs accounted more variance to their indicators than they lost to measurement error. The discriminant validity was confirmed through the square root of the AVE values being compared with the inter-construct correlations. As the AVE roots exceeded the corresponding correlation coefficients, the constructs were deemed clear and statistically reasonable. Table 6 represents the summarized findings, which provides a clear picture of the overall performance of every construct in all validity and reliability measures.

Table 6. Confirmatory Factor Analysis Results

Constructs and Variables	Factor loadings	Estimates	SE	Critical Ratio	P- Value	AVE	Construct Reliability
Vehicle performance and Maintenance Issues							
VPM 1	.812	1.000				.548	.826
VPM 2	.728	1.036	.157	6.609	***		
VPM 3	.716	0.924	.159	5.818	***		
VPM 4	.610	1.284	.192	6.677	***		
VPM 5	.594	1.375	.195	7.070	***		
VPM 6	.512	1.295	.190	6.816	***		
Delivery Challenges and Logistics Issues							
DCL1	.792	1.000				.521	.811
DCL2	.703	1.174	.186	6.327	***		
DCL3	.650	1.036	.173	6.001	***		

DCL4	.639	.919	.176	5.235	***		
DCL5	.611	.702	.160	4.389	***		
DCL6	.582	.576	.145	3.971	***		
App Reliability and Technical Issues							
ART1	.837	1.000				.539	.850
ART2	.867	1.737	.297	5.856	***		
ART3	.710	1.926	.315	6.108	***		
ART4	.649	1.688	.282	5.979	***		
ART5	.564	1.294	.253	5.117	***		
Packaging and Handling Issues							
PAH1	.760	1.000				.501	.710
PAH2	.707	.987	.108	9.142	***		
PAH3	.713	.784	.102	7.667	***		
PAH4	.563	.470	.079	5.963	***		
Product receival Issues							
PRR1	.785	1.000				.521	.716
PRR2	.639	1.220	.160	7.641	***		
PRR3	.597	1.202	.147	8.190	***		
Customer Satisfaction							
CS1	.796	1.000				.528	.681
CS2	.651	.907	.082	11.085	***		
Customer Loyalty							
CL1	.814	1.000				.608	.755
CL2	.744	.894	.062	14.327	***		

Model Fit Indices: $\chi^2 = 963.75$, $df = 329$, $\chi^2 / df = 2.92$ $p = .000$, $GFI = .925$, $AGFI = .924$, $IFI = .720$, $CFI = .831$, $TLI = .914$, $RMSEA = .071$, $NFI = .799$, $RFI = .768$

4.4 Discriminant Validity

Table 7 shows that the diagonal values are higher than the inter-construct correlation values,

confirming acceptable discriminant validity among the constructs.

Table 7. Correlation Matrix and Discriminant Validity

Correlation matrix and Discriminant Validity							
Factors	VPM	DCL	ART	PAH	PRR	CS	CR
VPM	0.740						
DCL	0.503	0.722					
ART	0.102	0.190	0.734				
PAH	0.235	0.144	0.224	0.708			
PRR	0.349	0.305	0.069	0.562	0.722		
CS	0.371	0.272	0.132	0.431	0.634	0.727	
CL	0.525	0.457	0.190	0.367	0.581	0.680	0.780

a. Goodness of fit in the hypothesized Model:

The SEM method and the maximum likelihood estimation method were used to analyze the research model. The strength of the model was

based on the intrinsic and extrinsic variables. The results shown in Table 8 illustrate a good fit of the hypothesized model, thus, it is authentic for evaluation.

Table 8. Goodness of fit in the hypothesized Model

Measures	Fit Indices	Value Accepted
RMSEA	.071	≤.08
GFI	.925	≥0.90
p-value	.000	P value ≥ 0.05
χ^2 / df	2.92	≤3 is Good
NFI	.799	≥0.90

CFI	.831	≥0.90
TLI	.914	≥0.90
CMIN/DF	2.82	≤3

b. Structural Equation Model Results:

A parameter’s standardization is judged based on regression weights (SE) and (CR) Hair et al. (2010), and then the critical ratio (CR) is divided by SE. It is

clear from the results shown in Table 9 below that the structural model supports the study’s hypotheses.

Table 9. Structural Equation Model Results

Hypothesis			Estimate	S.E.	C.R.	P
CS	<---	VPM	-.186	.071	2.631	***
CS	<---	DCL	.001	.071	.012	.990
CS	<---	ART	.065	.047	1.386	.166
CS	<---	PAH	-.479	.067	1.181	***
CS	<---	PRR	-.528	.068	7.738	***
CL	<---	VPM	-.370	.075	4.965	***
CL	<---	DCL	-.190	.075	2.526	***
CL	<---	ART	.120	.050	2.417	.438
CL	<---	PAH	-.416	.070	.221	***
CL	<---	PRR	-.460	.072	6.403	***

4.7 Summary of Results and Findings:

The Cronbach alpha - was used to determine the data trustworthiness - obtained 0.842, which is satisfactory to indicate that the questions complement each other. That implies that one gets responses that clustering around common notions and therefore the results are likely to represent actual trends. Having that said, Pearson correlations within the table exceeded the necessary levels and supported the validity thereof. To be prepared to do the factor analysis, KMO reached 0.853 which is a good evidence that the sample is fine to do the testing. Bartlett’s test on the other hand had a Chi-Square of 6673.218, Chi-square of 253, and a p-value of 0.000. This is a sharp contrast with random chance, which proves that variables are related to the extent of factoring.

A follow-up check was done on patterns with clear rotation method in order to identify basic links among items. This revealed 5 key themes that describe almost 69% of the overall differences. The former one encompassed the largest part on its own - slightly less than 28 percent - with a robust score more than six, far beyond the standard line of one, indicating that it is more important than others are. The two heads combined, less than five out of ten of the parts of variation; to which, by the third, it was raised to nearly half, and somewhat. The other factors however with smaller contribution individually, when summed together still contributed approximately 69% of the total variation - indicating the model captures most of the significant trends in the data. The review resulted in five themes, namely how vehicles are working and their maintenance challenges (VPM), issues related

to deliveries and logistics flow (DCL), app compatibility and technical hiccups (ART), challenges with packaging and goods handling (PAH), and challenges in product reception (PRR). Cronbach Alpha was applied to test the internal consistency of these groupings. In the case of VPM, the score was 0.823, indicating that the questions are closely related around a singular concept. In the meantime, DCL was 0.771, which indicates strong coherence among its elements. The Cronbach Alpha of ART was 0.728 - not very good, but only adequate. Nevertheless, PAH and PRR were lower and it suggests that those sections may require adjustments to make them stick together.

The Confirmatory Factor Analysis results indicate that the model has a high construct validity and reliability on the whole. The values of the Average Variance Extracted majorly surpass the acceptable value of 0.5 showing that the latent constructs explain a satisfactory level of variance in their indicators. Notably, Customer Loyalty has the highest AVE value (0.608) indicating strong construct validity since VPM (0.826) and DCL (0.811) have slightly lower values, although these are still above the necessary threshold. PAH construct has a slightly less reliability (0.710), but it is still good, whereas Customer Satisfaction has the lowest reliability (0.681), but it also remains within acceptable range. All the measured variables are statistically significant, and the p-values are observed (p < 0.001), which confirms that every indicator represents its latent construct. Overall, the results can confirm that the model will be valid and reliable since the majority of constructs have strong supports of convergent validity and internal

consistency. To compare the discriminant validity of the constructs, we compared the AVE values of each of the factors with the squared correlations of factor pairs. When the AVE of a construct value exceeds the squared correlation between that construct and any other construct, then it is possible to determine that a construct is discriminant-valid. The AVE values used in the analysis were above 0.5 on most constructs indicating that they are sufficient to explain the variance in the corresponding indicators. Further, the AVE values were compared with the squared correlations between factors, where the outcome indicated that the AVE of each factor has higher values compared to the squared correlations between the factors, thus indicating further the discriminant validity of the model. It means that constructs are highly differentiated and measurement model demonstrates high construct validity, which means that a factor reflects a different dimension of data.

The results from the Structural Equation Model reveal several important insights into the relationships between the independent constructs and the outcomes of Customer Satisfaction and Customer Loyalty. The major factors influencing these outcomes include Vehicle Performance and Maintenance Issues (VPM), Product Reveal Issues and Packaging and Handling Issues. Specifically, VPM has a significant negative effect on CS (Estimate = -0.186, C.R. = 2.631, $p < 0.001$), indicating that as vehicle performance and maintenance issues increase, customer satisfaction decreases. Similarly, PRR strongly negatively impacts both CS (Estimate = -0.528, C.R. = 7.738, $p < 0.001$) and CL (Estimate = -0.460, C.R. = 6.403, $p < 0.001$), demonstrating that issues with product receipt significantly lower both customer satisfaction and loyalty. PAH also has a negative influence on both outcomes, though it is non-significant for CS (Estimate = -0.479, C.R. = 1.181, $p < 0.001$) but significantly reduces CL (Estimate = -0.416, C.R. = 0.221, $p < 0.001$). On the other hand, Delivery Challenges and Logistics Issues and App Reliability and Technical Issues have less significant effects. DCL has a small negative impact on CL (Estimate = -0.190, C.R. = 2.526, $p < 0.01$) but no effect on CS (Estimate = 0.001, C.R. = 0.012, $p = 0.990$), suggesting that logistical issues are more influential on customer loyalty than satisfaction. ART, with a non-significant positive effect on CS (Estimate = 0.065, C.R. = 1.386, $p = 0.166$) and CL (Estimate = 0.120, C.R. = 2.417, $p = 0.438$), does not appear to be a strong determinant for either outcome. The major factors influencing Customer Satisfaction and Customer Loyalty are Vehicle Performance and Maintenance Issues and Product Reveal Issues, with PRR having the strongest negative impact. VPM and PAH also had customer satisfaction and customer loyalty negative relationship. The effect of DCL and ART has been

relatively small however, DCL had a significant effect on customer loyalty whilst ART had no significant effects.

5. Discussions

The results of this study have implications for sustainable quick commerce entrepreneurship in India. Speed, convenience, and customer responsiveness are typically used to assess quick-commerce businesses, but the results from this study also indicate the importance of last-mile delivery operations for the sustainability of these platform-based businesses. In emerging Asian markets, where the expectations of customers are growing and the models of digital retail are spreading quickly, sustainable entrepreneurship depends on businesses' ability to do more than just be efficient: they must be environmentally responsible, consider the well-being of riders, and gain customers' trust. Hence, performances of the vehicles, logistics for deliveries, reliability of the application, safe handling and receiving the product should not be considered solely as operational aspects but also as strategic aspects affecting the sustainable growth of quick-commerce businesses (Srinivas & Marathe, 2021).

On this aspect, it is shown that the poor state of vehicles and vehicle performance has negative effect on the satisfaction of customers with an estimated value of -0.186 and significance level of $p < 0.001$. The results align with the previous research, which has demonstrated that issues with vehicles emerge prominently in last-mile deliveries. Deliveries suffer, packages can be damaged, operational costs are higher when delivery bikes or vehicle fail, particularly in urban centres or in poor infrastructure areas. Stable roads, fuel prices, traffic congestion and mechanical issues can therefore have a direct impact on delivery performance and reliable, well-maintained delivery vehicles are therefore essential in a country like India, where these conditions are not stable. This is also an important sustainability implication. Delivery vehicles are not only assets but also a pivotal means for sustainable platform growth. Safety risks for the customers, reduced customer confidence in service, and fuel consumption can all be a result of poorly maintained vehicles. Hence, there is a need for quick-commerce companies to put money into frequent vehicle maintenance, fuel-efficient mobility, EV and rider safety support (Zhen et al., 2020).

One of the significant findings of the present study is that Product Reveal Issues has found to significantly affect Customers Satisfaction and Customer Loyalty with estimate values of -0.528 and -0.460 respectively and at $p < 0.001$. This result corroborates the literature, which shows that there is a recurring problem of failed deliveries and receiving products in bad condition that leads to dissatisfaction. Common issues that plague the

overall customer journey in the Indian quick commerce market are failed deliveries, wrong addresses, lack of communication, poor infrastructure, or damaged products. Sustainable entrepreneurship means that the key to customer trust and making platforms successful is product receipt reliability. Not only should customers receive their products quickly, but they also want them to arrive in good condition and with all the necessary parts. Deliveries that are unsuccessful, items delivered in the wrong order, damaged products or poor handover experiences can lessen customer satisfaction and decrease repeat purchase rates. Thus, product reliability of receipt is a key factor in retaining customers, establishing the credibility of a brand, and ensuring continuous business expansion, particularly in platform-based entrepreneurial businesses (Rashid & Rasheed, 2024).

The study outcomes also validate the importance of efficient and effective packaging and handling in product delivery to ensure success. The findings revealed that Packaging and Handling Issues had an estimate of -0.416 and significant at $p < 0.001$, having a significant influence on customer loyalty. Packaging and handling had no strong significant impacts on customer satisfaction in the present study, but the effect on customer loyalty suggests customers will be able to tolerate minor packaging and handling problems in the short term, but over a longer period of time, customer willingness to continue their usage decreases as a result of packaging and handling problems. Packaging and handling also has an inherent sustainability aspect. A poorly packaged product or mishandling can cause the product to be damaged or lost, returns, repeated delivery trips and complaints from customers. All these problems lead to unnecessary environmental burden and higher operational costs. In fast commerce, the place where the groceries and daily need goods are delivered within short time frame, quality of the package and handling of the product plays a very significant role. Therefore, the organizations should implement better quality control measures, handling procedures, and sustainable packaging solutions (Asawawibul et al., 2025).

Delivery Challenges and Logistics Issues were found to have negative values and a small effect on customer loyalty with estimate value of -0.190 and significant at $p < 0.01$, but not significant on customer satisfaction. This finding aligns with previous research, which have found that logistical inefficiencies, problems with route planning, pressure on delivery time, and infrastructural problems contribute significantly to customer dissatisfaction and lower loyalty. Operating costs, traffic jams, weather, fuel cost and customer requested changes are also often cited as aggravating logistical concerns. The lack of a

significant impact of delivery challenges and logistic issues on satisfaction, however, might indicate that customer's perception of final delivery result, i.e. correct, safe and timely delivery, is more important in urban quick-commerce markets. It can also be a sign of the cumulative impact of logistics issues. While one delivery failure might not directly cause customer dissatisfaction, multiple delivery failures can lead to customer dissatisfaction over time (Shao et al., 2019).

The study revealed that customer satisfaction and customer loyalty remained unaffected by the App Reliability and Technical Issues. This discovery is contrary to some older research that focuses on the role of mobile apps, tracking systems, digital notifications, and communication platforms in enhancing customer satisfaction. But, in the Indian quick-commerce scenario, the lower effect of app reliability could mean that consumers value the physical delivery aspects more than the digital delivery of the app itself. That doesn't mean that app reliability is not important. Instead, it indicates that digital innovation is reliant on solid physical infrastructure and reliable delivery execution. While getting the application interface to be smooth, it would not suffice if the vehicle performance is poor, delivery is missed, product damage or weak packaging. This implies technology must be combined with solid last-mile operations (Aljohani, 2024) for fast-commerce entrepreneurs.

This research finds that the results of this research are in accordance with the literature that is rapidly increasing regarding the role of technology in optimizing last mile delivery. There are various possibilities for mitigating the workload, delivery time, and operational efficiency in order to overcome the challenges of labour shortage, such as artificial intelligence, machine learning, autonomous vehicles, route optimization systems, and big data analytics. Likewise, evehicles and drones are seen as potential solutions to help decrease environmental impact and enhance delivery efficiency in urban areas. These technological developments could be used to solve some of the issues that were identified in this study, particularly with respect to vehicle reliability, delivery efficiency and customer experience. There are of course challenges to these technologies, such as infrastructure constraints, regulatory issues, customer acceptance, and investment costs. Technological solutions must be tailored to the local conditions found in emerging markets, such as India, including traffic congestion, road quality, address accuracy, and availability of riders, fuel costs, and consumer expectations (Hübner et al., 2016; Wollenburg et al., 2018).

Additionally, the study emphasizes the importance of rider welfare as a crucial element in sustainable quick commerce entrepreneurship. The speed at which work needs to be completed can cause fatigue, stress, burnout, accidents, and vehicle-related issues.

The well-being of delivery personnel is intrinsically linked to the reliability of service and overall customer experience, as they are the backbone of the quick-commerce operations. Applicants must have a good balance between speed of delivery and responsibility towards their working population when it comes to ethical and sustainable entrepreneurship. These involve realistic targets for delivery, training on safety measures, access to vehicle maintenance support, insurance support, fair grievance handling procedures, and improved route planning (Yuen et al., 2018).

Overall, the findings suggest that same-day and express delivery services are redefining last-mile logistics in India. The increasing pressure on urban logistics due to quick commerce requires existing delivery systems to adapt to shorter delivery times, changing customer expectations, and greater service complexity. In summary, the major factors influencing customer satisfaction and customer loyalty are Vehicle Performance and Maintenance Issues, Product Receiving Issues, and Packaging and Handling Issues. Product receipt issues have the strongest negative effect, while vehicle performance and packaging also play important roles. Delivery challenges and logistics issues have a weaker but relevant effect, particularly on customer loyalty, whereas app reliability and technical issues show no significant influence in the present study. These findings confirm that sustainable quick-commerce entrepreneurship in India depends on more than rapid delivery. It requires reliable last-mile infrastructure, green mobility, responsible packaging, accurate product receipt, rider-centred management, and customer-focused service quality (Morganti et al., 2014; Vrhovac et al., 2024).

6. Managerial Implications:

The findings of the study indicate that the operation of some of these aspects is important in determining customer satisfaction and loyalty. Specifically, the issues of the performance and the maintenance of the vehicles, the receipt of the products, and packaging and handling were determined as the most significant at the negative influence on CS and CL. As a result, the managers should aim at ensuring that the delivery vehicles are trustworthy and performing frequent repairs as a means of minimizing disruption. It is also necessary to enhance the product acceptance segment through delivering the product in time and packaging to maintain both the expectation of the customer and to enhance satisfaction. A smaller contribution to the satisfaction, however, packaging and handling issues were found to affect customer loyalty in a substantial manner and, subsequently, the quality control and training in this regard could be needed. Even though the reliability of the apps did indicate a relatively minimal impact on the customer outcome, glitchy-free apps are to be regarded as significant to

the experience of the entire user. The managers should also deal with inconsistencies in the company in the areas like packaging and receiving of products to improve reliability and operational efficiency in the company. Finally, customer-feedback loop would assist in noticing the issues and fixing them prior to its impact on the loyalty level. By tackling some areas of operational improvement and devising interventions to satisfy the customer needs, companies can become more customer friendly, improve customer satisfaction and customer loyalty, which in the long-term would turn into business success.

7. Limitations And Scope of Future Research:

This study has multiple limitations that are to be taken into account in order to derive the findings. First of all, a small sample size and the potential non-diversity can decrease the extrapolation value of the results. Also, the respondents may not be chosen in a huge demographic or geographical area, so the findings cannot be applied to a general customer base. It is also difficult to be able to establish how the operational factors were altered with the time and how long-term impacts of operational factors on customer satisfaction and loyalty as the cross-sectional nature of data also provides only a one-time image of customer experiences. It also has a weak point in the use of self-reported data, which can lead to the possible occurrence of any kind of a bias, such as social desirability bias or false memory, which can undermine the validity of the results. Lastly, the research was on critical elements of operations, including performance of vehicles, packaging and product receipt, yet, it failed to research other potential variables that influenced it, which includes interactions with customers and brand image.

Despite the existence of these limitations, there are a number of research directions that can be extended to cover the findings of this research. The weaknesses associated with sample diversity could be addressed in a new study by studying the effect of the factors identified so far on customer satisfaction and loyalty in different industries, regions, and customers. Longitudinal study would help in the case of the development in the perception of the customer over the years, particularly with regard to the response to the change in the quality of the service or the advancements made in the processes. In addition, self-reported surveys can be complemented with the objective information that may be the records of the transactions or service contacts with the clients and reduce the number of biases in the study. Additional variables that lead to customer loyalty may also be considered in further research, such as pricing, emotional engagement, or the effect of technological innovations like AI and automation on the customer service. The analysis of the evolving

demands of the customers in a more competitive and technologically inclined world can also be of great importance to the businesses who wish to retain the customers of the business over the years.

8. Conclusion

The study reveals the important variables that affect the satisfaction and loyalty of customers in the quick-commerce industry. Delivery speed was not the only factor for customer ratings, the quality of the goods and the packaging also had an influence. If any of these features aren't provided, the customers are aware of the same right away. While it might appear like a minor detail, app stability and route optimization deliver value on key features like navigation menus that are easy to understand, delivery times are consistent, and there are less technical problems during checkout. Delivering business to customers with greater confidence can be done through the maintenance of delivery vehicles, the improvement of order-matching systems, and the optimization of packaging processes. While some changes are small, they can yield significant improvements in customer perceptions and overall performance. There are some shortcomings in the study, however. Bias may have occurred in the results due to the sample consisting largely of one type of information source and to self-reported information. The study results are sound for further research, however, given these limitations. More in-depth analysis of certain products, their delivery processes or the embedding of smart technologies in the supply chain could yield other factors that affect customer retention and satisfaction.

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