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The Impact of Innovations on Service Quality and Consumer Satisfaction: A Study of Transportation Technology Aggregators in Pune, India

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Abstract

Modern technological advancements have introduced major changes to how people obtain rides from transportation companies. This research examines how technology advancements affect the service quality along with customer satisfaction for transportation technology aggregators serving in Pune. Research followed a quantitative method through the distribution of structured questionnaires to 129 respondents. Research examined the main service quality elements from accessibility through safety and pricing and efficiency to study their relationship with consumer satisfaction. The research adopted regression models as well as statistical procedures to establish relationships between technological improvements and service quality and consumer satisfaction levels. Technology-based features generate positive impacts on service quality based on statistical observation ($R^2 = 0.355$, $p < 0.001$) as app-based booking and real-time tracking and digital payments and AI-driven analytics directly improve operational efficiency along with user experience. The research data establishes that service upgrades directly create positive satisfaction outcomes within consumer groups ($R^2 = 0.540$, $p < 0.001$). The advantages of using digital systems are complemented by ongoing service functionality issues and customer privacy risks as well as dynamic pricing troubles. The research demonstrates both the necessity of technological development and regulatory institutions to enhance service delivery across all its aspects while resolving consumer issues. This research enhances existing knowledge of urban mobility patterns in Pune by offering practical recommendations to improve consumer satisfaction for aggregators. The obtained research results provide essential insights for stakeholders working in transportation industries and urban planners who want to develop sustainable transportation systems.

Keywords: *Transportation Technology Aggregators, Technological Innovations, Service Quality, Consumer Satisfaction, Urban Mobility.*

Introduction

The influence of innovations on service quality and user satisfaction within the realm of transportation technology aggregators has been extensively studied and debated. The diffusion of technology has transformed the transportation industry, with companies like Uber, OLA, and Rapido utilizing mobile applications, artificial intelligence, and data analytics to improve service efficiency and customer experience. These advancements have resulted in substantial enhancements in service quality, encompassing improved accessibility, diminished waiting periods, and augmented safety measures. With the rise of digital systems that allow for easy booking, real-time tracking, and cashless transactions, innovation has greatly impacted service quality. With the rise of app-based ride-hailing services, customers now have more choice over their transportation alternatives and the typical inefficiencies of taxi networks are gone. Travel routes and fare computations have been further optimized using GPS navigation and dynamic pricing algorithms, ensuring cost-effectiveness and efficiency. Aggregators are able to better distribute resources and reduce service interruptions with the use of AI-driven analytics, which also aid in demand forecasting and fleet management (Remez, 2024), (Prananta et al., 2024). Innovations in safety and security also improve the quality of service in Transportation Technology Aggregators. App security features like ride monitoring, SOS buttons, driver background checks, and in-app communication channels give users peace of mind.

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To ensure a greater level of professionalism among drivers, many platforms use rating and feedback systems to hold them accountable. In addition, developments in electric and autonomous car technologies are set to revolutionize the industry by cutting down on pollution and operational expenses, which is good news for everyone involved (Jain, 2024), (Zhou et al., 2013).

Improvements in service quality brought about by technology breakthroughs are closely correlated with consumer pleasure. Users may now have a more tailored experience thanks to features like customizable ride preferences, vehicle type selection, and loyalty program access. These platforms promote confidence and dependability through their transparency, especially when it comes to fare estimation and driver details. Additionally, the use of automated dispute resolution systems and customer service chatbots driven by artificial intelligence has simplified the management of complaints and increased the overall efficiency of consumer assistance.

Consistent service quality across areas remains a difficulty, despite these developments. Differences in customer experience may result from differences in network coverage, regulatory compliance, and the availability of the labor. The massive volumes of personal information collected by ride-hailing companies raise serious concerns about data privacy and cybersecurity. Maintaining consumer trust and regulatory permission requires a delicate balancing act between innovation and ethical concerns. The equity of transportation aggregators' pricing methods is another important component of customer happiness. Even though dynamic pricing makes peak hours more efficient, it has also caused price spikes that some may see as exploitative. Businesses still face the difficult task of keeping prices low while yet turning a profit (Verma, 2023), (Balamurugan & Kirubanidhi, 2024), (Chen & Chen, 2023).

Literature review

(Amara et al., 2024) To stay ahead of the competition in today's market, businesses are focusing on providing better services to their customers. At Annaba's national rail transport firm (SNTF), this study looks at how customer satisfaction is affected by the quality of transport services. We aimed to measure their influence on customer satisfaction by focusing on a spectrum of variables, including service offering, accessibility, information provision, time efficiency, customer care, comfort, safety, and environmental impact. With a quantitative method, we randomly distributed 277 surveys to SNTF Annaba train passengers and used SPSS to evaluate the results. Customer satisfaction levels are positively correlated with transport service quality measures, according to the data. Passengers are quite satisfied with the services they receive, and there is a strong dedication to following the AFNOR NF EN 13816 standard. Although our research has shown that the organization is taking the right steps to adopt a quality-focused policy, we have also found some places where they may improve to make their customers even happier. These results highlight the significance of keeping up the good work in improving customer satisfaction and fixing current problems.

(Chandratreya & Kulkarni, 2024) The ways in which these platforms are changing urban transportation are the primary subject of this investigation into the innovations and difficulties of managing online taxi aggregators. Regulatory compliance, driver management, customer happiness, and competition are just a few of the operational hurdles that cab aggregators must overcome in order to meet the increasing demand for ride-hailing services. Improving service efficiency and user experience is greatly aided by technological innovations including mobile applications, artificial intelligence, and real-time data analytics. The research looks at case studies from top taxi aggregator platforms to find out what works and what doesn't in terms of management and operation. This research seeks to analyze the relationship between technology and management strategies in order to help industry stakeholders adapt to the changing world of online cab aggregation.

(Madhumitha, 2022) The remarkable expansion of the passenger car market is significantly supported by the domestic taxi sector. The Indian passenger vehicle sector is anticipated to exhibit significant development potential in the short term, while medium to long-term expansion will be bolstered by low car penetration rates and rising consumer income levels. Th is study report examines consumer satisfaction about Ola call taxi service providers in Chennai, the southern hub. The study examines consumers' attitudes about the use of call taxi services, focusing on comfort, accessibility, pricing structure, promotions, safety, convenience, and overall satisfaction with the service quality provided. This descriptive research analyzes the factors influencing their choices, assesses their perspectives on service improvement, and identifies the reasons for their dissatisfaction. It employs convenience sampling, utilizes appropriate tools for data collection, and offers feasible recommendations. The outcome unequivocally highlights the exceptional growth anticipated in the future.

(Et. al., 2021) The objective of this study is to ascertain the correlation between service quality and customer satisfaction for cab services in Bengaluru, India. Six criteria were identified: comfort, safety, affordability, extent of service, driver behavior, and reliability. Pearson's correlation analysis indicated that all variables exhibited a positive association with customer satisfaction. Six hypotheses were examined to investigate the impact of these variables on customer satisfaction. Multiple regression indicated that the variables had a substantial impact on customer satisfaction. Up to 97% of the variance in customer satisfaction can be elucidated by six investigated variables.

(Narges et al., 2013) This study aims to examine the impact of service quality and new services on customer satisfaction. The study utilized a model proposed by Lein and elements of the Servqual model. This correlative study was performed as a field investigation including the statistical population of all customers with accounts at Parsian Banks in Tehran. The sample group was randomly selected, and data were collected by a questionnaire based on field research. For data analysis, 382 completed questionnaires were returned, and correlation and regression coefficients were calculated using SPSS. The results indicated that, regarding several facets of contemporary services, customer engagement with the institution is the most effective factor influencing customer happiness, followed by technology, the introduction of new services, and the delivery system. The development of new services had the most significant impact on service quality, followed by consumer connection with the institution, technology, and the delivery system. Furthermore, the findings of the regression analysis indicated that all dimensions

of service quality influenced customer happiness. Empathy yielded the highest customer satisfaction, followed by guarantee, responsiveness, and reliability.

(Danjum & Rasli, 2012) Innovation, previously a phrase mainly denoting advancements in manufacturing technologies, has increasingly been applied within the service industry. The emergence of globalization has resulted in demographic and technological transformations. Service innovation has gained prominence and presents challenges not only to profit-driven enterprises but also to non-profit entities such as higher education institutions. This necessitates a 'disruptive' approach to innovation within the sector, aimed at targeting new customer demographics and improving service quality to ensure satisfaction. Innovation frequently generates a substantial influx of new clientele, exemplified by the influx of new students at higher education institutions, while also addressing the evolving demands of existing consumers. This conceptual paper aims to examine issues related to service innovation, its characteristics, and implications within higher education institutions, particularly technological universities, to develop and utilize new value propositions for enhancing service quality, positioning, and achieving competitive advantage in the higher education marketplace. Conclusions were drawn concerning the impact of service innovation on enhancing customer satisfaction.

Research Gap

Few studies have concentrated on Transportation Technology Aggregators in the Pune context, despite the abundance of literature exploring the relationship between innovation, consumer satisfaction, and service quality in fields like banking, transportation, and higher education. Rail transport, Bengaluru taxi services, and Chennai's domestic taxi sector are just a few examples of areas where previous research has focused on measuring service quality. Nevertheless, there is a noticeable absence of a focused examination in these studies regarding the specific ways in which innovation in technology and services impacts customer satisfaction in the ever-changing urban transportation sector led by aggregators. In addition, previous studies have focused on broad methods of service enhancement without delving deeply enough into the complex ways in which digital technologies, real-time data analytics, and the integration of mobile applications affect urban consumers' experiences. The literature vacuum is further highlighted by the need for more in-depth analysis of regional consumer habits and expectations, particularly in a city experiencing rapid growth like Pune. If this is addressed, global ideas can be better adapted to meet the needs and preferences of local communities.

Significance of the Study

For multiple reasons, this study is crucial. The primary objective is to fill the knowledge gap by investigating how transportation technology aggregator ecosystem in Pune has benefited from service innovations, such as the use of cutting-edge digital technologies and operational efficiencies, in terms of both service quality and consumer happiness. Pune is a city with a rising demand for tech-driven mobility solutions; this study will give tailored insights into consumer dynamics in this area by concentrating on a specific metropolitan region. Additionally, Transportation Technology Aggregators will benefit from this study's practical suggestions for enhancing service quality and consumer satisfaction, which will add to the overall knowledge of how technological advancements change urban mobility. Policymakers, urban planners, and aggregator platforms can use the insights to improve urban mobility experiences while meeting consumer expectations, ensuring operational efficiency, and complying with regulations Finally, the research will add to the worldwide conversation on sustainable and innovation-driven urban transportation solutions by serving as a template for future studies in other developing metropolitan areas.

Statement of the problem

Transportation technology clumping has become prominent in Pune rapidly and has led to a dramatic increase in service improvements through technological influences. However, how these innovations affect the quality of services has not been well explained. Similarly, there is a research gap regarding how different service quality factors are related to consumers' satisfaction and how administrative practices factor the success of the transportation aggregator. This research will seek to establish the following objectives: To assess the effects of technological innovations on service quality, to examine the relation between service quality and consumers satisfaction, and finally, to determine the effects of administration practices on consumers satisfaction not forgetting the effects on service quality as well. From the understanding of these relationships, important insights toward the upliftment of service standards and consumers' experiences in the transportation technology platforms in Pune will be made.

Objectives

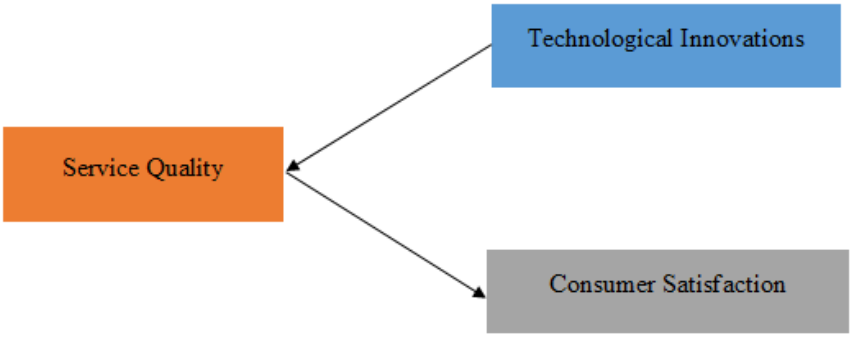
- To evaluate the impact of technological innovations on service quality parameters in Transportation Technology Aggregators in Pune.
- To analyze the impact of service quality parameters on consumer satisfaction in the context of Transportation Technology Aggregators.

Hypothesis

H1: Technological innovations in Transportation Technology Aggregators in Pune have a positive impact on the overall service quality.

H2: There is a significant impact of Service Quality parameters on Consumer Satisfaction in the context of Transportation Technology Aggregators.

Conceptual framework



Research Methodology

The systematic approach for gathering research data as well as executing research belongs to the research methodology. The research methodology involves specific methods alongside investigative tools that help researchers properly secure valid as well as reliable data outcomes. The methodology specifies how research procedures are designed through determining research methods and sample selection procedures and data collection tools that range from surveys to interviews and observations. The data analysis approach is defined within the methodology section to allow researchers to detect patterns and run hypothesis tests and answer specific research questions. The detailed definition of the research process allows methodology to create structured research frameworks that enable researchers to reproduce or evaluate studies. The study needs to focus on generating results that expand existing knowledge within its specific discipline.

Research Design

A quantitative approach drives this research investigation which studies technological innovation effects on service quality and consumer satisfaction in Pune-based transportation technology aggregation services. A survey structure collected information from consumers who accessed rides through Transportation Technology Aggregators such as Uber, Ola, inDrive and Rapido. The research implements a descriptive model to study service quality measurement units and their connections to customer satisfaction ratings. A regression analysis method confirmed the existence of statistical relationships by determining the power between different variables to produce valid conclusions.

Proposed Methodology

The study conducted a survey with predefined questionnaires to measure variables that explored service quality together with innovation and consumer satisfaction. A random sampling approach was utilized to pick participants for the study to include various members of different populations. Perceptions toward technological innovations and their effect on service quality were assessed through a Likert scale-based measurement system. A structured questionnaire divided its sections into main service aspects consisting of ride comfort and pricing alongside accessibility and safety elements and general user experience evaluation.

Data Collection

A total of 129 transportation aggregator users in Pune, India participated in surveys conducted online through a Google Form method. A sample of 129 respondents received the survey while the researcher implemented selection criteria for different user demographics including age groups and gender distribution alongside service usage frequency. The research depended on secondary information derived from academic investigations combined with published reports and industry journals. The analysis of internal consistency used Cronbach's alpha method which showed that all variables presented reliable results.

Statistical Analysis

The analysis of data through SPSS software verified research hypotheses along with the relationship between the examined variables.

Result and discussion

Internal consistency assessment comes first in the results section through evaluation of the selected item's reliability. The reliability assessment used Cronbach's alpha which demonstrated acceptable results above 0.70. The frequency and percentage evaluation was conducted after the reliability confirmation stages to study the response pattern across different categories. This approach generated information regarding the broader patterns present in the dataset while identifying important patterns based on different demographics and categories.

A statistical regression analysis took place to measure variable relationships. The regression test revealed both the degree of relationship and statistical measurement of independent variables to dependent variables. The statistical results revealed both R-squared value and standardized coefficients while displaying important p-values to establish how factors affected the outcome variable. Analysis of regression results revealed important connections between predictor variables and the dependent variable along with their effects on it. The gathered data provides meaningful information that should be examined for interpretation.

Table: 1 Reliability Statistics.

Reliability Statistics		
Cronbach's Alpha	N of Items	Variable Name
.918	15	Innovation
.814	5	Service quality
.885	5	Consumer satisfaction

Table 1 presents the reliability statistics for three variables: Innovation, Service Quality, and Consumer Satisfaction. The Cronbach's Alpha values indicate a high level of internal consistency for all constructs, with Innovation achieving the highest reliability at 0.918 across 15 items. Consumer Satisfaction follows with a reliability coefficient of 0.885 for five items, while Service Quality also demonstrates strong reliability at 0.814 for five items. These values suggest that the survey items measuring each construct are highly reliable and suitable for further analysis.

Table: 2 Age of the respondents.

Age (in years)		
Age groups	Frequency	Percent
18-24	28	21.7
25-34	28	21.7
35-44	25	19.4
Above 45	48	37.2
Total	129	100.0

The above table discusses the frequency and percentage of age of the respondents. In 18-24 and 25-34 years group, Frequency is 28 and percentage is 21.7%. In 35-44 years group, Frequency is 25 and percentage is 19.4%. In Above 45 Frequency is 48 and percentage is 37.2%.

Graph: 1 Graphical representation of Age of the respondents.

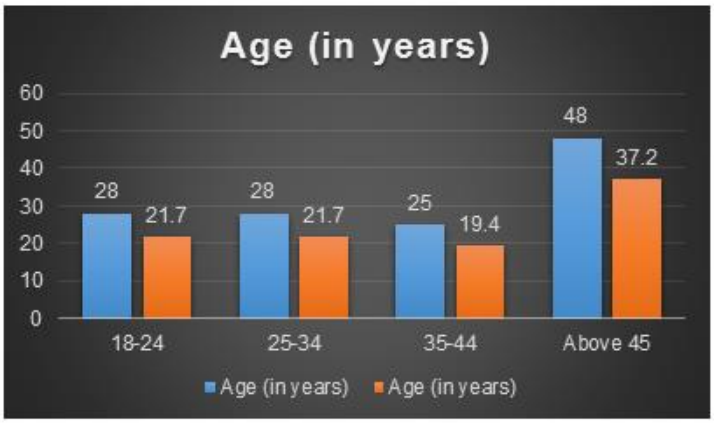


Table: 3 Gender of the respondents.

Gender		
	Frequency	Percent
Male	77	59.7
Female	52	40.3
Total	129	100.0

The above table discusses the frequency and percentage of Gender of the respondents. In male, Frequency is 77 and percentage is 59.7%. In Female, Frequency is 52 and percentage is 40.3%.

Graph: 2 Graphical representations of Gender of the respondents.

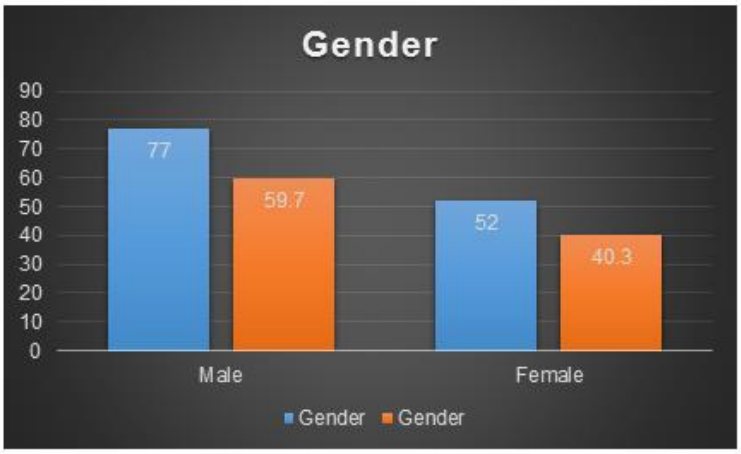


Table: 4 Education of the respondents.

Education		
	Frequency	**Percent**
Higher secondary	5	3.9
Graduate	39	30.2
Post-Graduate	75	58.1
Other	10	7.8
Total	129	100.0

The above table discusses the Education of the respondents. In Higher secondary, Frequency is 5 and percentage is 3.9%. In Graduate, Frequency is 39 and percentage is 30.2%. In Post-Graduate, Frequency is 75 and percentage is 58.1%. In Other, frequency is 10 and percentage is 7.8%.

Graph: 3 Graphical representation of Education of the respondents.

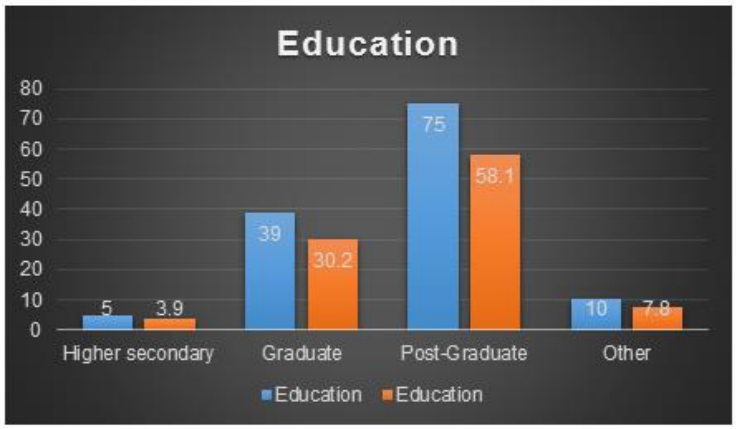


Table: 5 Transportation Technology Aggregator(s) you use

Which of the following Transportation Technology Aggregator(s) do you use?		
	Frequency	Percent
Uber	41	31.8
OLA	46	35.7
Rapido	1	.8
Other	41	31.8
Total	129	100.0

The above table discusses the Frequency and percentage of Which of the following Transportation Technology Aggregator(s) do you use, In Uber, Frequency is 41 and percentage is 31.8%. In OLA, frequency is 46 and percentage is 35.7%. In Rapido, Frequency is 1 and percentage is 0.8%. In Other, frequency is 41 and percentage is 31.8%.

Graph: 4 Graphical representation of Transportation Technology Aggregator(s) you use.

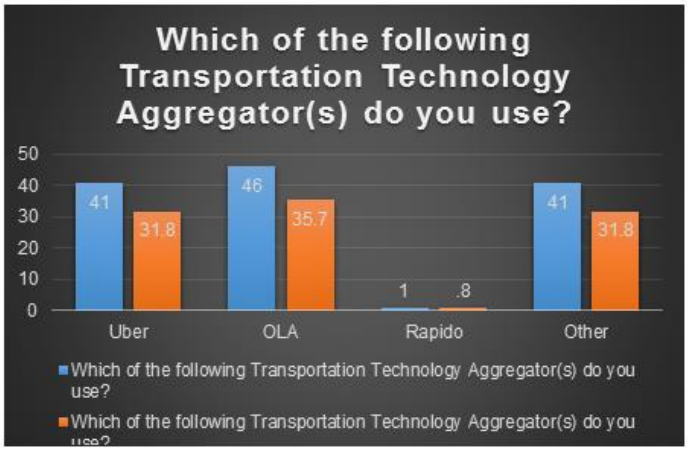


Table: 6 frequently use of transportation aggregator services.

How frequently do you use transportation aggregator services?		
	Frequency	**Percent**
Daily	11	8.5
Several times a week	13	10.1
Once a week	4	3.1
Several times a month	32	24.8
Rarely	68	52.7
Never	1	.8
Total	129	100.0

The above table discusses the Frequency and percentage of How frequently do you use transportation aggregator services, In Daily, Frequency is 11 and percentage is 8.5%. In Several Times a week, Frequency is 13 and percentage is 10.1%. In Once a week, Frequency is 4 and percentage is 3.1%. In Several times a month, Frequency is 32 and percentage is 24.8%. In Rarely, Frequency is 68 and percentage is 52.7%. In Never, Frequency is 1 and percentage is 0.8%.

Graph: 5 Graphical representation of frequently use of Transportation Technology Aggregator services.

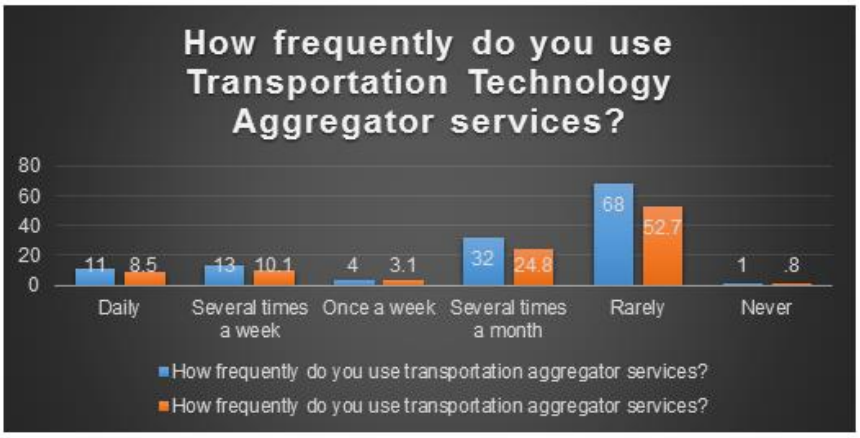


Table: 7 Regression test. (H1: Technological Innovations in Transportation Technology Aggregators in Pune have a positive impact on the overall Service Quality)

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.596[a]	.355	.350	1.03949
a. Predictors: (Constant), Technology Innovation				

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	75.446	1	75.446	69.822	.000[b]
	Residual	137.230	127	1.081		
	Total	212.676	128			
a. Dependent Variable: Service quality						
b. Predictors: (Constant), Technology Innovation						

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.349	.373		3.619	.000
	Technology Innovation	.692	.083	.596	8.356	.000
a. Dependent Variable: Service quality						

The regression test assesses the influence of technical improvements on service quality in transportation technology aggregators in Pune. The model summary reveals a moderate positive correlation, with a R value of 0.596 and a R^2 value of 0.355, indicating that 35.5% of the variance in service quality is accounted for by technical advancement. The ANOVA results validate the model's statistical significance ($F= 69.822$, $p< 0.001$), demonstrating that technical innovation is a strong predictor of service quality. The coefficients table corroborates this, indicating a positive and substantial impact of technical innovation ($B = 0.692$, $t = 8.356$, $p < 0.001$), signifying that an enhancement in technological innovation correlates with an improvement in service quality. Thus, the hypothesis (H1) is validated, indicating that technical advancements enhance service quality in transportation technology aggregators.

Table: 8 Regression test. (H2: There is a significant impact of Service Quality parameters on Consumer Satisfaction in the context of Transportation Technology Aggregators)

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.735[a]	.540	.536	.89888
a. Predictors: (Constant), Service quality				

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.328	1	120.328	148.923	.000[b]
	Residual	102.614	127	.808		
	Total	222.941	128			
a. Dependent Variable: Consumer satisfaction.						
b. Predictors: (Constant), Service quality.						

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	1.477	.281		5.260	.000
	Service quality.	.752	.062	.735	12.203	.000
a. Dependent Variable: Consumer satisfaction.						

The regression study investigates the influence of service quality on consumer satisfaction within the realm of transportation technology aggregators. The model summary indicates a robust positive correlation, with a R value of 0.735 and a R^2 value of 0.540, signifying that 54% of the variance in client satisfaction is accounted for by service quality. The ANOVA results validate the model's statistical significance ($F = 148.923$, $p<0.001$), indicating that service quality is a substantial predictor of client happiness. The coefficients table corroborates this conclusion, indicating that service quality has a positive and substantial impact ($B = 0.752$, $t = 12.203$, $p < 0.001$), implying that enhancements in service quality result in increased client satisfaction. Consequently, the hypothesis (H2) is validated, demonstrating a substantial influence of service quality on client satisfaction within transportation technology aggregators.

Discussion

Results from this study demonstrate that technological advancement plays a vital part in improving the quality-of-service delivery among transportation technology aggregators operating in Pune. Internal consistency was confirmed using the reliability test Cronbach's alpha which validated the study variables. The respondents showed an even distribution between age groups and genders and post-graduates made up a substantial part of the sample. Consumers typically used Ola and Uber for their rides but avoided these services most of the time given their reliance on traditional public transport.

The results of regression analysis proved that technological innovation strengthens service quality substantially (R^2 = 0.355, $p < 0.001$). The integration of real-time tracking alongside app-based bookings and digital payment solutions has led to significant improvements in consumer satisfaction. Service quality functions as an essential factor which determines consumer satisfaction at a statistically significant level (R^2 = 0.540, $p < 0.001$). The confirmed hypotheses demonstrate that investments made for better technology and service quality lead to enhanced consumer experiences within the transportation aggregator industry.

Major findings

- **Reliability Analysis:** All constructs exhibited high internal consistency (Cronbach's Alpha: Innovation = 0.918, Service Quality = 0.814, Consumer Satisfaction = 0.885).
- **Demographic Insights:** Most respondents were postgraduates (58.1%), with 59.7% identifying as male and 37.2% aged over 45 years.
- **Transportation Aggregator Preferences**: Ola (35.7%) and Uber (31.8%) were the predominant services utilized, however 52.7% of respondents indicated infrequent use of aggregator services.
- **Impact of Innovation on Service Quality:** The influence of innovation on service quality revealed a moderate positive correlation (R^2 = 0.355, $p < 0.001$), suggesting that technical improvements substantially enhance service quality.
- **Effect of Service Quality on Consumer Satisfaction:** The influence of service quality on consumer satisfaction was significantly positive (R^2 = 0.540, $p < 0.001$), demonstrating that improved service quality elevates customer contentment.

Conclusion

The research investigated technological effects on transportation technology aggregator service quality and consumer satisfaction within Pune. Research results show that digital innovations including app booking features, AI forecasting, and cashless payment systems drive major service quality, accessibility improvements and better user experiences. The results showed that technology innovations positively influenced service quality and resulted in a strong functional relationship between service quality and consumer satisfaction (R^2 = 0.355, $p < 0.001$ and R^2 = 0.540, $p < 0.001$ respectively). Transportation service improvements which occur continuously lead to building trust and loyalty with customers. Difficulty exists in the industry due to issues related to flexible pricing models and inconsistent services and privacy protection of user information. The effectiveness of technological innovations differs between different clientele groups that use them although operations become streamlined by these innovations while resources become more optimized. The development of policy-based regulations is necessary to create fair pricing systems that protect the privacy of user data. The service quality and customer satisfaction will further boost through improved driver training and regional infrastructure support measures. The study generates essential information for urban mobility research specifically for India since its ride-hailing market continues to grow. Transportation technology aggregators who focus on consumer needs together with responsible use of emerging technologies will reach sustainable growth and enhanced user satisfaction. The analysis of consumer trends between different cities would be beneficial for researchers to discover universal patterns related to technological behavior and consumer patterns. Research evidence demonstrates that technical advances power the transformation of transportation services yet demands both well-balanced tech adoption policies and regulatory control.

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Conflicts of interest

There are no conflicts of interest.

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