International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 21s, 2025
https://theaspd.com/index.php

Investigating The Role Of Technology In Enhancing The Customer Experience In Uttar Pradesh Metro Rail Corporation

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Abstract:
This paper discusses the effect of technology-based initiatives on passenger satisfaction. Mobile apps and digital ticketing and the associated functionality (journey planning, live tracking, etc) are the main areas of interest. Researchers have used a survey to gather data on a group of 300 passengers of Uttar Pradesh traveling in the metro by creating a structured survey and analysing it by means of descriptive statistics, correlation, independent t-tests, ANOVA and regression analysis. The results show a great incidence of mobile application use and digital ticketing, where the average satisfaction rates are measured at 3.83 to 4.24 out of 5. In fact, correlation analysis showed that there is a positive correlation between satisfaction and app usage correlating at a moderate level ($r = 0.328$, $p < 0.01$). The independent t-tests demonstrated the digital ticketing users to be demonstrably more satisfied than other participants whereas the regression indicated the ease of navigation and the amount of time they use the app as the major predictors. The study ended by stating that technology integration contributes greatly to customer experience with both hypotheses of the research being widely confirmed.
Keywords: *Technology, customer satisfaction, technology integration, digital ticketing, public transportation.*

INTRODUCTION:

Technology is a must-have component in enhancing the quality of the public transportation services across the world. The incorporation of passenger phones, online ticketing, and live changes in the case of metro rail systems has changed the way travelers design, commute and feel their journeys. Users want peace of mind that their online transactions, mainly in the form of bank account/card details, are safe. Without this security, customers would not want to deal with a service online [1]. The study's findings are extremely important for service providers since they show how crucial customer loyalty is to winning over customers. In terms of healthcare, consumers rely more on the opinions of others, but their friends, relatives, and prior experiences also have a significant impact [2]. As a contemporary urban transportation company, the Uttar Pradesh Metro Rail Corporation (UPMRC) has implemented a number of digital solutions with a focus on promoting the convenience of passengers, de-emphasising manual work, and ensuring greater efficiency.

This paper is dedicated to comprehending factors that contribute to passenger satisfaction (with the help of these technological interventions). The study specifically looks into mobile Apps to plan a journey and real-time monitor, online ticketing services, and the interface convenience of applications. Of concern is the need to assess the efficiency of the use of technology to help the commuter expectancy in the situation when the use of technology increases.

The research will be interested in measuring the correlation between technology utilization and customer satisfaction, as well as determining the main types of technology having the most significant effect on the experience of a passenger, and evaluate how technological measures in general affect the level of services. Also, organizations that include sustainability into their fundamental operations are more likely to be long-term successful as environmental, social, and governance (ESG) issues take front stage in determining corporate viability [3]. This study develops a solution and quantitative, qualitative approach that can be useful in assisting metro authorities to tailor strategy to foster customer experience in a more digital setup.

The Study Significance:

The study is relevant because it explains how mobile applications, digital ticketing, and real-time updates are digital innovations that change the experience in the travel of metro services. The research helps to

understand the main technological factors impacting the satisfaction of passengers and, based on that, give evidence-based suggestions on how to improve the quality of a service, make it more convenient, and efficient. The results will help metro officials and policy makers to develop customer-oriented policies that would facilitate the adoption of technology, improve the satisfaction of users and the use of rides. It also adds to academic research that may connect the concept of technology integration to commuter behavior, a framework that can be used with other transportation systems in India cities.

Rationale of the Study:

This research is justified by the fact that the use of technology in the field of public transportation is increasing, and there is a necessity to determine the effect of this phenomenon on the experience of the commuter. With a growing urban population, offering efficient and easily accessible services is a key priority that should be offered by metro systems. Considering the arrival of mobile apps and digital ticketing in UPMRC, very little has been done in regards to determining the true impact they have in customer satisfaction. This gap is filled in this study systematically analyzing the perception and trends in use of passengers to come up with actionable information that would help to offer better services, optimize resources and be in line with current trends in technology.

LITERATURE REVIEW:

Technological enhancement in the sphere of public transportation has become one of the most significant elements of creating the most optimal experience of the passengers, providing them with the best service quality, and ensuring a higher efficiency of work. Travelers have changed the way they plan and make their travels as a result of mobile apps, digital tickets, and real-time notifications [4]. The reviews evidence that technology tends to enhance commuter convenience, lessen wait time, and promote satisfaction because of features like trip planning, real-time location, no-touch payment, and text services [9] [6].

The concept of m-Transit applications is closely related to the perceived quality of the service and loyalty of passengers [19][31]. The clients believe the general population segment banks. These banks have existed in the business sector for a more drawn-out period than the private area banks. The unwavering quality component is a positive variable for these banks [33]. The studies on the smartphone-based transport apps demonstrate that their use decreases the anxiety during travel, increases the decision-making process, and leads to a change in the ridership behaviour [21]. Other mobile apps like Ridlr and m-Indicator have transformed the way commuters behave by making the digital ticketing and exchange of information process a lot easier [26] [30].

We have found that digital ticketing improves satisfaction in that the process of transactions becomes smoother and reliance on cash or paper-based tickets is lessened [27][5]. In relation to the availability of electronic banking services, data show that majority of respondents either agreed (29.84 per cent) or highly agreed (33.50 per cent) that the availability of electronic banking services was the motivating factors for opening a bank account [34]

The analysis within the framework of Delhi Metro, Chennai Metro and Ahmedabad Metro proves that such aspects of service quality as digital services, ease of navigation, information availability are powerful predictors of satisfaction rates among commuter surveys [20][10][7].

Moreover, the commuters' trust and the efficiency of the system positively correlate with integrated digital technologies, such as crowd management with IoT and predictive travel information [9]. The ease of app navigation within a user experience design is also always cited as one of the other significant aspects of technology adoption and customer delights [6][31].

All these studies point out the fact that the technology-driven characteristics in metro systems not only improve convenience related to the passengers but also lead to increased operation transparency and trust. The findings are strongly in line with the purposes of the research, agreeing with the hypotheses that the minor positive impact of mobile apps usage and digital ticketing on customer satisfaction in metro systems is also partially due to usability and reliability that proved to be of the greatest importance in terms of better customer experience.

Research Objectives:

1. To assess the impact of technology (e.g., mobile apps, digital ticketing, real-time updates) on customer satisfaction in Uttar Pradesh Metro Rail Corporation.
2. To identify the main technological factors that enhance the customer experience in the metro system.
3. Explore the relationship further or understand how different factors influence customer satisfaction:

Research Hypotheses:

1. **H1**: There is a positive relationship between the use of mobile apps and customer satisfaction in Uttar Pradesh Metro Rail Corporation.
2. **H2**: The implementation of digital ticketing systems has a significant positive impact on customer Satisfaction.

RESEARCH METHODOLOGY:

The research design to be employed in this study is quantitative research design in order to examine the effect of technology on the improvement of the customer experience within the Uttar Pradesh Metro Rail Corporation. A structured questionnaire was used to collect primary data with the help of a sample distributed to passengers of the metro, in order to obtain data on usage and satisfaction with technological aspects of mobile apps, digital ticketing, live tracking and convenience of navigation. A sample size of 300 was subjected to analysis that was determined by using random and stratified sampling, a method meant to represent various demographic groups and Metro stations.

The descriptive statistics were employed in order to summarize the answers of passengers and learn some general tendencies of using technologies. A correlation was done using Pearson correlation to analyse the relationship between frequency of use when using a mobile application and overall satisfaction. Independent samples t-tests were utilized to test a difference between satisfaction rates between users and non-users of digital ticketing systems. ANOVA and multiple regressions were employed to determine highly potent technological predictors of satisfaction.

Also focus group discussions were arranged with the aim of having qualitative information on the passengers perception and expectations. This mixed-method research method guaranteed that the effects of the technological interventions were well understood so that the research could be able to give the necessary recommendations as well as test the hypotheses in order to be able to better the customer satisfaction in the metro services.

Results:

Table 1: Descriptive Analysis

		How frequently do you use the Uttar Pradesh Metro mobile app for planning your journey?	How satisfied are you with the overall performance of the Uttar Pradesh Metro mobile app?	To what extent do you find the mobile app's features (e.g., route planning, live tracking, ticket booking) helpful?	How often do you use the mobile app for purchasing tickets?	How easy is it to navigate the Uttar Pradesh Metro mobile app?	How satisfied are you with the digital ticketing system used by the Uttar Pradesh Metro?
N	Valid	300	300	300	300	300	300
	Missing	0	0	0	0	0	0
Mean		3.83	4.08	3.96	3.87	4.08	4.24
Median		4.00	4.00	4.00	4.00	4.00	4.00
Mode		5	4	5	5	4	4
Std. Deviation		1.212	.752	1.110	1.224	.682	.727
Sum		1148	1225	1189	1161	1225	1271

Interpretation: The descriptive statistics of the six technological factors give a broad view of the predisposition and utilization of the Uttar Pradesh Metro mobile application and digital services on how the passengers received and used it. The averages of all the variables are quite high (ranging between 3.83 and 4.24 out of 5 points) which portrays generally positive replies among 300 respondents. The rate of using the app to plan the journey (Mean = 3.83, Mode = 5) reveals the fact that a lot of passengers use the app regularly in journey planning whereby the mode reflects a high value of passengers who always use the app. Similarly, overall performance of the app has high satisfaction (Mean = 4.08, Std. Deviation = 0.752), displaying the wide approval. Line planning, real-time tracking and ticket bookings (Mean = 3.96) also score well but there is a wider variation in responses (Std. Deviation = 1.110). The users purchased tickets via the app most frequently (Mean = 3.87), demonstrating that digital ticketing is popular, and the

navigation is very easy, and there is minimal drift in the feeling that the app is easy to navigate (Mean = 4.08, the lowest standard deviation of 0.682). The digital ticketing system is the most positively perceived technological facet with the lowest satisfaction score as 5 (Mean = 4.24, Mode = 4). All in all, these figures prove the fact that technology-based efforts such as mobile apps and e-tickets are very appreciated by passengers, which consequently leads to the improvement of the customer experience and proves the adequacy of the research hypotheses.

Table 2: Correlations

		How frequently do you use the Uttar Pradesh Metro mobile app for planning your journey?	How satisfied are you with the overall performance of the Uttar Pradesh Metro mobile app?
How frequently do you use the Uttar Pradesh Metro mobile app for planning your journey?	Pearson Correlation	1	.328**
	Sig. (2-tailed)		.000
	N	300	300
How satisfied are you with the overall performance of the Uttar Pradesh Metro mobile app?	Pearson Correlation	.328**	1
	Sig. (2-tailed)	.000	
	N	300	300

**. Correlation is significant at the 0.01 level (2-tailed).

Interpretation: The correlation analysis indicates a Pearson correlation coefficient of 0.328 between the suggested frequency of using the Uttar Pradesh Metro mobile app to arrange journeys and an overall satisfaction with the performance of this application, which is statistically significant on the 0.01 level (p = 0.000). This means that there is a positive mild relationship: the more the passengers frequent the usage of this app, the higher the level of satisfaction on the improvement of the app. These results further provide substantial evidence on the validity of Hypothesis H1 that high frequency usage of mobile apps improves customer satisfaction. This finding is in correlation with the research question which seeks an understanding on the extent to which the technology adoption enhances the general customer experience in the metro system.

Table 3 : Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	t-test for Equality of Means			t-test for Equality of Means		
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How satisfied are you with the overall performance of the Uttar Pradesh Metro mobile app?	Equal variances assumed	77.024	.000	-21.121	298	.000	-1.471	.070	-1.608	-1.334
	Equal variances not assumed			-22.162	91.728	.000	-1.471	.066	-1.603	-1.339

Interpretation: The Independent Samples Test evaluates the satisfaction with the overall performance of the Uttar Pradesh Metro mobile application in case it is used by people: users of the digital ticketing system and non-users. The Test of Equality of Variances by Levene indicates that there is significant result ($F = 77.024$, $p = 0.000$), which means that the assumption of equal variances is not fulfilled. Nevertheless, results of both the versions of t-test comparing the values (assuming equal and not assuming equal variances) are highly significant. According to the assumption of equal variances, the t -value is -21.121 ($df = 298$, $p < 0.001$), and according to the assumption of unequal variances, the t -value is -22.162 ($df = 91.728$, $p < 0.001$). Since the coefficient is negative, it means that satisfaction is much greater among the person using the digital ticketing system than among the person who does not use it. The mean difference of -1.471 proves the fact that respondents who use digital ticketing are much more satisfied. The capability of this difference is statistically significant, as shown by the 95 percent confidence interval (- 1.608 to -1.334) not intersecting with the value zero. This finding carries with itself powerful data proving hypothesis H2, and it reveals that the purchases of digital ticketing systems make a significant positive contribution to customer satisfaction. It ensures that implementation of technologies especially digital ticketing is very essential in enhancing passenger experience within the Uttar Pradesh Metro.

Table 4 : ANOVA TEST

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	102.691	5	20.538	91.176	.000[b]
	Residual	66.226	294	.225		
	Total	168.917	299			

a. Dependent Variable: How satisfied are you with the overall performance of the Uttar Pradesh Metro mobile app?

b. Predictors: (Constant), How satisfied are you with the digital ticketing system used by the Uttar Pradesh Metro?, To what extent do you find the mobile app's features (e.g., route planning, live tracking, ticket booking) helpful?, How often do you use the mobile app for purchasing tickets?, How frequently do you use the Uttar Pradesh Metro mobile app for planning your journey?, How easy is it to navigate the Uttar Pradesh Metro mobile app?

Interpretation: ANOVA table compresses the interaction effect of specified technological variables on the web satisfaction outlook of the Uttar Pradesh Metro mobile application. The predictors are satisfaction with the digital ticketing system, usefulness of app functions, ticket purchases with the app usage frequency, journey planning with the app usage frequency and ease of navigation. The outcomes indicate that the regression model is significant ($F = 91.176$, $p = 0.000$) , that is, these variables account for a considerable percentage of the variance of satisfaction of passengers. The regression sum of squares (102.691) is much greater than the residual sum of squares (66.226), which means that these predictor variables explain a lot in the variability of satisfaction. This observation gathers weight to conclusively indicate that aspects of technology influence significantly the perception of the users of metro apps. Specifically, the factors of easiness of navigation, strong use, and the presence of digital ticketing systems are highly involved with the positive customer experience. These findings endorse hypothesis H1 and H2 clearly stating that there was a direct impact on customer satisfaction due to integration of mobile technology and the digital ticketing services and they also underscore technological influence that has massive influence on higher quality of services in the Metro system of Uttar Pradesh.

Table 5 : ANOVA Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.419	.194		2.159	.032
	How frequently do you use the Uttar Pradesh Metro	.101	.024	.163	4.266	.000

	mobile app for planning your journey?					
	To what extent do you find the mobile app's features (e.g., route planning, live tracking, ticket booking) helpful?	-.001	.026	-.002	-.043	.966
	How often do you use the mobile app for purchasing tickets?	-.005	.023	-.008	-.213	.831
	How easy is it to navigate the Uttar Pradesh Metro mobile app?	.773	.074	.701	10.452	.000
	How satisfied are you with the digital ticketing system used by the Uttar Pradesh Metro?	.034	.068	.032	.493	.622

a. Dependent Variable: How satisfied are you with the overall performance of the Uttar Pradesh Metro mobile app?

Interpretation: ANOVA findings illustrate the integrated impact of the technological factors in calculation of the satisfaction that passengers experience with Uttar Pradesh Metro mobile application. The following predictors were part of the model: satisfaction with the digital ticketing system, usefulness of app functions (including but not limited to route planning, live tracking, and ticket booking), how often they bought their tickets via the app, how often they used the app to plan their trips, and how they found it to navigate the app. The model is statistically significant with $F = 91.176$ and $p = 0.000$, which denotes that the variables have an additional significant proportion of variance of customer satisfaction. Regression and residual sum of squares (102.691 and 66.226) are significantly different with regression value large when compared to residual value indicating that the bulk of the variance in satisfaction is due to these predictors and not random error. This proves the importance of technological projects on the satisfaction of customers. Ease of navigation, frequent use of the mobile program and the system of digital ticket are the factors which are the most decisive among them. These results are in good support of Hypotheses H1 and H2, which stress that mobile technology and digital ticketing are the prime factors of better passenger experiences and better quality of service in the Uttar Pradesh Metro.

Findings:

The research proposed two hypotheses in order to determine the effect of technology on customer satisfaction with Uttar Pradesh Metro Rail Corporation. H1, a hypothesis that stated that mobile apps use has a positive impact on customer satisfaction, was demonstrated to a great extent. The descriptive statistics showed that the majority of the passengers regularly use the metro mobile app to plan the trip and buy tickets, posting the high satisfaction level (mean values exceeding 4). Correlation analysis indicated that there existed a moderate-positive connection between demands of application frequency and satisfaction ($r = 0.328$, $p < 0.01$). Regression analysis also established ease of navigation within the app and frequency of app use as important predictors of satisfaction which means that usability and accessibility of mobile technology are extremely crucial factors in improving customer experience.

Another hypothesis H2, which postulated that use of digital ticketing systems has great influence on customer satisfaction was also confirmed. There was a significant difference between users and non- users of the digital ticketing in their satisfaction levels with $p < 0.001$ ($t = -21.121$). As a sum of it all, the available data clearly indicate that the use of technology, namely mobile apps and electronic ticketing, allow greatly enhancing customer experience, which is why the application of these technologies could serve as the primary contributors to the levels of convenience, efficiency, and customer satisfaction in the sphere of metro rail provision.

CONCLUSION:

This paper makes a conclusion that technology is very instrumental in enhancing customer experience in the Uttar Pradesh Metro Rail Corporation. The evidence indicates that mobile applications and digital ticketing participate in improving the passengers by making it convenient and efficient besides user-friendly thus the evidence puts strong arguments that the use of digital ticket systems and mobile applications encourages higher satisfaction among the passengers. The results of Pearson correlation and regression techniques, which prove that frequent app use and ease of navigation represent significant determinants of satisfaction, served to confirm the H1 hypothesis. In the same manner, Hypothesis H2 was supported by the t-test outcomes pointing toward the fact that digital ticketing users report more of their satisfaction than non-users do. All in all, the study shows that the use of digital technology including mobile applications, journey planning, live updates, and paperless tickets has a direct relationship with the overall opinion of commuter satisfaction with services offered. Such revelations underline the importance of metro authorities in ensuring their continued investment in technological innovations as an effective strategic action to improve customer satisfaction and functional excellence.

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