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Digital Transformation in Indian Railways: A Study of Passenger Awareness, Usage Patterns, and Satisfaction

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Abstract

Digital initiatives by Indian railways aims to enhance passenger convenience and operational efficiency. India's vast geography and the rising competition from low-cost airlines, luxury buses, and personalized transport options becomes crucial to rail networks. The study examines the passenger perceptions and usage patterns of digital services offered by Indian railway. Convenance sampling was employed with a sample size of 150 passengers. Data were collected through a standardized questionnaire and analyzed using regression analysis. Passenger-related variables such as demographic profile, travel frequency, awareness of digital services etc. were examined to predict usage patterns and satisfaction. The findings underscore the paramount importance of educating strong awareness, not only as a pioneer to usage that work without glitches but focus towards an ultimate user satisfaction. The study thus provides insights into improving digital literacy, service adoption, and overall passenger satisfaction.

Keywords: igital Services, Passenger awareness, Usage Pattern, Technology adoption, Passenger Satisfaction.

Introduction

Indian railway network plays a crucial role in facilitating mobility and trade across the subcontinent, it has made unparalleled contributions to national integration, regional development, and economic connectivity. Recognized as one of the world's most extensive transportation systems, Indian railways has embarked on an ambitious journey of modernization. In alignment with the government of India's digital India initiative, the organization has adopted technology-driven innovations aimed at improving efficiency, enhancing service quality, and increasing passenger convenience. These initiatives mark a shift from traditional, paper-based processes toward more agile and user-friendly digital platforms viz online ticketing, mobile applications, and real-time information systems significantly transforming the way users engage with this railway system. The adoption of digital infrastructure reflects a forward-looking approach that redefines Indian railways as not only a national lifeline but also a model of scalable and inclusive public transport. Beyond improving passenger services, its digital initiatives extend to infrastructure development, safety measures, and sustainability goals. With ongoing efforts toward electrification, energy efficiency, and carbon neutrality, Indian railways is steadily progressing toward its commitment of becoming a net-zero carbon emitter by 2030.

As public transport systems increasingly adopt digital platforms, it becomes essential to investigate whether such changes genuinely align with the expectations, experiences, and needs of the public. This gap highlights the importance of critically examining the digital shift in Indian railways to ensure that innovations translate into meaningful, inclusive, and sustainable improvements in service delivery.

Literature Review

The role of service quality, facilities, and passenger perceptions in shaping customer satisfaction in railways has been widely investigated in recent years.

Yunani et al. (2024) examined how facilities and environmental awareness affect customer satisfaction with PT Kereta Api Indonesia (KAI). Using a quantitative survey of 102 respondents and PLS analysis, the study highlighted that both service quality and available facilities significantly influence passenger satisfaction, providing insights for improving railway service delivery in Indonesia.

Dubey et al. (2024), explored how passengers perceive service quality and their ability to be productive or relaxed during travel. The study found that punctuality, clean coaches, and affordable pricing are key drivers of satisfaction, while the ability to read, work, or rest during travel further enhances the experience.

Rajyaguru et al. (2024) surveyed 161 passengers to identify satisfaction determinants in a government-operated railway. The study revealed that while technological and digital advancements are improving service quality, employee behaviour has the most significant impact on overall satisfaction.

Bharati et al. (2024), examined responses from passengers in Vijayawada and found punctuality and staff behaviour as primary factors affecting satisfaction, whereas seating and digital services had lesser impact. The study recommended staff training, infrastructure upgrades, and customer-centred strategies.

Kalaivani et al. (2023} highlighted the importance of digital financial inclusion in enhancing passenger convenience and satisfaction.

Kumar et al. (2023) emphasized reliability and comfort as top priorities influencing customer loyalty in Indian railways, suggesting that consistent service quality builds trust and repeat usage.

Sharma et al. (2023), highlighted tangibility, reliability, empathy, and responsiveness as key service quality dimensions. Small actions like courteous staff and clean stations significantly enhance passenger loyalty and overall satisfaction.

Patel et al. (2023) identified cleanliness, safety, and accurate information as critical satisfaction elements, emphasizing the need for transparent communication and timely updates to reduce travel anxiety. Extending the regional perspective.

Nazeer et al. (2023) highlighted the negative impact of poorly maintained stations, train delays, and lack of real-time information on user experience, stressing that service reliability, cleanliness, and effective communication are key to improving passenger satisfaction

Objectives

1. To evaluate the level of customer awareness regarding digital innovations introduced by Indian railways.
2. To examine the extent of adoption and utilization of digital facilities among passengers.
3. To assess customer satisfaction in relation to the digital services provided by Indian railways.

Hypothesis

H_{01}: Customer awareness has no significant influence on the usage of digital services offered by Indian

railways.

H_{02}: customer awareness and usage of digital services do not have a significant combined effect on customer satisfaction with digital services offered by Indian railways.

Research Design and Methodology

The study employs a descriptive research design, enabling a systematic exploration of the current scenario, capturing the real experiences and attitudes of users without manipulating variables. This design provides both qualitative and quantitative insights into passenger interactions with digital services such as online ticket booking through IRTC, the UTS mobile app, e-catering facilities, real-time train tracking, digital payments, and enquiry platforms.

Data collection for the study involves both primary and secondary sources. Primary data was gathered directly from railway passengers using a structured questionnaire. The questionnaire was carefully designed to include relevant questions on awareness, frequency of usage, satisfaction, and challenges faced while using digital services. By collecting data directly from actual users, the study ensures authenticity and accuracy in capturing passenger opinions. Secondary data was sourced from academic journals, published research articles, government reports, and official Indian railways documents..

The sample size for this research consists of 150 respondents. The research is geographically focused on passengers in Kottayam district, Kerala,

A convenience sampling method was adopted for selecting respondents.

The collected data was processed and analysed using. Techniques such as descriptive statistics, correlation, and regression analysis were applied to examine relationships between awareness, usage, satisfaction, and demographic factors.

Limitations of the study

The primary limitations is the geographical focus, as the research is confined to the kottayam district of kerala. Passenger awareness, usage patterns, and satisfaction levels in metropolitan cities or rural regions may differ significantly from those observed in kottayam.

The dynamic nature of passenger perceptions and preferences. Respondents' views, satisfaction levels, and usage behavior are influenced by evolving service quality, technological updates, and personal circumstances.

Analysis and Interpretations

Table. 1- Awareness of Digital Services Offered.

Service Offered	No:of Respondents	Mean	Std.Deviation
Online ticket booking (IRTC)	150	3.43	1.297
Train tracking and live status Apps	150	3.33	1.329
Digital payment options at Stations	150	3.19	1.246
UTS mobile ticketing app	150	3.17	1.335

E-catering	150	2.99	1.179
Smart ticketing	150	2.95	1.325

From the table, it is evident that respondents exhibit the highest level of awareness regarding online ticket booking, reflecting its widespread use and extensive promotion compared to other digital services. In contrast, smart ticketing and e-catering recorded the lowest awareness levels, suggesting a need for targeted awareness-building initiatives to enhance their adoption. The observed standard deviations further indicate variability in awareness across respondents, pointing to possible differences influenced by demographic characteristics or patterns of service usage.

Table .2- Usage of Digital Services Offered

Usage of Digital Service	N	Mean	Std. Deviation
Train tracking and live status apps	150	3.21	1.334
Online ticket booking (irctc)	150	3.06	1.406
Digital payment options at stations	150	2.95	1.266
Uts mobile ticketing app	150	2.94	1.372
Smart ticketing (qr codes/ smart cards)	150	2.65	1.242
E-catering Valid n (list wise)	150	2.57	1.244

The table results indicate that respondents are more comfortable with fundamental digital services such as information access and online booking, whereas newer services like smart ticketing and e-catering are still in the early stages of adoption. The presence of moderate standard deviations across all services reflects a reasonable spread of responses, suggesting variability in user familiarity. This variation may be attributed to differences in digital literacy, technological exposure, or prior experience among passengers.

Table 3- Satisfaction of Digital Services

Satisfaction of Digital Services	N	Mean	Std. Deviation
Satisfaction – speed	150	3.40	1.036
Satisfaction- ease	150	3.23	0.958
Satisfaction- reliability	150	3.23	0.949
Satisfaction- customer support	150	3.21	1.014

The table results indicate that satisfaction levels are generally moderate to high across all service aspects, with mean values. The relatively low standard deviations suggest a high degree of consistency in respondent perceptions. Among the various dimensions, speed achieved the highest satisfaction rating, underscoring the efficiency benefits of digitalization. Conversely, customer support emerged as the weakest area, signalling the need for targeted improvements. These findings suggest that, although

significant progress has been made in digitizing services, strengthening support infrastructure and ensuring long-term reliability remain critical to enhancing the overall user experience.

Hypothesis Testing

1.Influence of Awareness on Usage of Digital Services

Null Hypothesis H_0:customer awareness has no significant influence on the usage of digital services offered by indian railways.

Alternative Hypothesis (H_1): customer awareness has a significant influence on the usage of digital services offered by indian railways.

Table 4- Regression analysis

Model summary

Model	R	R square	Adjusted r Square	Std. Error of The estimate
1	.693[a]	.481	.477	.73681

Predictors: (constant), awareness

Dependent variable: usage

Table 5-Anova

Model	Sum of squares	Df	Mean square	F	Sig.
1 regression	74.425	1	74.425	137.090	.000[b]
Residual total	80.347	148	.543		
	154.772	149			

Table-6 Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (constant)	.714	.196	.693	3.642	.000
awareness	.132	.011		11.709	.000

The model summary reveals a correlation coefficient (r) of 0.693, indicating a strong positive association between customer awareness and the usage of digital services. The r square value (0.481) suggests that customer awareness accounts for 48.1% of the variance in digital service usage, signifying that nearly half of the variation in usage can be attributed to differences in awareness. Furthermore, the adjusted r square (0.477) confirms the robustness of the model after controlling for sample size and number of predictors, thereby demonstrating a satisfactory model fit.

The Anova results reinforce the validity of the regression model. Since the significance value is below the threshold of 0.05, the null hypothesis (h_0) is rejected, affirming that customer awareness significantly predicts digital service usage.

Overall, the regression analysis confirms that customer awareness plays a critical role in influencing the adoption and usage of digital services, accounting for a substantial proportion of usage variability and demonstrating both statistical and practical significance.

Hypothesis Testing 2. Influence of awareness and usage on satisfaction

Null Hypothesis *(H_0): customer awareness and usage of digital services do not have a significant combined effect on customer satisfaction with digital services offered by Indian railways.*

Alternative Hypothesis (H_1): *(H_1): customer awareness and usage of digital services have a significant combined effect on customer satisfaction with digital services offered by Indian railways.*

Table 7- Regression Anlaysis

Model summary

Model	R	R square	Adj. R square	Std. Error of the Estimate	Durbin-Watson
1	.258[a]	.067	.054	.76230	2.161

Predictors: (constant), usage, awareness

Dependent variable: satisfaction

Table 8- Anova

Model	Sum of squares	Df	Mean square	F	Sig.
1 regression	6.091	2	3.046	5.241	.006[b]
Residual total	85.421	147	.581		
	91.512	149			

Dependent variable: satisfaction

Predictors: (constant), usage, awareness

Interpretation

The model summary reveals a correlation coefficient (r) of 0.258 and an r-squared value of 0.067, suggesting that approximately 6.7% of the variance in customer satisfaction is explained by the combined influence of customer awareness and usage of digital services

The anova results show an f-value of 5.241 with a corresponding p-value of 0.006, which is below the 0.05 threshold. Accordingly, the null hypothesis (h_{02}) is rejected, and the alternative hypothesis (h_{12}) is accepted.

The overall significance of the model, as established by the anova, reinforces the conclusion that awareness and usage together significantly contribute to customer satisfaction, thereby supporting hypothesis (h_{12}).

FINDINGS AND SUGGESTIONS

Findings

1. awareness is highest for online ticket booking (mean = 3.43) and lowest for smart ticketing (mean = 2.95) and e-catering (mean = 2.99).
2. Usage of digital services is highest for train tracking and IRTC ticket booking, with lower usage of smart ticketing and e-catering.

3. Satisfaction is moderate, with speed of service rated highest (mean = 3.40), and customer support rated comparatively lower (mean = 3.21).
4. Regression analysis shows a significant and strong influence of awareness on usage ($r = 0.693$, $r^2 = 0.481$, $p < 0.001$).
5. Awareness and usage combined significantly influence satisfaction ($p = 0.006$), although awareness alone plays a more critical role. Usage by itself does not significantly influence satisfaction ($p = 0.802$).

Suggestions

Priority should be placed on resolving technical issues such as bugs, payment failures, and slow loading times in digital platforms, while the introduction of a more responsive and user-centered support system would significantly improve the passenger experience.

Passenger adoption of smart ticketing and e-catering can be strengthened by simplifying apps and offering practical, on-site demonstrations at stations.

A quicker and more transparent grievance resolution mechanism is essential for fostering passenger trust. Regularly collecting user feedback and integrating their suggestions can ensure that services remain user-friendly and relevant.

Equipping railway staff with the skills to guide passengers in using digital services, along with improving official communication platforms, can help reduce reliance on unverified sources.

The findings of this study carry significant implications for policymakers, practitioners, and the broader public transport ecosystem. The results emphasize the importance of formulating inclusive digital strategies that extend beyond urban centres. Policymakers must ensure that investments in digital infrastructure are accompanied by awareness initiatives and accessibility measures, particularly for rural and semi-urban populations. Such measures will help reduce disparities in access to railway services and promote equitable adoption of digital technologies.

CONCLUSIONS

The digital transformation initiatives undertaken by Indian Railways represent a significant step toward modernizing railway operations, enhancing passenger convenience, and aligning with the broader vision of Digital India. The study reveals a high level of awareness and usage of widely adopted digital services such as online ticket booking and real-time train tracking, which have become integral to the travel experience for many passengers. However, comparatively lower awareness of services like smart ticketing and e-catering highlights gaps in promotion and communication. This limited awareness appears to stem not from a lack of interest, but from insufficient visibility and outreach through official communication channels. The findings suggest that peer influence plays a significant role in shaping awareness and adoption, underscoring the need for more user-centric and socially driven engagement strategies by Indian Railways. Despite the overall positive outlook, challenges such as technical glitches, limited customer support, and reluctance to use lesser-known features continue to hinder optimal utilization. These findings reinforce the notion that digital transformation extends beyond the introduction of new technologies and must focus equally on reliability, ease of use, and trust-building measures.

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