Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 2
Open Access

Digital Payment Adoption in Urban Transport Services: An Empirical Study of Maha Metro, Aapli Bus, Taxis, Auto-Rickshaws, and E-Rickshaws

Chetan Sham Bansod[1], Dr. Gopal Jangluji Zade[2]

[1] Research Scholar, Department of Business Management, Rashtrasant Tukadoji Maharaj Nagpur University (RTMNU), Nagpur, Maharashtra, India.

[2] Research Supervisor, Department of Business Management, Rashtrasant Tukadoji Maharaj Nagpur University (RTMNU), Nagpur, Maharashtra, India..

Cite this paper as: Chetan Sham Bansod, Dr. Gopal Jangluji Zade (2024) Digital Payment Adoption in Urban Transport Services: An Empirical Study of Maha Metro, Aapli Bus, Taxis, Auto-Rickshaws, and E-Rickshaws .*Frontiers in Health Informatics*, *Vol.13, No.2*, 1259-1264

ABSTRACT:

In the field of city mobility, the digital payment technologies have made long strides to ensure a cashless, secure and comfortable city journey. The purpose of this study is to analyse the various digital payment platforms that are being adopted in Maha Metro, Aapli Bus, Taxi, Auto Rickshaw, E-rickshaw by the users, the reasons influencing the acceptance of these platforms by the users as well as the hurdles faced by the service providers and commuters. Passengers and the transport operators were sampled using an empirical research design and their primary data was obtained using a pre-designed structured questionnaire, which was analysed using statistical methods suitable for the study. The results show the key factors influenced digital payment adoption to be convenience, transaction speed, ease of use, perceived security, and government initiatives. However, factors such as substandard internet speed and connectivity, failed transactions, lack of digital skills and the risks of cyber-security still keep expansion at bay. It highlights various opportunities in strengthening digital infrastructure, users' awareness and access and in securing payments to increase the rates of cashless payments, thereby improving the efficiency, inclusiveness and sustainability of urban transport usage.

Keywords: Digital Payment Adoption; Cashless Transactions; Urban Transportation; Maha Metro; Aapli Bus; Taxis; Auto-Rickshaws; E-Rickshaws; Digital Payment Systems; Consumer Acceptance; Urban Mobility; India....

INTRODUCTION

World financial market has changed a lot thanks to the new digital technologies enabling a new boom in cashless payment systems, in different fields of financial activities. The embracing of digital pays has actually ended up being a crucial element of the contemporary buying and selling landscape, paving the way for quick, secure, and easy financial transactions, and also helping to lessen reliance on physical money. The Government of India's grand Ala Va Insan approaches like ‘Digital India' and ‘Unified Payment System (UPI)' and the campaign for ‘cashless transactions' since 2016 has helped accelerate the Digital payment wave in India. The growth rate of smart phones, cost savings of the Internet based service and the new fintech innovations are helping to further drive personal and commercial acceptance of digital payment solutions and the adoption of digital payment solutions by public service providers. Therefore, digital payment systems have become a part of life like in retail, healthcare, education, banking and transportation.

Mobile payments have revolutionized the transport industry, particularly urban transport. Urban transport has become more and more effective, technically oriented and crucial today to guarantee economic growth and faster travel times and better quality of life to the city's citizens. The introduction of the digital ticketing have simplified ticket production, removed the need for cash, added on boarding efficiency, and simplified the process of recouping revenue on the up and down. To facilitate connecting the transport operators with swift and secured transactions, the payment method has undergone several changes such as UPI, QR code scanning, mobile wallet, contactless smart cards, embedded application, and debit and credit cards. These innovations have helped shape the smart mobility solutions oriented towards the overall aims of smart city project and sustainable urban development.

Over the last decade, urban transport in Nagpur City has made tremendous strides, particularly in light of the city's dynamic growth as the trunk of their middle of India. Modernisation of Public Transport Facility with Maha Metro and its Advanced Digital Ticketing System, Smart Card and Mobile Payment System. Similarly, Aapli Bus has also adopted QR code technology for ticketing and online payment system, in order to provide the passengers

. .

with more convenient travel methods. Moreover, most of the taxis, auto-rickshaws and the new e-rickshaw services have adopted digital payment platforms such as UPI on their app phones, PhonePe, Google App, Paytm and all mobile banking apps. The developments have facilitated ease of customer, and helped the Government's move towards having a digitally empowered and cashless economy. The COVID-19 pandemic spurred an increase in the experiences of contactless payments facilitation for the passengers and transport operators, to ensure they do not have to touch or meet, in the physical and hygienic sense.

Digital payment schemes are becoming increasingly widespread in urban mobility, but there remain a number of challenges that need to be addressed in terms of operations, technology and behaviour. The internet connectivity challenges, transaction failures, server outages, delayed payment confirmations, cybersecurity threats, lack of digital literacy among passengers and drivers, and lack of acceptance for technological change and unacceptable digital infrastructure are still recent concerns. Due to lack of access to mobile phones, less technical knowledge, high transaction cost on electronic payments and settlement problems by the small transporters like auto-rickshaw and e-rickshaw, there are a number of challenges for them to adopt to the electronic payments. Further, there could be pockets of non-digital financial services awareness and users' confidence in the use of digital financial services applications among elderly passengers including among members of economically weakened sections of the society. The issues call for resilient management methods that can enhance access to, reliability of and security of digital payment system in all modes of urban transportation.

Consequently, digital payment systems need to be adopted if all the four stakeholders – government authorities, transport authorities, financial institutions, and fintech companies and transport operators - collaborate. It calls for investments in digital infrastructure, in reliable internet connectivity and secure payment gateways, in apps that are user friendly, in supporting digital literacy programmes and in setting up a digital grievance redressal system to pave the way for the adoption of e-services. Further strengthening of consumer confidence and in Cashless Faire collection efficiency could be achieved through continued awareness campaigns, driver training programmes, enhanced remuneration for drivers towards electronic fare collection and cashless fare collection efficiency improvement due to technological innovation. Digital payments can enhance operational efficiency and effectiveness of digital payments, as well as increase transparency, financial inclusion and cut on handling and enhance transport revenue monitoring.

The present study is aimed to understand the usage of digital payment options in using the urban transportation system with a special context of Maha Metro, Aapli bus, taxis, auto-rickshaws and e-rickshaws in Nagpur city. The research objective is to get the insight into the situation of usage of digital payment, the main hurdles of digital payments to passengers along with the transport services providers and the practices that can be implemented in order to improve the success cases of cashless payments. It also analyzes also an urban mobility scenario which reflects the mix between technological, economic and behavioural factors that influence digital payment system utilization. The insights gained from this research can be beneficial for policy makers, transport authority, financial institutions and fintech service providers in formulating policies for improving digital payment enablers and urban planners in urban mobility planning. The study will also recommend ways to boost and make payments in Indian cities more safe, ease the barriers and make the smart transportation systems and financial inclusion better in Indian cities.

LITERATURE REVIEW

Digital payments systems are an important research area, particularly with the speed pace of the digitalization in the financial and public sectors. Different aspects of cashless transactions – such as the issue of the acceptance of the technology, consumer attitude and behavior, digital infrastructure, security risk and service quality – have been studied. Digital payment systems have revolutionized fare collection systems in the realm of urban transportation, improving convenience, transparency, and efficiency. This review is meant to give a general summary of the relevant literature to date on uptake of digital payment systems in the field of transportation and public services.

Dahlberg, Guo and Ondrus (2015) did a review on Mobile Payment related research and discussed the Mobile Payment technologies development in various countries. They have reviewed the literature and divided it into the two categories: technology adoption and consumer behavior, business models and security issues. The authors highlighted that for the consumers to be willing to embrace mobile payment systems, the perceived usefulness, ease of use, trust, and technological readiness factors played a great influence. They also stated the need for the development of secure payment mechanisms and recommended further studies be conducted on applications for specific industries like transportation, healthcare and government services.

In case of rural public transport systems in India, Joshi (2019) studied the adoption of FinTech solutions. The study has identified several factors that are preventing digital payments from becoming mainstream: Low internet penetration, Low smartphone penetration, Low economic/capital knowledge, Low acceptance of technology changes, proffered by transport operators. The insights pointed out that while awareness of digital payment had

increased with the government's initiatives, there were two issues that still lay ahead of the population; infrastructural issue and educative issue. The study has proposed to improve digital apparatus and awareness campaigns to promote digital cashless transactions for public transport.

Singh and Srivastava (2019) investigated the acceptance of mobile wallet of urban commuters while traveling in public transport. Their empirical findings indicated that convenience, transaction speed, access to the service, promotion and perceived security were positive factors of the use of the mobile wallet. Some of the users, however, were discouraged to use purely digital swipes due to worries with transactions failing, data privacy and internet connectivity. The study has now confirmed that further technological progress and enhanced cyber security will have a pivotal role to play in surging trust in digital payments.

Ravichandran and Ragupathi (2020) have studied about awareness and adoption of digital payment system in public services in Tamilnadu. They found that there was a marked improvement in awareness of the public through government support, increased usage of mobiles and financial inclusion initiatives. Digital literacy-levels, consumer confidence in online transactions and risks to security with using the internet, however, were noted as a continuing challenge to mass adoption. The authors reinforced the importance of ongoing (ongoing) public awareness campaigns with various target groups reaching them through the implementation of more accessible digital payment methods.

Kumar & Bansal 2021 did an analysis of the Indian metro rail and city bus ticketing systems of QR (Quick Response) code and NFC (Near Field Communication) and documented the user satisfaction. The research revealed that the enhancements to waiting time, no touch transactions and ticketing efficiencies had resulted in a high level of Customer Satisfaction. Convenience and speed of electronic ticket systems were appreciated by respondents particularly as a result of the Covid-19 pandemic, which has led to an increase in demand for electronic transactions and contactless services. However, their user experience was affected by a few minor problems with technology, the Internet and the lack of grasp on the technology among seniors. The researchers recommended that further improvements in technology and that passengers be made more aware should help make the system more reliable.

Based on the study of government services of Tamilnadu, Sundararajan (2022) investigated behaviour problem of the UPI platform. The factors found to be significant in the influence on acceptance of the payment system using UPI in this study consist of perceived risk, habit, trust, digital literacy and social influence. Internet fraud, failure to pay and poor technical support topped the list of complaints among all the respondents. The author has observed that making people aware and strengthening cybersecurity policies would also lead them towards a positive attitude towards accepting UPI-based transactions for public services like transportation, which could also simultaneously lead to an improvement in customer service policies.

Ramesh and Natarajan conducted a study to see the attitudes of passengers towards digital ticketing in the government town busses of Tamil Nadu in the year 2023. Their ticketing system reduced ticket processing time, eliminated the need for cash handling, provided revenue visibility visibility, and improved passenger convenience and so forth, we learnt that their digital ticketing system really reduced the time of processing ticket, eliminated the need of cash handling, increased the visibility for seeing the revenue and increased passenger convenience. Multiple payment options like QR codes, UPI and mobile wallets were appreciated by the passengers. Intermittent internet connectivity, limited technological literacy in the older population and operational challenges due to technical problems remained. The authors suggested service enhancement involving better quality of digital infrastructure as well as regular and continuous training of the transport workers; regular maintenance of the system.

Most digital payment adoption studies are provided with a theoretical underpinning from Venkatesh et al (2003), the UTAUT - Unified Theory of Acceptance and Use of Technology. According to the UTAUT model, the factors that have been emphasized for the technology acceptance and usage are performance expectancy, effort expectancy, social influence and facilitating conditions. The model has been extensively used for research and analytics on mobile banking, mobile payments, e-commerce and smart mobility. The principles which it espouses remain very relevant to the study of digital payment uptake as part of the different modes of urban mobility.

The literature explored shows that technological, behavioral, infrastructural and institutional factors play a role in the adoption of digital payments in transportation. Convenience, ease of use, transaction speed, security and governments' backing are all significant factors for adoption, whereas internet connectivity challenges, cybersecurity concerns, transaction failures, and digital literacy obstacles remain hurdles to broad adoption. Though there is a lot of literature available on digital payments and public service, digital payment and simultaneous use of multiple modes of urban transportation (e-rickshaws, auto-rickshaws, taxis, Aapli Bus, Maha Metro) in a single metropolitan area have not yet been deeply explored empirically. To bridge this research gap the present study would take a detailed empirical analysis of the digital payment adoption, problems encountered with the digital payment and governance measures taken for urban transportation in Nagpur City.

Objectives of the Study

To examine the extent of digital payment adoption among commuters and service providers in urban transport services, with special reference to Maha Metro, Aapli Bus, taxis, auto-rickshaws, and e-rickshaws in Nagpur City.

To identify the major challenges and problems affecting the adoption and use of digital payment systems in urban transportation, including technological, operational, behavioral, and security-related issues.

To evaluate the management practices and suggest strategies for improving the efficiency, security, and acceptance of digital payment systems in urban transportation services in Nagpur City.

Hypothesis

Null Hypothesis (H_{01}): There is no significant extent of digital payment adoption among commuters and service providers in urban transport services, with special reference to Maha Metro, Aapli Bus, taxis, auto-rickshaws, and e-rickshaws in Nagpur City.

Alternative Hypothesis (H_{11}): There is a significant extent of digital payment adoption among commuters and service providers in urban transport services, with special reference to Maha Metro, Aapli Bus, taxis, auto-rickshaws, and e-rickshaws in Nagpur City.

RESEARCH METHODOLOGY

This study is essentially descriptive in nature and to investigate the level of willingness of people towards digital payment in urban transport service for commuters & service providers in Nagpur City (with Maha Metro, Aapli bus, taxis, auto rickshaws & e-rickshaws). In this work primary and secondary data are used. The primary data were gathered through a structured questionnaire which was administered to commuters and transport service providers who used/d used to transport passengers using digital payment method on their everyday routine. Various questions covering the use of digital payment platforms, transaction frequency, ease of use, convenience, security, and transaction problems faced were asked in the questionnaire. Secondary data obtained from the published research articles, books, government reports, transport authority reports, Reserve Bank of India (RBI) reports, publications of National Payments Corporation of India (NPCI) etc. and other relevant sources available through Internet. The people who were chosen were 300 respondents who were obtained by using a simple random sampling technique to select the respondents. The data collected were coded and analyzed with the help of the Statistical Package for the Social Sciences (SPSS). Descriptive statistical methods like frequency, percentage, mean and standard deviation were used to summarise the data and inferential statistical methods like One-Sample t-test were used to test the formulated hypothesis. The results were triangulated in an interpretation process to evaluate the adoption level and give meaningful recommendations for the development of cashless payment systems in urban transport systems.

Table 1: Descriptive Statistics of Digital Payment Adoption among Commuters and Service Providers (N = 300)

Variables	N	Mean	Std. Deviation	Interpretation
Regular use of digital payments for fare transactions	300	4.21	0.68	High adoption
Preference for UPI/QR code payments over cash	300	4.15	0.72	High preference
Ease of using digital payment applications	300	4.09	0.74	Positive perception
Availability of digital payment facilities across transport modes	300	3.98	0.81	Moderately high availability
Perceived security of digital payment transactions	300	3.91	0.79	Positive perception
Satisfaction with digital payment services	300	4.05	0.70	High satisfaction
Overall Digital Payment Adoption	**300**	**4.07**	**0.64**	**High level of adoption**

Analysis

In the present study, researcher has collected digital payment adoption details in urban transport services for users in Nagpur city and presented these details by using descriptive statistics in the table 1 for users and service providers of urban transport services in Nagpur city respectively. From the above results, it is noted that the digital

payment systems have a good level of adoption with the mean score of the data on a five point Likert scale to be (4.07, SD = 0.64). The highest mean score of the variables measured was for frequency of using digital payment methods to pay for fares while travelling (M = 4.21, SD = 0.68). Preference to use UPI and QR code payments also got a high mean score (M = 4.15, SD = 0.72) indicating the rise/re-emergence of an alternative payment mode to cash in urban transportation systems. The respondents had favorable attitudes toward their digital payment applications use (M = 4.09, SD = 0.74), and high satisfaction with their digital payment services (M = 4.05, SD = 0.70). The digital payment accessibility of other modes of transport received a median rating of 3.98 (SD = 0.81), which meant that these are considered to be fairly available but there are still some issues. Overall, participants indicated that they trust the security of their transactions has a high level of sense, and the mean transaction security score of perceived transaction security comes to 3.91 (SD = 0.79). The highly acceptance of the digital payment system inside Maha Metro, Aapli Bus, taxis, auto-rickshaws, and e-rickshaws shows the acceptance of using digital payments for urban transportation in Nagpur City.

Table 2: One-Way ANOVA for Digital Payment Adoption among Urban Transport Services

ANOVA	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18.462	4	4.616	9.783	0.000
Within Groups	139.218	295	0.472		
Total	157.680	299			

Dependent Variable: Digital Payment Adoption Score

Grouping Variable: Mode of Urban Transportation (Maha Metro, Aapli Bus, Taxi, Auto-Rickshaw, E-Rickshaw)

Interpretation

A One-Way ANOVA test was carried out to check whether there is any significant difference in level of adoption of digital payment among different urban transport service like Maha Metro, Aapli Bus, Taxis, Auto-Rickshaws, eRickshaws with regards to Nagpur City. Based on the results shown, the sum of squares between groups is 18.462, the sum of squares within groups is 139.218 and the total sum of squares is 157.680. The F value is 9.783 which is significant at 0.000 ($p<0.05$), with statistically highly significant differences in the uptake for different modes of transportation with digital payments. Based on this, the null hypothesis (H_{01}) is rejected and the alternate hypothesis (H_{11}) is accepted. The findings show that there are significant differences in the rate of usage of digital payments among the commuters, the service providers and the people having digital payment system including the commuters of the respective transport services of Maha Metro, Aapli Bus, taxi, AMBFA (Auto Rickshaw and e-Rickshaw) in Nagpur City.

Overall Conclusion

The researchers found that digital payment has now become the integral part of an urban transport system and a marker of digitization of the public transportation system in Nagpur City. Data analysis on the field observation reveals a good number of people have become a part of the electronic payment system in commuters in Maha Metro service providers and taxi/dhrishti auto-rickshaws/e-rickshaws. People's penchant for cashless payments is enhanced by quick payment systems, the embrace of the Unified Payments Interface (UPI), QR code-based payment systems, mobile wallet and smart card facilities, which epitomized the cosiness, speed, transparency and security of the payment process. Various government initiatives such as 'Digital India', 'Development of Digital Banking Infrastructure' and increasing Smartphone penetration in all the modes of transportation have also been conducive in the acceptance of this digital payment option.

The descriptive statistical analysis showed a high level of acceptance of digital payment, which indicates that most respondents use digital payment regularly for fare activities, and they are accepting the ease of use and convenience of digital payment. The respondents also spoke of some of these problems: internet connection problems, transaction failure, delay in confirming payment, cyber security problems, and awareness of internet capabilities of commuters/travel agencies. These challenge continue to be encountered in ensuring smooth operation of cashless systems particularly at informal vehicles such as Auto-rickshaws and e-rickshaws.

The results of the One-Way ANOVA revealed that there is a significant difference between digital payment adoption and the transport services, meaning the readiness of digital payment has a connection to the readiness of digital infrastructure, digital technology and digital practices. Digital payment supports for organized transport modes such as Maha Metro and Aapli Bus are observed as higher compared to the other transport modes such as

taxi, auto-rickshaw and e-rickshaws that are less developed their infrastructure and digital payment awareness level is less. The findings highlight the significance of targeted measures to develop the digital payment systems.

The study reveals importance of strengthening of the Internet connectivity and enhancement of cyber security measures and digital payment infrastructure in addition to organizing, digital literacy trekking, awareness-raising activities and providing continuous tech support to the commuters and transport operators to promote the use of cashless transactions. To create an environment for the use of digital payment – cooperative relationships between the transport sector, private sector organisations including financial institutions and fintech service providers, Government institutions and authorities will be needed. To conclude the study, enhancement of digital payment systems will not only help in the city's operational efficiencies but will also contribute to the financial inclusion, the financial transparency and smart city development and sustainable urban transportation in the Nagpur City.

REFERENCES

1. Dahlberg, T., Guo, J., & Ondrus, J. (2015). A critical review of mobile payment research. Electronic Commerce Research and Applications, 14(5), 265–284. https://doi.org/10.1016/j.elerap.2015.07.006

2. Joshi, A. (2019). FinTech adoption in rural public transport systems: Challenges and scope. Indian Journal of Rural Studies, 3(1), 18–25.

3. Kumar, A., & Bansal, S. (2021). User experience of QR code and NFC-based ticketing in Indian metro and city bus services. Transport Research Journal, 5(3), 72–80.

4. Ramesh, S., & Natarajan, P. (2023). Digital ticketing in Tamil Nadu's government town buses: A passenger perspective. Journal of Public Transport and Technology, 4(1), 60–68.

5. Ravichandran, M., & Ragupathi, M. (2020). Awareness and adoption of digital payments in public services: A study in Tamil Nadu. International Journal of Management Studies, 7(2), 45–53.

6. Singh, R., & Srivastava, M. (2019). Adoption of mobile wallets in public transportation: A study of urban commuters. Journal of Digital Economy, 1(1), 21–30.

7. Sundararajan, K. (2022). Behavioral challenges in UPI adoption in Tamil Nadu's public services. South India Journal of Digital Innovation, 6(2), 35–42.

8. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425–478. https://doi.org/10.2307/30036540..