International Conference on Role Of Digital Transformation in Commerce: Leveraging Technology for Sustainable Growth, 4 Sep, 2025

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

A Chi-Square Approach to Understanding Recent Developments in Digital Payment Systems

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Abstract- The Chi-square test is used in this study to investigate the association between digital payment methods and their frequency of use. Understanding user preferences is critical as online banking, mobile banking, and mobile wallets proliferate at a rapid pace, fueled by technology advancements and the COVID-19 epidemic. A standardized questionnaire was used to obtain information about transaction behavior and payment options. The study reveals a direct link between the type of digital payment mechanism and how frequently people conduct online transactions. The findings imply that factors such as ease, accessibility, and familiarity have a major impact on user behavior. These findings are useful for enhancing digital payment platforms, advising financial institutions, and supporting initiatives that encourage the widespread adoption of safe and user-friendly digital payment methods.

Keywords- Digital Payment; Payment System; Online Transactions; Digital Literacy; Chi-square; Frequency of Usage.

I. INTRODUCTION

In today's fast-changing digital world, especially in banking and finance, countries around the globe are adopting quick and efficient digital payment systems. A digital payment system, also known as an electronic payment (e-payment), allows people to make transactions electronically instead of using cash or checks[1]. These systems come in different types, and this study focuses on online banking, mobile banking, and mobile wallets.

Customers can use a bank's secure online website to conduct financial transactions through online banking, also known as Internet banking. Online banks frequently offer a variety of services, such as online bill payment; check ordering, account management, enabling money transfers between accounts at the same bank or at different banks, and online mortgage and loan applications. Additionally, mobile banking allows users to conduct a variety of banking tasks using a mobile device, like a tablet or smartphone. For contactless payments, it can also be linked with mobile wallets like Samsung Pay, Amazon Pay, Google Pay, and Paytm.

India's financial payment infrastructure has changed significantly in the last two decades. The global COVID-19 outbreak sped up this change, causing a sharp rise in the use of digital payments (Das, 2021). Supported by effective regulations issued by the RBI and the Indian Government, digital payments for

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ISSN: 2348-4098, P-ISSN: 2395-4752

retail transactions—particularly via UPI—have experienced rapid growth. Between 2016-17 and 2022-23, the number of transactions increased by 51% per year, and their total value grew by 27% annually. Nevertheless, even with this digital boom, the use of cash has continued to increase. The proportion of cash in circulation relative to GDP reached as high as 14.4% in 2020-21[2].

These results in an interesting contradiction: cash and digital payments are both growing at the same time. Because digital payments are typically considered an alternative to cash, their simultaneous use seems unexpected. This situation, called the 'currency demand paradox,' needs careful examination to identify the reasons why people continue to use different payment options.

II. OBJECTIVES OF THE METHOD

The main objectives of this study are:

- To examine the association between different payment methods and the frequency of online payment transactions.
- To analyse whether the type of payment method used significantly influences how often individuals make online payments.
- To identify patterns in user preferences for digital payment methods based on their online payment frequency.

III. LITERATURE REVIEW

The rise of digital payment systems has revolutionized financial transactions across the globe. With the growing penetration of smartphones, internet access, and fintech innovations, users are increasingly shifting from traditional cash transactions to digital modes such as UPI, mobile wallets, debit/credit cards, and online banking. These platforms offer faster, safer, and more convenient ways to manage payments, contributing to the development of a cashless economy.

A key factor that influences the successful adoption of digital payments is digital literacy. Users must be able to access, understand, and confidently navigate digital platforms to perform transactions securely. Several studies have emphasized the need for awareness and training programs to enhance users' understanding of digital payment tools, especially in areas where traditional banking services are limited. The effectiveness of a payment system is closely tied to how accessible and user-friendly it is for a broad audience.

To analyse such patterns and determine if there is a significant association between variables like payment method and frequency of usage, researchers often employ the Chi-square test[5]. This statistical method is suitable when working with categorical variables, allowing analysts to test whether differences observed in data are due to chance or indicate a meaningful relationship. Accordingly, the Chi-square test requires a sufficiently large sample size (at least 50) with no expected frequency below 10 in any category to ensure accuracy and reliability.

In digital payment research, the Chi-square test is typically used to assess whether the selection of a particular payment method (e.g., UPI, card, wallet) is related to the frequency of online transactions (e.g., rarely, occasionally, frequently). The resulting p-value indicates the strength of this relationship. A p-value less than 0.05 is generally considered statistically significant, meaning there is strong evidence of an association between the variables. As noted by Bekerson, even extremely low or high p-values offer clear direction on whether to accept or reject the null hypothesis, especially in large-scale data sets.

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In summary, the literature highlights the transformative impact of digital payment systems on transaction behaviour and the value of applying statistical tools like the Chi-square test to examine user patterns. These insights are vital for improving payment technologies and promoting inclusive digital financial services.

IV. PROPOSED METHOD

The Chi-square test is a statistical method used to evaluate whether there is a significant relationship between two categorical variables. In this study, Chi-square hypothesis testing was applied to interpret the data, with a p-value calculated to assess the hypothesis. While software such as SPSS can also perform correlation analysis, correlation measures the strength and direction of a linear relationship between two continuous variables, whereas the Chi-square test examines the association or independence between categorical variables[6].

The test works by comparing the observed frequencies (actual data) with the expected frequencies (predicted if no association exists). Larger differences between these values result in a higher Chi-square statistic, indicating a stronger deviation from independence. This method is often applied to test the independence of variables or to check how well a sample fits a known population distribution (goodness-of-fit). Overall, the Chi-square test provides a simple yet effective way to determine associations in categorical data and ensures that sample results reflect the larger population accurately. Overall, the Chi-square test is a simple and useful way to check if different categories are related or to see if the data matches what we would expect from the larger population, especially when studying how people use digital payments. Hypothesis:

H0: There is no relationship between payment method and frequency of online payment.
H1: There is relationship between payment method and frequency of online payment.

V. RELATIONSHIP BETWEEN PAYMENT METHODS AND FREQUENCY OF DIGITAL TRANSACTIONS

In particular, the development of digital payment systems has advanced dramatically since the COVID-19 pandemic, which increased reliance on online and contactless payment methods. With a focus on key factors such as geography (rural vs. urban) and educational attainment, this study explores the relationship between the type of payment method utilized and the frequency of digital payment transactions among users.

The rise of technologies like UPI, mobile wallets, internet banking, and card payments has made financial services faster and easier for users. Digital payment use was initially more widespread among urban and digitally literate individuals, but recent trends indicate that it is gradually spreading across a variety of demographics, including rural regions and less formally educated groups.

Government programs, financial literacy campaigns, and expanded access to mobile and internet connectivity are all part of the effort to boost the use of digital payments. These initiatives seek to encourage the adoption of safe and convenient payment methods while guaranteeing equitable access to cashless transactions.

People all over India are realizing the importance of digital financial tools for everyday transactions, bill payment, and peer-to-peer transfers as they become more and more integrated into daily life. In this

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

regard, knowing the most popular payment methods and their usage rates offers important information about user behaviour and financial inclusion.

The study used a structured questionnaire with Likert scale items to collect data on participants' transactional patterns, preferences, and ease of access to digital payment platforms. Using the Chi-square test for statistical validation, the gathered data enables a thorough examination of whether the kind of payment method used is connected to the frequency of usage.

Payment Method	Rarely (1–3 times/month)	Occasionally (4–9 times/month)	Frequently (10+ times/month)
Credit Card	25	40	35
Debit Card	30	25	15
UPI	10	30	60
E-Wallet	20	35	25

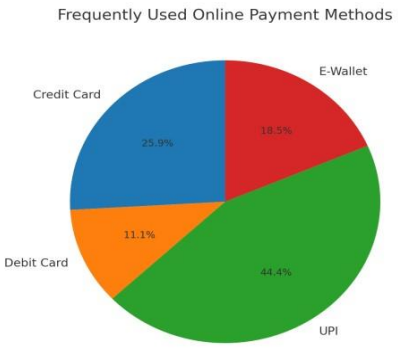

Table 1: Observed values

Chi square test	x^2	df	P-value
	39.64	6	12.592
Chi square test	x^2	df	P-value
	39.64	6	12.592

Table 2: Chi square experimentation of payment method and frequency of online payment

Table1 presents the observed values collected from respondents based on their usage of various digital payment methods and their frequency of use. These values were used to perform the Chi-square test of independence. Table2 shows the results of this test, where the calculated Chi-square value is 39.64 and the critical value at the given degrees of freedom is 12.592. Since the calculated value is greater than the critical value, we reject the null hypothesis. This indicates that there is a statistically significant association between the type of payment method used and the frequency of digital payment transactions.

VI. CONCLUSION

This study shows that the type of digital payment method people choose is closely connected to how often they use digital payments. The results from Table 1 and the Chi-square analysis in Table 2 clearly indicate that this relationship is not due to chance. Since the Chi-square value (39.64) is higher than the critical value (12.592), we can confidently say that there is a meaningful link between payment method and usage frequency. In simple terms, people tend to use certain payment methods more often than others, and their choices matter. These insights highlight how important it is to understand user

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

behaviour in digital finance, and they point to the value of improving digital payment systems to better meet people's needs and habits.

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