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Sustainable growth towards achieving a cashless ecosystem and a surge in volume of digital payment users

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ABSTRACT

Though computerization began in the 1980s, the effect of demonetization in 2016, coupled with COVID-19 digital stimulation, was a revolutionary move in digital innovation and transformation into a cashless ecosystem. Traditional banks and digital enablers embraced digital technologies to keep up with the dynamism in the payment landscape. The Government of India envisioned a "faceless, paperless, cashless" economy through effective implementation of the Digital India flagship program. A study on cashless payment and EU nations' economic growth advocated the effects of adopting the cashless payment system can be perceived with the gradual development in innovation and technology in the long run. The study examined the surge in volume of digital transactions and users' perspectives on the cashless ecosystem. The descriptive method used both first-hand information gathered by collecting and pooling 492 responses and information gathered from RBI and NPCI reports. We analyze the qualitative data using chi-square, one-way ANOVA, and DMRT tests. The quantitative data analysis employed CAGR, correlation, and linear regression analysis. Line graphs depict the trend in transaction volume and user activity. The perceived opinions revealed that the majority of respondents are convenient in using digital modes, though the concerns of security and identity sharing existed. However, the absolute volume of RTGS and mobile banking transactions has shown a significantly increasing trend compared to NEFT and internet banking transactions. The mode of RTGS and mobile banking transactions experienced a rapid increase, and the statistical results revealed a substantial and significant correlation with the volume of active mobile banking users.

Contribution/ Originality: The study adds novelty to the literature by examining perceived opinion across different age groups and has provided insight into digital inclusivity and user agreement. Furthermore, the study's findings on the number of digital users and their impact on transaction volume can enhance policy implications, aiding in the development of a long-lasting cashless system.

1. INTRODUCTION

The 21st century began its progress by embracing the objectives of globalization and making footprints in an era of technology. The progressive growth in technology has witnessed an expeditious and enormous rise in tech-enabled services globally. The services gradually percolated into the banking system and revolutionized the provision

of financial services. The trends in technology-led economies show that India is said to be one of the fast-growing economies adopting technology in attaining financial inclusivity and a cashless economy (Raya & Vargas, 2022). The unprecedented move of demonetization initiated to grasp the changes in cutting-edge technology surfacing the payment ecosystem, and India started witnessing a phenomenal surge in users of digital platforms (Oyewole, Gambo, Abba, & Onuh, 2013). The Indian government's Digital India program aims to create a number of digital platforms, such as debit and credit cards, UPI (Unified Payment Interface) mobile wallets, point-of-sale (POS) systems, USSD (Unstructured Supplementary Service Data) micro-aTMs (Automatedata), AEPS (Aadhaar Enabled Payment Systems), the internet, and mobile banking. With an aim to digitalize and transform into a cashless ecosystem, the Indian government has taken initiative by imparting education and creating awareness through DigiShala on Door Darshan (Okoye & Raymond, 2013). The measures began to transform India into a digitally empowered nation.

Recent technological developments, rising internet usage, and the emergence of digital payment platforms have all contributed to the shift toward a cashless ecosystem (Slozko & Pelo, 2014). In order for this industry to flourish sustainably, digital payment methods must be adopted consistently and be backed by strong infrastructure, legal frameworks, and user-friendly technologies.

A key element of contemporary economies, the growing number of people using digital payments demonstrates a trend in society toward ease, security, and financial inclusion. By decreasing reliance on physical cash, increasing transparency, and encouraging fintech innovation, the rise in digital payments is not only revolutionizing financial transactions but also advancing sustainable economic growth as governments and financial institutions push for greater digitalization. The current study focuses on how different age groups of digital users perceive the adoption of a cashless ecosystem. The study analyzes the growth rate of the volume of digital payment transactions and the volume of digital payment users. Finally, the study examines the influence of volume digital users on the volume of digital payment transactions.

2. REVIEW OF LITERATURE

The digital ecosystem is an innovative thought process in making India a "faceless, paperless, cashless" economy. The digital innovation marks a significant milestone in the payment and settlement system, setting a benchmark for both the pre- and post-digitalization eras. This innovation has revolutionized the payment mechanism by encouraging digital users to adopt a virtual grid. A study by Okoye and Raymond (2013) aimed at Nigeria's shortcomings in embracing and putting into practice the cashless economy strategy, emphasizing its advantages and potential to improve financial stability. The study collects data using a questionnaire and a descriptive research design with 68 participants in the sample. The majority of Nigerians, according to the results, are aware of the policy and think it lowers monetary risk and fights corruption. But significant issues like illiteracy and cybercrime impede its adoption. Creating a framework for cybersecurity and teaching illiterate Nigerians about the cashless economy are among the recommendations.

Nigeria's economy is facing difficult times right now, and strong foundations are required to get through them. Omotunde, Sunday, and John-Dewole (2013) said it is the right step towards a cashless economy and can have a positive effect on modernization of the payment system; transparency can be fostered. Reducing the operational cost of a traditional system is possible. Oyewole et al. (2013) examined the connection between Nigeria's economic expansion and e-payment systems using data from 2005 to 2012. The most advantageous connection between payment systems and economic growth, according to the results, is that of ATMs. Other electronic payment methods, however, have a negative impact. According to the report, in order to successfully transition to a cashless economy, present cashless policies should prioritize other issues and concentrate on efficient e-payment systems.

Ebeiyamba (2014) examined the impact of Nigeria's cashless policy on micro and small companies. It seeks to ascertain the effects of a cashless economy and offer remedies for the difficulties these companies encounter. The report examines the body of research on the idea of a cashless society and offers practical implementation suggestions

to support entrepreneurs. The article also discusses the drawbacks of a cashless society, including the anxiety of running out of cash and the loss of actual value. The study recommends appropriate foundations, stakeholder attention, and empowerment for small and micro enterprises in order to prevent failure. The article concludes that implementing change for everyone's benefit is feasible. Slozko and Pelo (2014) argued the digital and cashless payment system has a direct influence on the financial system as a whole and fosters economic development. A cashless payment system accelerates a country's economic development. Tee and Ong (2016) evaluated the effects of adopting cashless payments in five EU nations between 2000 and 2012. The Pedroni residual cointegration and panel vector error correction model are used to look into the cause-and-effect link between checks, telegraphic transfers, cards, and electronic money. Findings indicate a short-term causal relationship, but there is a major long-term impact on economic growth. Encouraging cashless transactions has a delayed impact on the economy. Sagayarani (2017) study found that cashless payments have gone up, and the usage of debit cards or credit cards via mobile transactions has geared up electronic payments. Despite this progress, a significant portion of the population still relies on cash. We must implement the necessary measures to enhance safety and make digital transactions more convenient.

Bansal (2017) explained that the shift of the Indian economy from a cashless, branch-based model to one powered by technology is still in its early stages. This change intends to ensure a variety of lifestyles, improve disposable income, and expand the prevalence of mobile and internet technology. But there are still problems, like inadequate internet access in remote regions, issues with digital literacy and cybersecurity, and a dispersed, unorganized sector of the business.

The government has started initiatives like Startup India, Stand Up India, tax law reform, financial inclusion, foreign investment promotion, and demonetization to set the groundwork for this digital revolution. The largest obstacles, nevertheless, are the absence of digital literacy, poor rural internet access, shoddy banking facilities, ignorance among rural clients, and disorganized indigenous marketplaces. Thomas and Krishnamurthi (2017) examined how demonetization has affected India's rural economy and whether the government's goal of making the country cashless has been achieved. Based on secondary data gathered from multiple sources, it highlights the advantages and disadvantages of creating a cashless rural economy. The study comes to the conclusion that there is a great deal of potential for the rural economy to go cashless and that basic support systems such as laptop distribution, internet incentives, sound infrastructure, digital transaction awareness, and multilingual online payment platforms will be put in place by the government. Garg and Panchal (2017) examined opinions regarding the implementation of a cashless economy in India. According to the respondents, it would lessen robberies, fight terrorism, stop black money, and boost economic growth. But obstacles like cybercrime, high rates of illiteracy, and opaque digital payment systems make it difficult to put into practice. To make adoption easier, the government should make electronic payment systems more open and effective, allow payment banks to handle cashless transactions, support mobile wallets, and start financial literacy programs to make more people aware of the benefits of electronic payments. The study stated the success of achieving a cashless economy can be seen by bringing transparency and efficiency in the e-payment system, conducting e-literacy campaigns. A similar observation has been found in the study made by Choudhary (2018) and stresses that to make India a cashless economy, the government must implement policies and grassroots initiatives, but there are still obstacles to overcome because a large number of people do not have access to banking services.

Imran (2018) delves into the evolution and obstacles around the cashless policy in the Indian economy, with a particular emphasis on how it affects financial reporting and business activities. The results show that because there is less tax fraud, inflation, and revenue leakage in cashless economies, stakeholders in company financial statements have greater faith in these systems. However, the report also mentions issues such as insufficient literacy, unsafe banking practices, limited infrastructure, and the perception of higher vendor costs. A cashless economy can counter money laundering, tax evasion, inflation, low balance of payments, and inefficiencies in financial statement reporting. Additionally, it lessens the demands and load on auditors, encouraging cost-cutting measures in cost-management

plans. According to Budheshwar Prasad Singhraul (2018) this approach differs significantly from that of developed economies. India is at a nascent stage in adopting digital payment systems, and there is a need to enhance the digital infrastructure to achieve inclusivity. Goswami and Sinha (2019) examined the impact of the cashless economy on bank marketing strategies in Dimapur, Nagaland, India. It lists the challenges banks have in putting cashless payment systems in place, including low literacy rates, a lack of knowledge, and a shortage of ATMs and POS (Point of Sale) equipment. The report also emphasized how crucial it is to use digital marketing techniques to reach specific clients, including social media, mobile marketing, digital ads, and online banking.

Raya and Vargas (2022) aimed to ascertain the determinants by which individuals decide to use credit cards as a payment method rather than cash; that is, to understand changes in socioeconomic factors that affect the long-term use of alternatives to cash. Using the data from the waves (2002–2017) of the Spanish Survey of Household Finances (SSHF) and a panel data estimation (static and dynamic), we identified education, age, income, and wealth as the main drivers of credit cards as a payment method. The study has unraveled the effect of age and the cohort effect, checked for nonlinearity problems, and card use persistence. A secondary aim is to establish, using a controlled experiment, some of the financial consequences of being a cashless economy. Sri Sai Chilukuri (2018) The study on customer satisfaction with modern banking services in Hyderabad found a 5% difference between factors promoting modern services and satisfaction. It recommends public sector banks update technology and customer services, including cash deposit machines, internet banking, and awareness of fake calls. Factors like quality of service, trust, and technology were important, with online banking being the most used and satisfying service. Sunitha and Venu (2020) examine how fin-tech has revolutionized the banking industry, emphasizing both its advantages and disadvantages. The study offers a thorough examination of the ways in which fin-tech innovations like digital payments, mobile banking, and blockchain have improved the effectiveness, convenience, and accessibility of financial services. It also explores the difficulties traditional banks have implementing new technology, such as legal restrictions, cybersecurity issues, and customer mistrust. The study provides insightful information about the opportunities fin-tech brings to banking organizations, particularly in terms of promoting competition and financial inclusion. The authors do, however, emphasize the necessity of strong frameworks to handle the dangers related to the adoption of fintech. Although the essay provides a comprehensive analysis of fin-tech's impact on banking services, it would benefit from deeper debates on evolving regulatory landscapes and future trends.

2.1. Research Gap

Numerous studies in the literature asserted the necessity of constructing appropriate digital infrastructure to enable a cashless economy (Ratan, 2018). The literature on cashless economies states that their attainment is dependent on the provision of necessary digital infrastructure. Further, it's been almost 8 years since the vision of the cashless and digital ecosystem. But the literature found is scarce, with the studies emphasizing the growth in volume of digital users and qualitative data analysis on perspectives of digital users. In light of this, the current study's goals were to look into the rise in digital transactions and find out what users think about the progress of the cashless ecosystem.

2.2. Research Question

RQ1-Are there differences in how digital users perceive and adopt the cashless ecosystem?

RQ2- Does an increase in the number of digital users impact the growth rate of digital transactions?

2.3. Research Objectives

1) To analyze the perceived opinion in adopting a cashless ecosystem based on the age group of digital users.
2) To study the growth rate of volume of digital payment transactions and volume of digital payment users.
3) To examine the influence of volume digital users on volume of digital payment transactions.

3. METHODOLOGY OF THE STUDY

3.1. Sources of Data Collection

The study is descriptive in nature, comprising both a qualitative study and a quantitative study. The qualitative study pooled data from the 492 respondents by administering a questionnaire based on convenience and judgmental random sampling techniques. We distributed the questionnaire to approximately 1800 respondents, but only 492 respondents returned the data. The quantitative analysis is based on the data pooled from published sources in the RBI—Reserve Bank of India and NPCI—National Payments Corporation of India databases.

The study employed a mixed-methods strategy, combining quantitative and qualitative research methodologies. Quantitative data will be gathered through surveys and secondary data analysis from places like government publications, digital payment platforms, and financial institutions in order to look at the patterns of growth, the rate of user adoption, and the number of transactions. Interviews with digital payment users were used to gather qualitative information about the motivations behind and difficulties associated with the shift to a cashless economy. Regression analysis and statistical tools were utilized to find relationships between indices of sustainable growth and the uptake of digital payments.

The study is crucial to comprehending how digital financial technology has revolutionized contemporary economies. In the context of global digitization, a cashless ecosystem presents several advantages, such as better financial inclusion, heightened transparency, decreased transaction costs, and heightened security. Because real cash has less of an environmental impact, it also promotes fintech innovation, increases economic efficiency, and supports global sustainability goals (Sunitha & Venu, 2020). Policymakers, businesses, and financial institutions should look at the things that are driving this shift and the things that are stopping people from using digital payments. This will help make sure that the growth of digital payments is safe, inclusive, and resilient, and that it leads to a more effective and long-lasting financial system.

The study's approach was chosen because it could adequately represent the dynamic and ever-changing character of the adoption of digital payments. A quantitative approach was chosen to find out how many digital payments are used, how they affect different groups of people, and what factors are affecting the move to a cashless ecosystem. Using this method, it is possible to collect statistically significant data from a large population. This can give information about how people use technology, how they buy things, and how these things affect overall sustainability goals. This approach has also been effectively used in related research in the field, supporting its suitability for achieving the study's goals.

3.2. Data Analysis Tools

IBM—International Business Machines Corporation SPSS—Statistical Package of Social Sciences 20V—runs both qualitative and quantitative data.

i). Digital users of different ages use the chi-square test of independence to understand the differences in their perspectives on the adoption of cashless ecosystems. These differences include reasons for adopting digital payment, concerns about adopting digital payment, preferred mode of digital payment, changing device passwords, PIN (Personal Identification Number) for debit/credit cards, and safety in sharing identity during digital payment. These statements are categorical variables, depending on the type of question.

ii). *The one-way ANOVA using the DUNCAN Multiple Range Test* is executed to examine the differences among different age groups of digital users with respect to factors of digital adoption, viz., accessing public Wi-Fi, installing antivirus and malware protection on devices, saving card details in devices, and timely redressal regarding queries related to digital payments. These statements are dichotomous rating scale questions having 'yes' and 'no' as 2 and 1 scaling, respectively.

iii). A CAGR (Compound Annual Growth Rate) is used to look at the growth rate of quantitative data, such as the number of transactions through NEFT, RTGS, mobile, and internet banking, as well as the number of people who use mobile and internet banking. This is done for 10 months, from April 2023 to January 2024.

iv). The line graphs are used for representing the trend in volume of transactions.

v). In addition to CAGR, the data is subjected to correlation and linear regression analysis in identifying the influence of volume of mobile banking users and internet banking users on volume of digital payment transactions.

3.3. Research Hypothesis

H_{01}: *There is no-significant association among the age groups of digital user respondents regarding adoption of a cashless ecosystem.*

"Association based on reasons for adopting digital payment".

"Association based on concerns on adopting digital payment".

"Association based on preferred mode of digital payment".

"Association based on change of device passwords, pin of debit/credit cards".

"Association based on 'safety of sharing identity during digital payment".

H_{02}: *There are no-significant differences among the age groups of digital user respondents with regard to factors of digital adoption.*

"Difference of opinion regarding accessing public Wi-Fi".

"Difference of opinion regarding antivirus and malware protection on device".

"Difference of opinion regarding saving card details on device".

"Difference of opinion regarding redressal of digital payment queries by concerned service providers".

H_{03}: *There is no-significant relationship between the volume of users in mobile and internet banking and the volume of digital payment transactions.*

"Volume of users in mobile banking with volume of NEFT, RTGS, mobile banking, and internet banking transactions".

"Volume of users in internet banking with volume of NEFT, RTGS, mobile banking, and internet banking transactions".

H_{04}: *There is no-significant impact of the volume of mobile and internet banking users on the volume of digital payment transactions.*

"Volume of users in mobile and internet banking on volume of RTGS transactions".

"Volume of users in mobile and internet banking on volume of NEFT transactions".

"Volume of users in mobile and internet banking on volume of mobile banking transactions".

"Volume of users in mobile and internet banking on volume of internet banking transactions".

3.4. Proposed Model of the Study

The proposed model of the study based on the volume of usage of mobile banking and internet banking's influence on volume of digital payment transactions is presented below in Figure 1.

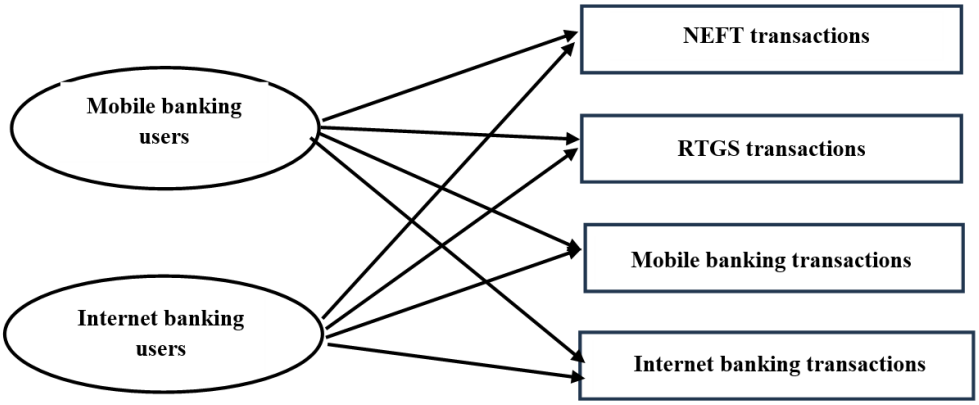

Figure 1. Proposed model of the study.

4. METHODS AND MATERIALS

This section of the study is divided into two parts, viz., Part A: qualitative data Part B: Analysis and Quantitative Data Analysis.

Table 1. Showing age group of digital user respondents.

Age group	Frequency	Percentage
Up to 25 years	108	22
26 - 35 years	174	35
36 - 50 years	120	24
51 years and more	90	18
Total	492	100

Source: Computation based on survey responses.

4.1. Part-A

The above Table 1 exhibits the demographic nature based on the age group of digital user respondents. The total number of respondents was 492. The majority of research survey respondents belong to the category of 26-35 years, with 174 (35%), and a smaller number of respondents under 51 years and more category as 90 (18%).

H_0: There is no-significant association among the age groups of digital user respondents regarding adoption of a cashless ecosystem.

Table 2. Contingency table showing association of age group of respondents with reasons for adopting digital payment.

Parameter	Convenience	Cash back offers	Shortage of currency	Quick payment	Easy tracking of payments	Total	Chi-square	p-value
Up to 25 years	72 (66.72) [23.5]	6 (5.6) [14.3]	6 (5.6) [33.3]	6 (5.6) [8.3]	18 (16.7) [33.3]	108 (100) [22]	105.197	<0.001**
26 - 35 years	96 (55.2) [31.4]	30 (17.2) [71.4]	6 (3.4) [33.3]	24 (13.8) [33.3]	18 (10.3) [33.3]	174 (100) [35.4]		
36 - 50 years	60 (50) [19.6]	6 (5) [14.3]	0 (0) [0]	42 (35) [58.3]	12 (10) [22.2]	120 (100) [24.4]		
51 years and more	78 (86.7) [25.5]	0 (0) [0]	6 (6.7) [33.3]	0 (0) [0]	6 (6.7) [11.1]	90 (100) [18.3]		
Total	306 (62.2) [100]	42 (8.5) [100]	18 (3.7) [100]	72 (14.6) [100]	54 (11) [100]	492 (100) [100]		

Note: Row percentage (i.e. within age group) indicated within ( ).
Column Percentage (i.e. within the reasons of adoption) indicated within [ ].
** indicates significant at 1% level.
Source: Primary data computation using SPSS.

The above Table 2 on the contingency table shows the relationship between the age groups of respondents and the reasons they gave for using digital payments at a 1% significance level and 12 degrees of freedom. With a p-value less than 0.01, the alternate hypothesis is accepted, affirming there is a significant association among the age groups of digital user respondents with regard to the adoption of a cashless economy. Based on the row percentage, the age group up to 25 years has a lower adoption rate for cashback offers, currency shortages, and quick payments, but a higher adoption rate for convenience. In contrast, the age group between 26 and 35 years has a lower adoption rate for currency shortages and a higher adoption rate for convenience. The results based on the remaining age groups also reveal convenience as the high association. However, the low association differs with 36-50 years as a shortage of currency and 51 years and more as cashback offers and quick payment. The chi-square test of association reveals that convenience is the major reason for the adoption of a cashless ecosystem.

Table 3. Contingency table showing association of age group of respondents with concerns on adopting digital payment.

Parameter	Security	Poor server connectivity	Merchant acceptance	Lack of complete knowledge of usage	Total	Chi-square	p-value
Up to 25 years	78 (72.2) [22.8]	24 (22.2) [36.4]	6 (5.6) [11.1]	0 (0) [0]	108 (100) [22]	91.071	<0.001**
26 - 35 years	120 (69) [35.1]	30 (17.2) [45.5]	18 (10.3) [33.3]	6 (3.4) [20]	174 (100) [35.4]		
36 - 50 years	96 (80) [28.1]	12 (10) [18.2]	6 (5) [11.1]	6 (5) [20]	120 (100) [24.4]		
51 years and more	48 (53.3) [14]	0 (0) [0]	24 (26.7) [44.4]	18 (20) [60]	90 (100) [18.3]		
Total	342 (69.5) [100]	66 (13.4) [100]	54 (11) [100]	30 (6.1) [100]	492 (100) [100]		

Note: Row percentage (i.e. within age group) indicated within ( ).
"The value within [ ] refers to column percentage".
"** Denotes significant at 1% level (i.e. within the concerns on adopting adoption)".
Source: Primary data computation using SPSS.

Concerns about using digital payments are linked to respondents' age groups in Table 3, which is part of the contingency table. The level of significance is 1%, and the degree of freedom is 9. The p-value is less than 0.01; the alternate hypothesis is accepted, affirming there is a significant association among the age group of digital user respondents with regard to the adoption of a cashless economy. Based on row percentage, the age group of up to 25 years has less association of adoption due to lack of complete knowledge of usage and is highly associated with security. The results of remaining age groups also exhibit a similar level of adoption. Therefore, the chi-square test of association exhibits security as the major concern in the adoption of the cashless ecosystem.

Table 4 in the contingency table illustrates the correlation between respondents' age groups and their preferred mode of digital payment, using a 1 percent significance level and 12 degrees of freedom. The p-value is less than 0.01; the alternate hypothesis is accepted, affirming there is a significant association among the age group of digital user respondents with regard to preferred mode of digital payment. Based on row percentage, the age group up to 25 years is highly associated with credit/debit card payment and less associated with check payment. The age groups of 36-50 and 51 years and above exhibit a similar association. However, the age group of 26-35 years shows a significant difference, demonstrating a strong association with e-wallets or Google Pay. Therefore, the chi-square test of association exhibits credit card or debit card usage as the highly preferred mode of digital payment.

Table 4. Contingency table showing association of age group of respondents with preferred mode of digital payment.

Parameter	Net banking	Credit card or debit card	E-Wallet or mobile pay or google pay	Cash	Cheques	Total	Chi-square	p-value
Up to 25 years	18 (16.7) [16.7]	60 (55.6) [24.4]	24 (22.2) [19]	6 (5.6) [100]	0 (0) [0]	108 (100) [22]	99.07	<0.001**
26 - 35 Years	42 (24.1) [28.9]	60 (34.5) [24.4]	72 (41.4) [57.1]	0 (0) [0]	0 (0) [0]	174 (100) [35.4]		
36 - 50 Years	36 (30) [33.3]	66 (55) [26.8]	18 (15) [14.3]	0 (0) [0]	0 (0) [0]	120 (100) [24.4]		
51 years and more	12 (13.3) [11.1]	60 (66.7) [24.4]	12 (13.3) [9.5]	0 (0) [0]	6 (6.7) [100]	90 (100) [18.3]		
Total	108 (22) [100]	246 (50) [100]	126 (25.6) [100]	6 (1.2) [100]	6 (1.2) [100]	492 (100) [100]		

Note: Row percentage (i.e. within age group) indicated within ( ).
"The value within [ ] refers to column percentage (i.e. within preferred mode of payment)".
** indicates significant at 1% level.
Source: Primary data computation using SPSS.

Table 5. Contingency table showing association of age group of respondents with change of device passwords, PIN of debit/Credit cards.

Parameter	Once in a year	Once in 6 months	Once in a month	Once in a week	Never	Total	Chi-square	p-value
Upto 25 Years	36 (33.3) [31.6]	24 (22.2) [16]	18 (16.7) [17.6]	0 (0) [0]	30 (27.8) [29.4]	108 (100) [22]	122.426	<0.001**
26 - 35 Years	12 (6.9) [10.5]	72 (41.4) [48]	54 (31) [52.9]	0 (0) [0]	36 (20.7) [35.3]	174 (100) [35.4]		
36 - 50 Years	36 (30) [31.6]	36 (30) [24]	24 (20) [23.5]	0 (5) [25]	18 (15) [17.6]	120 (100) [24.4]		
51 Years and more	30 (33.3) [26.3]	18 (20) [12]	6 (6.7) [5.9]	18 (20) [75]	18 (20) [17.6]	90 (100) [18.3]		
Total	114 (23.2) [100]	150 (30.5) [100]	102 (20.7) [100]	24 (4.9) [100]	102 (20.7) [100]	492 (100) [100]		

Note: Row percentage (i.e. within age group) indicated within ( ).
"The value within [ ] refers to column percentage (i.e.. within change in passwords, PIN of debit/Credit cards)".
** indicates significant at 1% level.
Source: Primary data computation using SPSS.

With 12 possible outcomes, Table 5 of the contingency table shows the link between the age groups of respondents and changing their device passwords and debit/credit card PINs. The significance level is 1%. The p-value is less than 0.01; the alternate hypothesis is accepted, affirming there is a significant association among the age groups of digital user respondents with regard to changing device passwords and PINs of debit/credit cards. Based on row percentage, the age group up to 25 years shows highly associated with once in a year and less associated with once a week. The age group of 26-35 years shows highly associated with once in 6 months and less associated with once a week. The age group of 36-50 years is highly associated with once a year and once in 6 months and less with once a week. Those aged 51 years and above showed a strong correlation with once a year and a lower correlation with once per month. Furthermore, the chi-square test of association reveals significant differences among age groups in relation to the frequency of device password changes and the PIN of debit/credit cards. So, the chi-square test of association shows that there are important differences between age groups when it comes to the link between changing device passwords and debit/credit card PINs.

Table 6 in the contingency table illustrates the correlation between respondents' age groups and the safety of sharing their identities during digital payments, with a significance level of 1 percent and a degree of freedom set at 15. The p-value is less than 0.01; the alternate hypothesis is accepted, affirming there is a significant association among the age groups of digital user respondents with regard to the safety of sharing identity during digital payment. All the age groups exhibited a high association with none of the options being safe to share identity during digital payment. While people have different thoughts on whether or not sharing your identity during digital payment is less safe, the chi-square test of association shows that there are significant differences between age groups. These differences in association do not mean that sharing your identity during digital payment is not safe.

H_{02}: There are no-significant differences among the age groups of digital user respondents with regard to factors of digital adoption.

Table 6. Contingency table showing association of age group of respondents with safety of sharing identity during digital payment.

Parameter	Aadhaar number	PAN number	Bank account number	Debit card or credit card number	All of these	None	Total	Chi-square	p-value
Up to 25 years	6 (5.6) [14.3]	0 (0) [0]	12 (11.1) [22.2]	12 (11.1) [25]	18 (16.7) [27.3]	60 (55.6) [23.3]	108 (100) [22]	70.625	<0.001**
26 - 35 years	12 (6.9) [28.6]	12 (6.9) [50]	12 (6.9) [22.2]	6 (3.4) [12.5]	30 (17.2) [45.5]	102 (58.6) [39.5]	174 (100) [35.4]		
36 - 50 years	6 (5) [14.3]	6 (5) [25]	24 (20) [44.4]	24 (20) [50]	12 (10) [18.2]	48 (40) [18.6]	120 (100) [24.4]		
51 years and more	18 (20) [42.9]	6 (6.7) [25]	6 (6.7) [11.1]	6 (6.7) [12.5]	6 (6.7) [9.1]	48 (53.3) [18.6]	90 (100) [18.3]		
Total	42 (8.5) [100]	24 (4.9) [100]	54 (11) [100]	48 (9.8) [100]	66 (13.4) [100]	258 (52.4) [100]	492 (100) [100]		

Note: Row percentage (i.e. within age group) indicated within ( ).
"The value within [ ] refers to column percentage (i.e.. within safety of sharing the identity)".
** indicates significant at 1% level.
Source: Primary data computation using SPSS.

Table 7. ANOVA on significant difference among age groups with respect to factors of digital adoption.

Digital adoption	Age group of digital user respondents				F-value	p-value
	Up to 25 years	26- 5 years	36-50 years	51 years and more		
Access public WiFi	1.78^{b} (0.418)	1.69^{ab} (0.464)	1.78^{a} (.492)	1.78^{b} (.402)	4.506	0.004**
Antivirus and malware protection on device	1.44^{c} (0.499)	1.28^{b} (0.448)	1.10^{a} (.301)	1.33^{bc} (.474)	12.465	<0.001**
Saving card details on your device	1.39^{b} (0.490)	1.24^{a} (0.429)	1.20^{a} (.402)	1.33^{a} (.342)	6.727	<0.001**
Redressal of digital payment queries by concerned service providers	1.78^{b} (0.418)	1.59^{a} (0.494)	1.55^{a} (0.500)	1.67^{ab} (0.474)	5.256	0.001**

Note: Value within '( )' indicates standard deviation.
** indicates significant at 1% level.
"Different alphabets i.e, a,b,c among age group in years denotes significant at 5% DMRT".
Source: Primary data computation using SPSS.

ANOVA (Analysis of Variance) shows that there are important differences between age groups when it comes to factors of digital adoption (Table 7). The results exhibit a significance value less than 0.01 at the 1 percent level with regard to all the factors of digital adoption. Hence, there is a significant difference among the respondents in the age group of digital users. The DMRT-Duncan Multiple Range Test results show the age group 36-50 years differs with

up to 25 years and 51 years and above with regards to accessing public Wi-Fi, and the age 26-35 years has no significant difference. With regard to antivirus and malware protection on devices, there are significant differences among the age groups of up to 25 years, 26-35 years, and 36-50 years, while 51 years and above differ only with 36-50 years. Regarding saving card details on devices, age groups 26–35 years, 36–50 years, and 51 years and above didn't differ, while up to 25 years exhibited significant differences. With regards to the redressal of digital payment queries by concerned service providers, there is no difference between 26-35 years and 36-50 years. While up to 25 years of age differ, 51 years and older don't.

Table 8. Growth in volume of digital payment transactions.

Month, year	NEFT*		RTGS*		Mobile banking*		Internet banking*	
	Volume	CAGR (%)	Volume	CAGR (%)	Volume	CAGR (%)	Volume	CAGR (%)
April, 2023	4825.374	-	20156669	-	8335717239	-	340605386	-
May, 2023	4896.658	0.0148	22045538	0.094	8710070080	0.045	359898786	0.057
June, 2023	5097.124	0.0278	21230112	0.026	8809774143	0.028	356628993	0.023
July, 2023	5476.794	0.0431	21189226	0.017	9334030869	0.039	393894565	0.050
August, 2023	5652.048	0.0403	21808172	0.020	10142321481	0.050	379098298	0.027
September, 2023	5598.052	0.0302	21393514	0.012	10121460712	0.040	365025710	0.014
October, 2023	6314.527	0.0458	22461619	0.018	10933405345	0.046	373600269	0.016
November, 2023	6394.006	0.0410	21919829	0.012	10864611770	0.039	362258139	0.009
December, 2023	6673.929	0.0414	23038753	0.017	11632975015	0.043	383626423	0.015
January, 2024	6882.784	0.0402	23099363	0.015	11790361002	0.039	383771160	0.013

Note: '*' denotes volume of transactions in lakhs.
All the decimals are rounded-off to three decimal points
Source: Compiled from published reports of RBI and NPCI database.

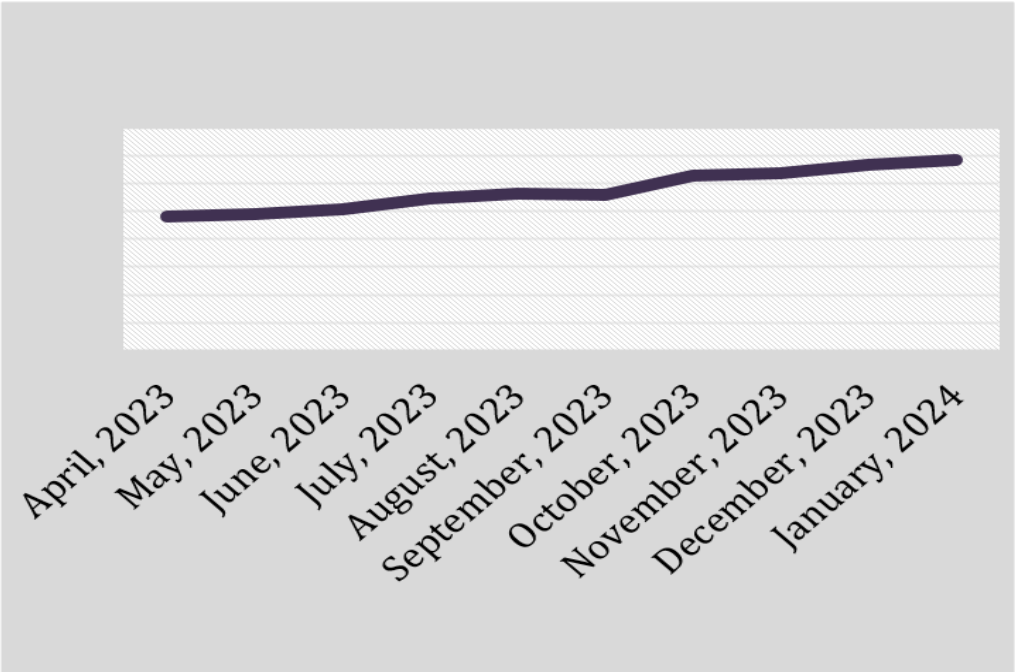

Figure 2. Growth in volume of NEFT transactions.

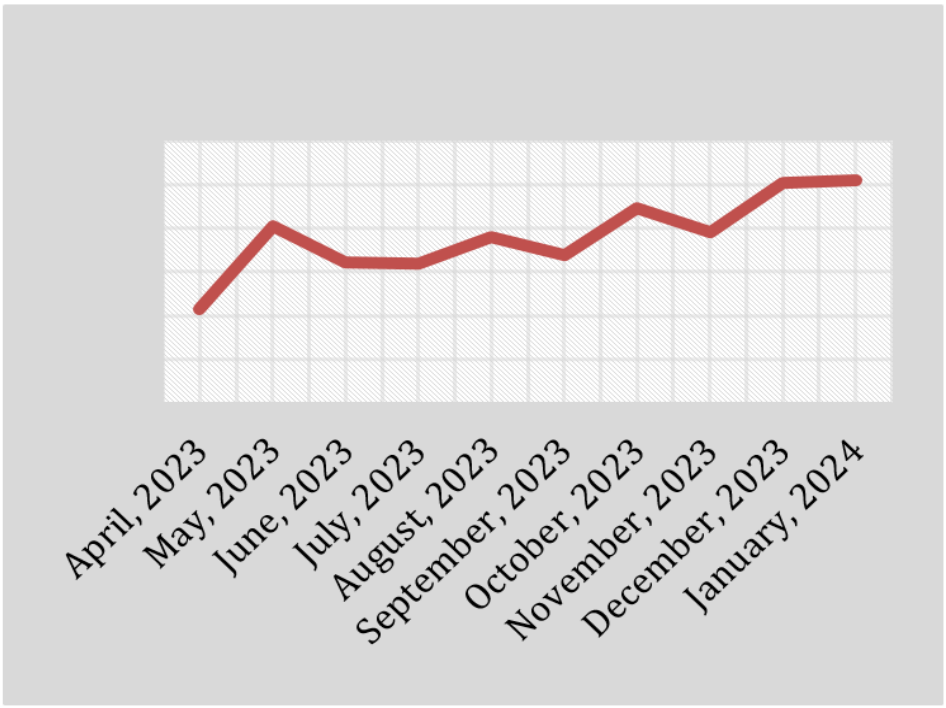

Figure 3. Growth in volume of RTGS transactions.

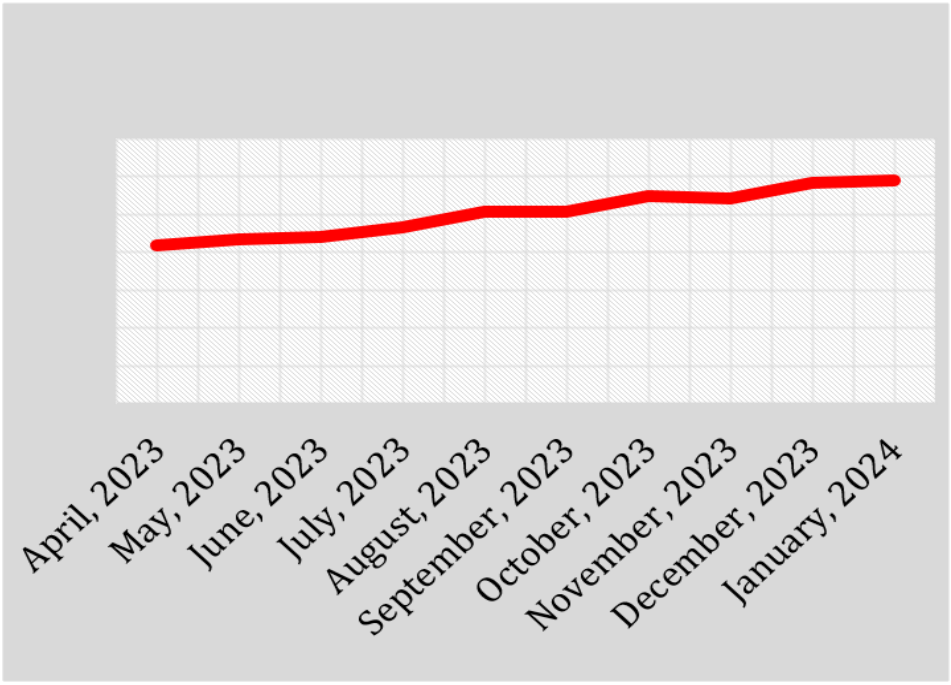

Figure 4. Growth in volume of mobile banking transactions.

The nature of curve (Figure 3) is wavy and inversely related. The rate of increase in mobile banking transactions showed a dwindling trend (Figure 4) during the beginning period and started to increase gradually. The CAGR of mobile banking transactions started at 0.0449% (8710070080 lakhs) during May 2023 and stood at 0.0393% (11790361002) by the end of January 2024. The curve exhibits an inverse relationship. The volume of internet banking transactions has been observed to vary in a greater proportion over the period. The curve (Figure 5) shows a peak in July 2023, with a compound annual growth rate (CAGR) of 0.0496% (393894565 lakh transactions), marking the highest point during the period. Later, the curve skewed with a wavy shape, reaching a CAGR of 0.0133% (383771160 lakh transactions).

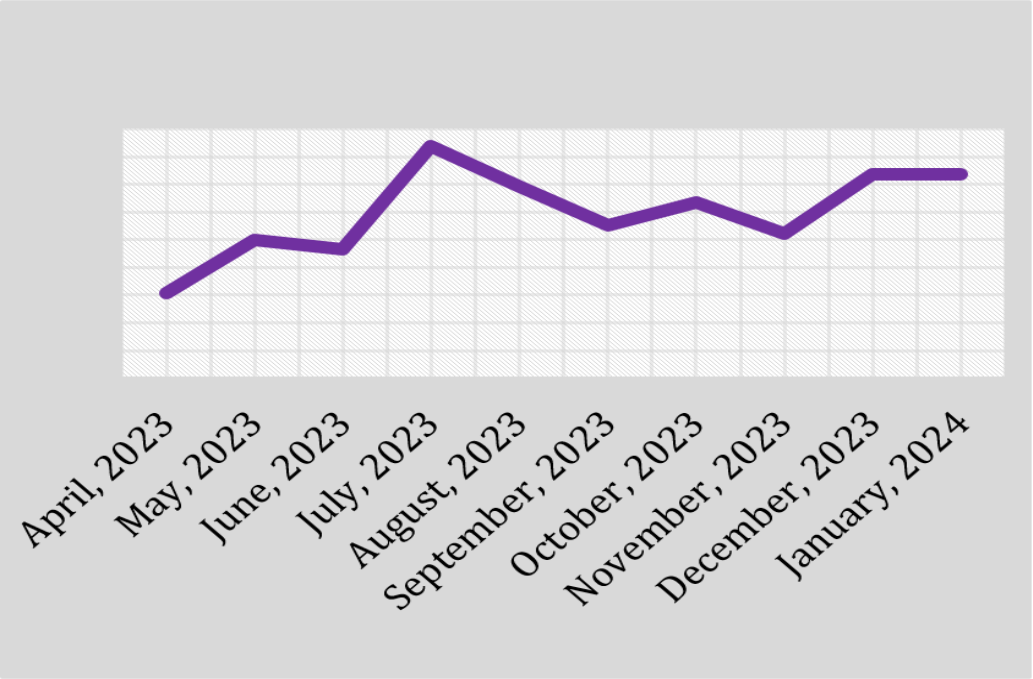

Figure 5. Growth in volume of internet banking transactions.

4.2. Part-B Quantitative Data Analysis and Hypothesis Testing

In Table 8, you can see the average annual growth in the number of digital transactions made through RTGS, NEFT, mobile banking, and internet banking over the course of nine months, from April 2023 to January 2024. There is a gradual rise in the volume of NEFT transactions, with a CAGR of 0.0148% (4896.6575 lakhs) in May 2023 with a slight variation during the period, and it reached a CAGR of 0.0402% (6882.7842 lakhs) by January 2024. Looking at Figure 2, the NEFT (National Electronic Fund Transfer) growth curve, we can see that it changes in the opposite direction of the time period. It was found that the rate of increase in RTGS (Real Volume of RTGS Time Gross Settlement) transactions was lower than that of NEFT. However, the absolute increase in RTGS transactions is much higher. The CAGR of NEFT at the beginning of the period is 0.0937% (22045538 lakhs) and reached 0.0153% (23099363 lakhs) by the end of the period.

Table 9. Growth in number of active digital users.

Month, year	Mobile banking users		Internet banking users	
	Volume*	CAGR (%)	Volume*	CAGR (%)
April, 2023	227823515	-	79751562	-
May, 2023	226735017	-0.0048	79432349	-0.0040
June, 2023	231653593	0.0084	79872742	0.0008
July, 2023	235523404	0.0111	82281067	0.0105
August, 2023	239197270	0.0123	82215579	0.0076
September, 2023	239750345	0.0103	81534477	0.0044
October, 2023	244472894	0.0118	81643847	0.0039
November, 2023	246463156	0.0113	79838949	0.0002
December, 2023	248978602	0.0112	80992858	0.0019
January, 2024	254202338	0.0122	82105213	0.0032

Note: '*' denotes volume of transactions in lakhs.
Source: Compiled from published reports of RBI and NPCI database NPCI database.

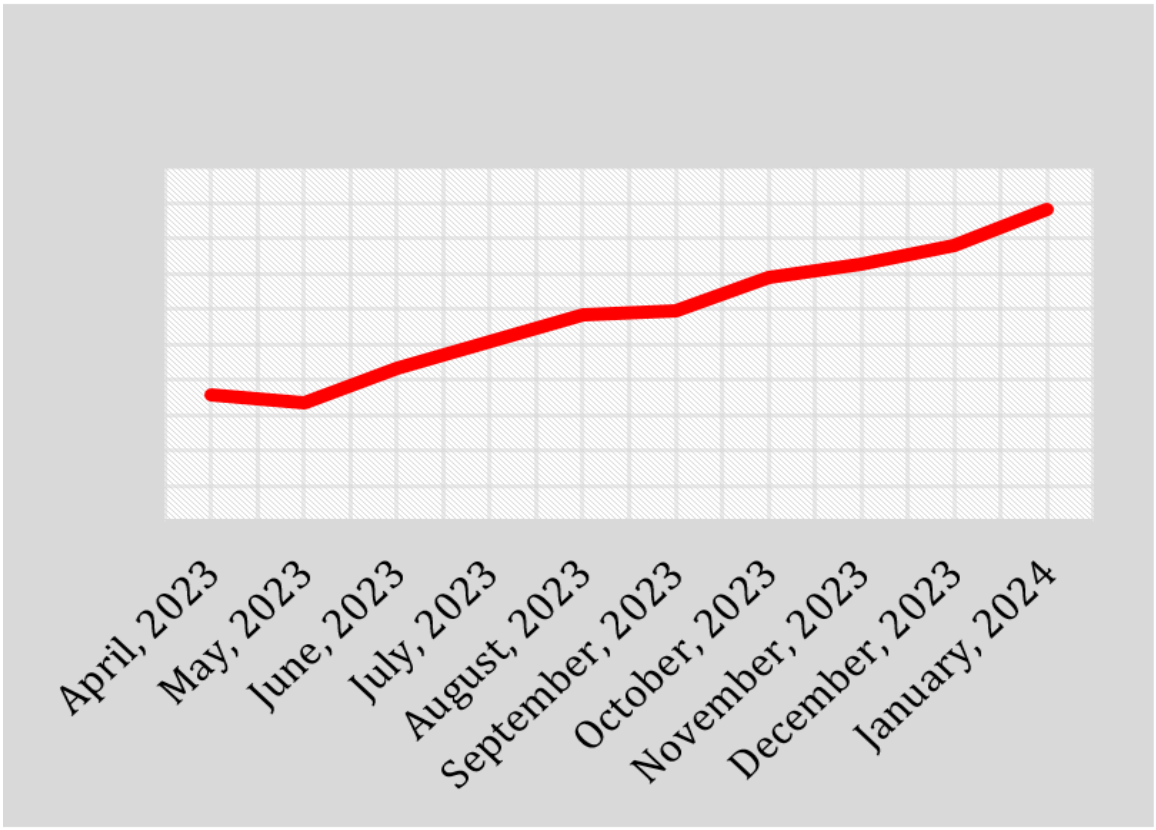

Figure 6. Growth in volume of mobile banking users.

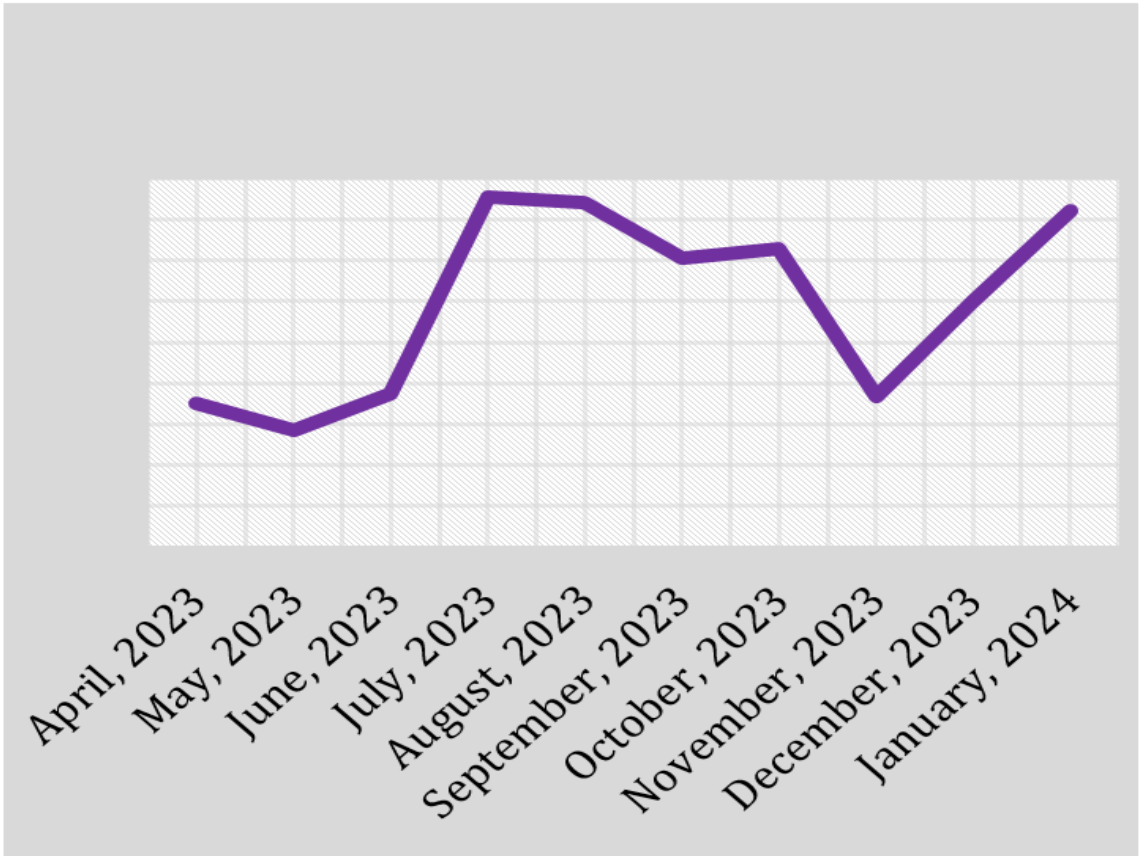

Figure 7. Growth in volume of internet banking users.

Table 9 presents the rate of increase in both mobile and internet banking volume. The rate of increase in the volume of internet banking users (Figure 6) was observed to be inversely related to the time period; the rate of increase is steeper compared to the volume of mobile banking users. The CAGR during May 2023 is -0.0048% (226,735,017 lakh users) and increased to 0.0122% (254,202,338 lakh users). The volume of internet banking users, as depicted in (Figure 7) exhibited a varied trend throughout the period. The number of internet banking users peaked in July 2023 with a compound annual growth rate (CAGR) of 0.0105% (82,281,067 lakh users), gradually decreased by November 2023 with a CAGR of 0.0032% (82,105,213 lakh users), and then began to increase at a steady pace.

4.3. Examination of Impact of Volume of Users in Mobile Banking and Internet Banking on Volume of Digital Payment Transactions

H_{03}: There is no-significant relationship between the volume of users in mobile and internet banking and the volume of digital payment transactions.

Table 10. Showing relationship between volume of users in mobile and internet banking with volume of digital payment systems.

Digital payment systems	NEFT	RTGS	Mobile banking	Internet banking
Mobile banking users	0.988**	0.779**	0.983**	0.590
Internet banking users	0.466	0.330	0.506	0.817**

Note: ** indicates Correlation is significant at 1 percent (2-tailed).
Source: Secondary data computation using SPSS.

Table 10 shows the relationship between mobile and internet banking users and the volume of digital payment systems. At the 1% level of significance, there was a very strong and highly significant link between the number of mobile banking users and the number of NEFT users (r =.988), mobile banking users (r =.983), and RTGS users (r =.779). Therefore, the alternate hypothesis is accepted, affirming there is a significant relationship between the number of mobile banking users and the volume of RTGS, NEFT, and mobile banking transactions. The number of people who use internet banking showed a very strong and significant correlation with the number of people who use internet banking (r =.817). This means that the alternative hypothesis is correct and there is a significant relationship between the number of people who use internet banking and the number of people who use internet banking.

Since there is a weak but significant link between the number of mobile banking users and the number of internet banking transactions (r =.59), the null hypothesis was not rejected. This means that there is no significant link between the number of mobile banking users and the number of internet banking transactions. Similarly, the volume of internet banking users exhibited an insignificantly strong correlation with the volume of mobile banking transactions at 50.6% (r = .506), with NEFT at 46.6% (r = .466) and a moderate relationship with RTGS at 33% (r = .330). Therefore, the null hypothesis failed to reject, affirming there is no significant relationship between the volume of internet banking users and the volume of NEFT, RTGS, and mobile banking transactions.

H_{04}: There is no-significant impact of the volume of mobile banking and internet banking users on the volume of digital payment transactions.

Table 11. Showing the impact of volume of users in mobile banking and internet banking on volume of NEFT transactions.

Model summary		ANOVA		Coefficients			
R	R^2	F	Sig.	Independent variable	Unstandardized coefficients	t	Sig.
0.99	0.98	170.346	<0.001**	(Constant)	-10243.466	-3.549	0.009
				Mobile banking users	8.334E-005	16.286	<0.001**
				Internet banking users	-4.86E-05	-1.179	0.277

Note: ** indicates correlation is significant at 1 percent (2-tailed). Volume of NEFT transactions indicates dependent variable.
Source: Secondary data computation using SPSS.

Table 11 depicts the influence of the volume of mobile banking users and internet banking users on the volume of NEFT transactions. The multicollinearity is 99% (R = .99), which shows there is a very strong relation. The model is highly robust with goodness of fit (df 2, F 170.346) at 1 percent of significance. The beta coefficient of the volume of mobile banking users on the volume of NEFT (t 16.286, 8.334E-005) is highly significant. This indicates a significant increase of 8.334E-005 in the volume of transactions among mobile banking users. Therefore, we accept the alternate hypothesis, which affirms that the volume of mobile banking users has no significant impact on the volume of NEFT transactions. Conversely, the impact of the volume of internet banking users on the volume of NEFT transactions (t = -1.179, -4.86E-05) is not significant. Therefore, the null hypothesis fails to reject the assertion that there is no significant impact of the volume of mobile banking users on the volume of NEFT transactions.

$$Volume\ of\ NEFT = -10243.46558 + (8.334E-005)\ Volume\ of\ mobile\ banking\ users + (-4.86E-05)\ Volume\ of\ internet\ banking\ users \quad \text{(Model Equation 1)}$$

Table 12. Showing the impact of volume of users in mobile and internet banking on volume of RTGS transactions.

Model summary		ANOVA		Coefficients			
R	R square	F	Sig.	Independent variable	Unstandardized coefficients	t	Sig.
0.785	0.616	5.608	0.035	(Constant)	9195771.772	0.603	0.566
				Mobile banking users	0.082	3.038	0.019*
				Internet banking users	-8.70E-02	-0.399	0.702

Note: * indicates Correlation is significant at 5 percent (2-tailed).
Volume of RTGS transactions indicates dependent variable.
Source: Secondary data computation using SPSS.

Table 12 depicts the influence of the volume of mobile banking users and internet banking users on the volume of RTGS transactions. The multicollinearity is 78.5% (R = .785), which shows there is a very strong relation. The model is robust with goodness of fit (df 2, F 5.608) at 5 percent significance. The beta coefficient of the volume of mobile banking users on the volume of RTGS (t = 3.038, p = .082) is highly significant. It denotes an increase in mobile banking user increase of .082 volume of transactions. Therefore, the alternate hypothesis is accepted, affirming there is no significant impact of the volume of mobile banking users on the volume of RTGS transactions. Whereas the volume of internet banking users on the volume of RTGS (t = -0.399, -8.70E-02) insignificantly impacts negatively. Therefore, the null hypothesis fails to reject the assertion that there is no significant impact of the volume of mobile banking users on the volume of RTGS transactions.

$$Volume\ of\ RTGS = 9195771.772 + (.082)\ Volume\ of\ mobile\ banking\ users + (-8.70E-02)\ Volume\ of\ internet\ banking\ users \quad \text{(Model Equation 2)}$$

Table 13. Showing the impact of volume of users in mobile and internet banking on volume of mobile banking transactions.

Model summary		ANOVA		Coefficients			
R	R^2	F	Sig.	Independent variable	Unstandardized coefficients	t	Sig.
0.983	0.967	103.144	<0.001**	(Constant)	-20607031079	-3.362	0.012
				Mobile banking users	133.845	12.316	<0.001**
				Internet banking users	-1.70E+01	-0.195	0.851

Note: ** indicates Correlation is significant at 1 percent (2-tailed).
Volume of mobile banking transactions indicates dependent variable.
Source: Secondary data computation using SPSS.

Table 13 depicts the influence of the volume of mobile banking users and internet banking users on the volume of mobile banking transactions. The multicollinearity is 98.3% (R = .983), which shows there is a very strong relation. The model is robust with goodness of fit (df 2, F 103.144) at 1 percent of significance. The beta coefficient of the

volume of mobile banking users on the volume of mobile banking transactions (t 12.316, 133.845) is highly significant. It denotes an increase in mobile banking user increase of .082 volume of transactions. Therefore, the alternate hypothesis is accepted, affirming there is no significant impact of the volume of mobile banking users on the volume of mobile banking transactions. Whereas the volume of internet banking users on the volume of mobile banking transactions (t = -0.195, -1.70E+01) insignificantly impacts negatively. Therefore, the null hypothesis fails to reject the assertion that there is no significant impact of the volume of mobile banking users on the volume of mobile banking transactions.

$$Volume\ of\ mobile\ banking\ transactions\ = -20607031079\ + (133.845)\ Volume\ of\ mobile\ banking\ users\ +\ (-1.70E + 018.70E - 02)\ Volume\ of\ internet\ banking\ users$$ (Model Equation 3)

Table 14. Showing the impact of volume of users in mobile and internet banking on volume of internet banking transactions.

Model summary		ANOVA		Coefficients			
R	R^2	F	Sig	Independent variable	Unstandardized coefficients	t	Sig
0.839	0.703	8.295	0.014	(Constant)	-513520501.6	-2.17	0.067
				Mobile banking users	0.385	0.917	0.39
				Internet banking users	9.77E+00	2.893	0.023*

Note: * indicates correlation is significant at 5 percent (2-tailed).
Volume internet banking transactions indicates dependent variable.
Source: Secondary data computation using SPSS.

Table 14 depicts the influence of the volume of mobile banking users and internet banking users on the volume of internet banking transactions. The multicollinearity is 83.9% (R = .839), which shows there is a very strong relation. The model is robust with goodness of fit (df 2, F 8.295) at 1 percent of significance. However, the beta coefficient is the volume of mobile banking users on the volume of internet banking transactions (t 0.917, 0.385). Therefore, the null hypothesis fails to reject the assertion that there is no significant impact of the volume of mobile banking users on the volume of internet banking transactions. While the beta coefficients of internet banking users (t 2.893, 9.77E+00) significantly impact. Therefore, the alternate hypothesis is accepted, affirming there is a significant impact of the volume of internet banking users on the volume of internet banking transactions.

$$Volume\ of\ internet\ banking\ transactions\ = -513520501.6\ + (0.385)\ Volume\ of\ mobile\ banking\ users\ +\ (9.77E + 00)\ Volume\ of\ internet\ banking\ users$$ (Model Equation 4)

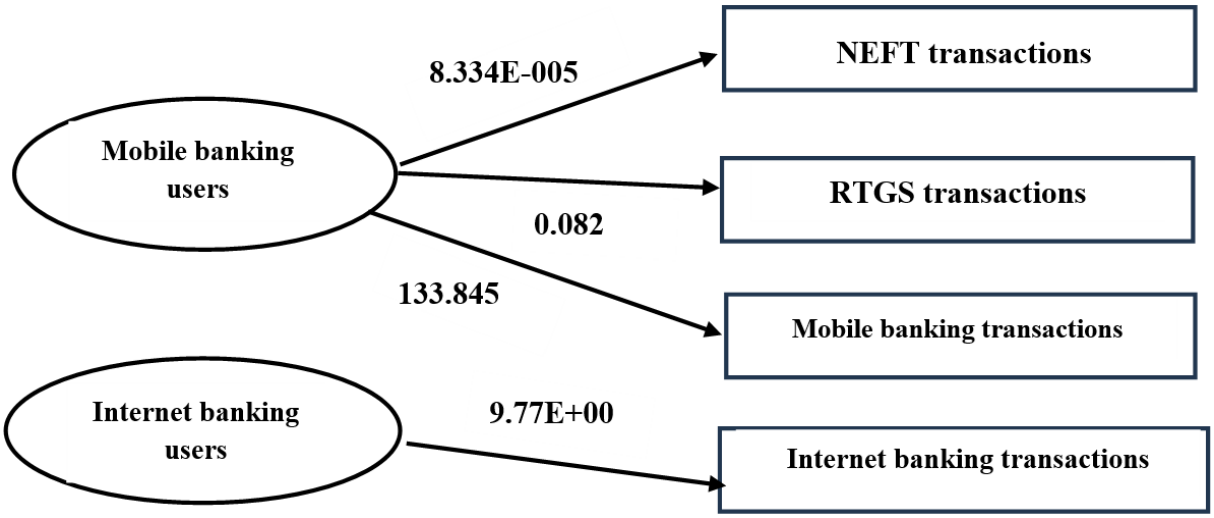

Figure 8. Final model based on the statistical evidences of research.

The statistical evidence of the study findings explained and presented in model equations 1, 2, 3, and 4 is depicted with significant beta values in Figure 8, illustrating the impact of mobile banking and internet banking users on the volume of NEFT, RTGS, mobile banking, and internet banking transactions.

5. FINDINGS OF THE STUDY

The study results exhibited that the majority of the digital users, 62%, opined that transacting digitally is a convenient mode of payment. 4% of user respondents stated that the lack of currency is the least important factor in adopting the cashless ecosystem. So, the Digital India campaign is a successful move. However, 70% of user respondents expressed concerns about the security of transactions when adopting digital payment modes. It is further identified that 13% of user respondents are against the argument that identity sharing is a threat during digital usage. The study observes there is an inclination towards debit/credit cards and e-wallets as the preferred mode of usage, with 50% and 26% of digital user respondents, respectively. With regard to change in password and/or PIN of digital payment mode, it was found to be very insignificant, with only 5% of user respondents modifying the password once in a week. The study revealed that the growth rate of NEFT transactions pales in comparison to the volume of other modes of transactions, with the exception of internet banking. The study's CAGR analysis revealed a steady increase in the volume of RTGS and mobile banking transactions. Statistical results of the study disclose this finding to be logically correct and significantly highly correlated. The linear regression modelling also reveals the steep rise in active mobile banking users has a greater influence on the rise in the volume of NEFT, RTGS, and mobile banking transactions. The active internet banking users have a disproportionate effect on NEFT, RTGS, and mobile banking transactions compared to internet banking transactions.

5.1. Answers to Research Question

RQ1-Are there differences in how digital users perceive and adopt the cashless ecosystem?

RA1- The ANOVA followed by the DMRT post hoc test reveals there exists a significant difference in perspective of digital users in adopting the cashless ecosystem with regard to accessing public Wi-Fi, installation of antivirus and malware protection on devices, storage of digital details on devices, and getting queries resolved by service providers.

RQ2- Does an increase in the number of digital users impact the growth rate of digital transactions?

RA2- The increase in the CAGR of volume of active mobile banking users was found to be statistically significant in affecting the rate of growth of volume of digital payment transactions.

6. SUGGESTIONS AND CONCLUSIONS

The study results indicate the execution of the vision of the "Digital India" flagship program was found to be running successfully. The rapid growth in the volume of digital transactions indicates a rise in online users. It is suggested to the digital banking service providers to ensure safety in the security of transactions by enhancing the productivity of firewall protection, etc., and educate the users regarding the precautionary measures to be taken by end users. The service providers need to promote a hassle-free, secure payment gateway. It is the prime responsibility of the service providers to resolve the issues, concerns, and queries on a war-footed basis. The survey results of the study found grey, the storing of identity information on devices, and the frequency of change in passwords and/or PIN numbers. Though the users know different modes of digital technologies, the motto of service providers and the government is to strengthen the "Digital India" campaign to create more awareness and pave the way to a smooth transition to the cashless ecosystem. Comprehending the pros and cons and having clarity of thought about using digital payment would definitely transform India into a cashless economy. In addition to this, cashback offers and prompt refunds of it would encourage and transform currency users to digital users. It is equally important to have e-literary campaigns for merchants and aid themselves in hassle-free merchandise. The stringent measures in identifying the cyber frauds and strengthening cyber laws, emphasizing the curtailment of cyber fidelity,

embezzlement, and misappropriation of funds electronically, can build confidence and motivate people to have hassle-free digital transactions, firming up India into a cashless society.

6.1. Policy Implications

The study has several important policy implications. Firstly, governments and regulatory bodies should implement policies to support the development of digital infrastructure. Robust cyber security measures will protect users and ensure widespread internet access. Secondly, policies should target underserved populations, such as those living in rural areas or marginalized groups, to ensure that they have equitable access to digital payment systems. Lastly, regulatory frameworks should balance innovation and security to encourage fintech advancements while maintaining consumer protection and preventing fraud. Additionally, tax breaks and other financial aid may motivate small companies to use electronic payment systems, hastening the shift away from cash. In order to guarantee smooth and effective digital transactions across borders, cooperation between governments, financial institutions, and the private sector is essential for standardizing payment platforms and fostering interoperability. Together, these regulations can support a safe, inclusive, and long-lasting cashless system.

6.2. Scope of Future Research

i). The future studies can emphasize evaluating the effects of growth in volume and value of digital transaction influence on Indian GDP - Gross Domestic Product and per-capita level of economic cycle.

ii). Further, studies can stress the effects of artificial intelligence (AI) in detecting the cyber frauds relating to digital payments.

iii). Even studies can emphasize the positive and negative effects of AI integration in banking automation on carrying cost of the banking sector.

iv). Further studies can lay emphasis on measuring the effectiveness of digital transactions in global economies.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Data Availability Statement: The corresponding author can provide the supporting data of this study upon a reasonable request.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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