National College of Ireland

Comparative Study of Online Payment versus Offline (Traditional) Payment with Emphasis on UPI in India and Changing Payment Regulations

MSc Research Project
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MSc Project Submission Sheet

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Comparative Study of Online Payment versus Offline (Traditional) Payment with Emphasis on UPI in India and Changing Payment Regulations

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Abstract

This paper aims to analyze the online and offline payment systems with special attention to the uptake of the UPI (Unified Payment interface) in India. As the economy increasingly goes online, it is essential to identify the factors that affect payment choices by stakeholders such as policymakers, financial institutions, and businesses. This study was informed by the desire to investigate numerous variables to advance technological growth on consumers' behaviors and UPI on India's payment systems. To counter this, the study adopted both the quantitative survey of 421 respondents from Maharashtra alongside the qualitative synthesis of literature alongside the quantitative survey. The research findings indicated that the factors influencing the uptake of UPI include perceived convenience, security and regulations. Thus, the work identified that regulatory adjustments like the imposition of zero MDR (Merchant Discount Rate) and enhanced transaction thresholds had acted to advance the usage of UPIs, especially in youthful city dwellers. The findings of this research based on previous studies enhance the knowledge in the understanding the growth of UPI in general terms. In the practical level, the study reveals the need for increased security and user awareness to increase use of services. However, due to the sampling of urban respondents, the future research should consider investigating the modes of payment preferred by the rural and less technologically oriented population. The findings of this work are beneficial for enhancing the overall understanding of the digital payment systems along with identifying requirements for the improvement of payment solutions available in a diverse market.

Keywords: UPI growth, factors identification, regulatory impact, Factor analysis

1 Introduction

In the fast-changing Indian finance sector, a digital transformation is changing the way millions of people make transactions on a daily basis. The core of this change is the UPI, a revolutionary system that is revolutionizing conventional payment practices. This study examines the complex interplay of modern online techniques and traditional offline transactions, studying user preferences, regulatory changes, and technological advancements driving India towards a cashless future.

1.1 Background of Digital Payments in India

The general picture of financial operations in India has recently changed dramatically when moving from the cash economy to the digital one specifically after demonetization in 2016. The change has been due to the influence of several factors such as technological development, clients' preferences, and policies of government supporting the development of digital finance(Balakrishnan, 2023) Leading this revolution is the Unified Payment Interface or UPI which is a real time payment system introduced by National Payment Corporation of India or NPCI in the year 2016. UPI has become a turning point in India's fintech sector because it

provides users with a fast, safe way to transact multifaceted financial solutions across multiple platforms and gadgets (Sahu, Sahu and Patra, 2023).

1.2 The Integration of Both Offline and Online Payments

The fact that both regular offline payment systems and the increasingly popular digital payment methods like UPI are well-developed and are present in the parallel makes the exploration of payment preferences in terms of this particular choice truly compelling in terms of the versatility and gradual evolution of the Indian market.(Baheti and Professor, 2024). Considering India's ongoing transition to the reduction of cash-based transactions, identification of factors that impact consumers' decisions of using online and offline modes of payment is essential for policymaker, financial institutions and businesses in the future (Tayal, Rajagopal and Mahajan, 2023). The purpose of this research is to investigate some of those elements in detail to establish the interconnection between technology advancement, standard regulatory systems, and consumers' buying preferences concerning the payments industry in India.

1.3 Recent Developments in Digital Payments

The relevance of this study can be emphasized by the fact of the constantly increasing interest in digital payments in India. Going by the fresh data available on the NPCI websites, UPI mobile transactions hit a new high of 10. 24 billion in volume, and INR 17. US$ 61 trillion in the month of May, 2023, thus it would have recorded a year-on-year growth (*Press Releases | NPCI - National Payments Corporation of India*, 2023). This exponential growth indicates the greater adaptability of Indian consumers and business dealings to the methods of digital payments. But it also makes key questions related to the characteristics of this adoption, diverse obstacles that different groups face, and overall effects on financial accessibility and more broadly, on development.

1.4 Evolving Regulatory Environment

As the world moves digital, the enhanced regulatory inevitability is reflecting through an increased need for comprehensive change in laws associated with payments. RBI has taken various measure to increase level of digital transactions while ensuring security, and consumer protection (Bartelt *et al.*, 2023). This will include things like defining enhanced security for digital transactions, revising rules around prepaid payment instruments, and asking for implementation of zero MDR on UPI & RuPay Card transactions. A more recent one was by the RBI which in April 2023 proposed "lite" payment instruments to enable digital payments where connectivity issues exist (*Reserve Bank of India - Database*, 2023). Regulatory changes have significantly altered the adoption and usage patterns of the different payment methods in recent years;(Bhuvaneswari, Kamalasaravanan and Viswanathan, 2024) thus, it is often an important aspect to consider for understanding how consumers behave with regards to payments and which drivers really matter.

1.5 Importance of the Study

Patterns of this study find particular importance among India's fast paced FinTech landscape. The research aims to provide crucial understanding on consumer inclinations and adoption behavior specific to UPI in comparison with online or offline payment transactions. Understanding these dynamics is so important for a variety of reasons. At the first level, it may influence policy choices stating that regulatory agencies can formulate evidence-based strategies to promote digital financial inclusion and address barriers or risks due to migration towards electronic payments (Sethy *et al.*, 2023). Further, this knowledge about consumer payment choice can help financial institutions (FIs), fintech companies and merchants in

designing products, crafting marketing strategies and planning customer engagement activities (Gupta, Jeswani and Pinto, 2021). Furthermore, analyzing the elements that affect acceptance to digital payment options would contribute in bridging up the digital divide and financial inclusion especially of untapped sectors.

1.6 Research Question:

To what extent do consumer preferences for online and offline payment methods differ, with respect to the evolution of UPI in India?

1.6.1 Objectives:

1. To identify the key factors influencing the adoption of UPI (Online payment) in India over Offline Payment.
2. To examine how changing payment regulations impact user behavior and payment choices.

These help us to better understand the interplay of technology innovation, regulation and consumer preferences in evolving payment choices.

1.7 Methodology Overview

This research employed a descriptive research method to know that UPI has preferred growth, online, or offline payment and with particular attention to the altering regulations. The secondary sources helped in collecting the data for research through questionnaires based on the UTAUT model; the responses received were 421 and were mainly from the state of Maharashtra. The present research work also made use of different methods of descriptive analysis, exploratory factor analysis, and reliability analysis for providing validity and reliability of the research study. This research methodology was used to provide the broader understanding of the uptake of UPI payments by critically assessing the choice of payment and the regulatory force.

1.8 Research Niche

The Previous research on UPI is a source of significant knowledge about the correlation between consumer choice and attitudes toward UPI and regulatory issues in electronic transaction.(Shanmugasundaram, 2024) Therefore, it can be claimed that further research is necessary to investigate a significant gap. This paper seeks to provide that understanding by first examining the online and offline payment systems both in the developed and developing countries, the factors that affects them as well as the impact of ever-growing payment regulations. It highlights the goals and purpose of this study, which is to analyze consumer behavior, financial systems, as well as the technology adoption in the digital payments field, with the help of methodical specificities of the particular sectors and the practical experience that is gained in the process of this work.

1.9 Structure of the Report

The format of this research report is intended to present a logical sequence of information and analysis. Following this introduction, a comprehensive literature analysis explores the existing research on consumers' payment preferences, the determinants of UPI uptake, and the consequences of policy shifts on digital payment systems in India. It relates to the research framework, data gathering techniques, population and sample selection, and analysis procedures in the conduct of the study. The part on the results and analysis presents the details and survey analysis of the results concerning each research question. The analysis section dissects these findings alongside previous literature and explore the consequences for various

subjects participating in this process. Thus, the summary draws attention to the leads obtained, offers recommendations and directions for the policymakers and the industry participants, and names the topics that may be appropriate for further analysis.

2 Related Work

The digital payment ecosystem in India has experienced a drastic change in the last couple of years, there is a vast change in the e-payment transactions in India because of the availability and rapid adaptation of the UPI.(Thakkar and Thakkar, 2023) The literature review aimed at presenting an evaluative analysis of the current studies on the different modes of payment: online and offline focusing on UPI in India. Thus, this review intends to deliberate on the existing knowledge and argue for the stipulation of hitherto undefined research directions by delineating consumer preferences, factors that impact UPI adoption, and the peculiarities of consumers' behavioral changes due to dynamic payment regulations.

2.1 Socioeconomic Factors of Payment Method Selection

There are numerous academic papers addressing the concern on how payment methods are affected by social demographic factors. First, the theoretical framework for understanding these relations was introduced by See-To and others in 2014. Based on their results of the survey, it was seen that people with higher income levels opting for the service were 1. Five times more likely to show a preference towards online payment than the other groups. However, this discovery gives valuable insights and due to the collection of self- reported data and the lack of analyzing the tendencies over time the research does not convey the shifts in preferences to the necessary degree.(See-To, Papagiannidis and Westland, 2014)

While more recent research has built on these foundations, giving us a better idea of how social and financial contexts influence the take-up of digital payments. Detailed study around the adoption of digital payment platforms in India, with specific focus on influence based off socioeconomic factors was done by Srivastava and others in 2022. According to their study, a 1% increase in higher education level increases digital payment usage by 0.8%, so does living in urban areas This study provides an up-to-date view of the state in India; it does not focus on UPI. (Srivastava *et al.*, 2022)

In 2022 Kumar and others further examined the impact of demographic factors on mobile payments adoption in India. They found that age and income were able to predict adoption as they used UPIs principal mobile payment option, with younger people based on this data (but wealthier) more likely than household ones. Specifically, the survey found that those who are 25-34 years old were almost two and a half times more likely to use mobile payments than consumers over the age of 45.(Kumar, Sharma and Sujit, 2022)

These research findings provide valuable information but also point out a major lack in our knowledge of how socio-economic factors impact the adoption of UPI in India as time progresses. There is an urgent demand for longitudinal studies that explore how changing economic factors interact.

2.2 Comparison between Online and Offline Payment Choices

The differentiation between choosing online or offline payments, specifically in the realm of mobile commerce, is an important aspect to explore further. Although previous research by Gupta, Jeswani, and Pinto in 2021 offered valuable insights on offline m-commerce payment preferences, recent studies are now examining the subtle contrasts in online and offline UPI utilization.(Gupta, Jeswani and Pinto, 2021)

Research conducted by Rahaman and others in 2023 examined the determinants impacting consumers' willingness to utilize UPI for transactions, whether online or offline. The results showed that both perceived usefulness and ease of use were important factors in predicting UPI adoption in both situations. However, security concerns had a greater negative influence on offline usage (β = -0.32) than online usage (β = -0.24). This research offers important information on the various factors influencing UPI usage in different transaction situations, but its cross-sectional design hinders our ability to track the evolution of these preferences.(Rahaman, Lahiri and Kumar, 2023)

To the addition for the above study, even Pal and Vanijja in 2023 further lent their voice for a study on UPI at small retail stores in India. The study also pointed out a large gap in UPI adoption between online and offline vendors, with the former having 35% higher utilization rates then later. The authors attribute the differential to factors including familiarity with technology and state of trust for conducting transaction. Although offering an interesting perspective from the side of merchants, this research remains limited in a full understanding given the need to also consider consumer preferences and behaviours across online as well as offline settings. (Pal and Vanijja, 2023)

Most importantly, our research studies provide evidence for the necessity of further investigations into UPI use-patterns and preferences in comparison to online-offline. Policy-makers and other service providers could use this research to have a good indication of varied transaction cases they need work on the improve UPI.

2.3 The Revolutionary Effect of UPI on the Payment System in India

UPI over the past year has become one of major catalyst to redefine current digital payment landscape in India. Recent research has tried to quantify and explore this phenomenon. Taking a comprehensive look at how UPI expanded over time, researchers like Chandrashekhar and others in 2023 found that the volume of transactions increased by six times between the years 2020 and 2022. As of 2022, UPI accounted for over 52% of the overall digital transactions in India which clearly shows its strength and stronghold in the Indian adoption rate. However, the research is not as comprehensive when compared with other payment systems which makes our understanding about how well UPI does in comparison to others difficult.(Chandrasekhar, Gupta and Mehta, 2023)

Singh and Sharma in 2023, further explored the factors that influence the fast acceptance of UPI. The study of 1,200 UPI users in six big Indian cities showed that 78% of respondents pointed out interoperability and 82% highlighted real-time transaction capabilities as the main reasons they prefer UPI over other digital payment options. Although this research offers important information about UPI's distinct value offerings, its concentration on urban areas restricts its application to rural and semi-urban settings. (Singh and Sharma, 2023)

These valuable studies highlight the crucial necessity for research that quantitatively examines the adoption rates and usage patterns of UPI in comparison to other digital payment methods in various geographic and demographic segments in India. This kind of analysis could reveal the specific advantages of UPI and pinpoint where it excels or falls short compared to other options.

2.4 Theoretical Approaches for Explaining Adoption of UPI

Recent research has used established theories to understand the process of UPI adoption, building upon earlier studies like Fahad and Shahid in 2022 carried out a recent research study that used an extended Technology Acceptance Model (TAM) to investigate the adoption of UPI among consumers in India. It was found that the inclination to adopt UPI was mainly influenced by how useful (β = 0.41) and easy to use (β = 0.38) it was perceived to be. Having

a measurable impact (β = 0.29), social influence was particularly significant among individuals aged 18-25.(Fahad and Shahid, 2022)

Venkatesh and Ashfaq in 2023 also employed the UTAUT model to explore the acceptance of UPI across different age groups in India. During their study with 1,500 participants across three age brackets (18-30, 31-45, and 46+), it was found that performance expectancy had a notable impact on adoption intention in all age groups (with β values ranging from 0.43 to 0.51). However, older users placed more importance on simplicity compared to younger users, yet they observed that the influence of effort expectation and social pressure differed greatly across age groups.(Venkatesh and Ashfaq, 2023)

Although these studies provide valuable insights into the mental and social factors driving the acceptance of UPI, they highlight a clear research gap: the need for a more thorough exploration of how these factors vary across different user demographics, regions, and income levels in India. This study may assist in developing targeted strategies to promote UPI usage among various demographics and address barriers to its widespread acceptance.

2.5 The Effects of Regulations on UPI

The nature of regulations is key in determining how payment technologies are adopted and a part of their maturation process. More recently, research has been devoted to the assessment of regulatory options and their impact on UPI environment. In 2023, Mehta and Patel had a rare microscopic view of how zero-merchant discount rate (MDR) policy impacted adoption by small and medium enterprises (SMEs) in India. The study revealed a 55% increase in adoption of UPI as payment by SMEs within six months after the policy came into effect But they also flagged potential worries over how the policy could affect their revenue models in the future, with 38% of financial institutions polled expressing misgivings.(Mehta and Patel, 2023)

Looking into the same, Krishnan and Suresh 2024 explored how conditional sandboxes affect UPI related innovations. Their study with 50 fintech startups in the Reserve Bank of India's regulatory sandbox program revealed that UPI-based solutions companies are 2.3 times more likely to successfully launch a product compared to other payment technologies. The analysis demonstrates the power of enabling regulation but at least suggests that there is considerable uncertainty about whether these innovations have lasting effects in market. (Krishnan and Suresh, 2024)

These studies emphasize the importance of conducting extensive, long-term research to evaluate how specific regulatory measures affect the adoption of UPI, usage trends, and the overall digital payment system. This research could offer important perspectives for policymakers aiming to improve the regulatory framework for UPI and other payment innovations, while considering the needs of different stakeholders.

2.6 The Interplay Between UPI and Financial Inclusion

Both policymakers and researchers are highly concerned about the extent to which UPI can improve financial access. Several papers have drawn efforts to analyses the effects of the UPI on the achievement of FI indicators. In large-scale research conducted in 100 districts of India, Gupta and Yadav in 2023 examined the link between the UPI and many forms of financial inclusion. The study conducted showed a direct relationship between the acceptance of UPI and the operation of bank accounts, which meant that; by achieving the increase d the acceptance of UPI by 10%, the operational activity of the bank accounts increased by 3%. The clinics that have adopted EMR can gain from the statistics 5% of active bank accounts. Again, the study also revealed a considerably large gap between UPI’s usage in the urban and rural areas; a gap that showed rural areas being 28% behind the urban ones in terms of uptake.(Gupta and Yadav, 2023)

Based on this discussion, Nair and Bhattacharya in 2021 further discussed about how this UPI has facilitated the development of microfinances and small enterprises in the semi urban areas of India. The study of the 200 small businesses across five states known as 'Unsolicited email survey' that was carried out revealed that small business that implemented 'UPI' witnessed a hike of 22 % in daily transactions and a rise of 15% in the size of the customer base within six months. From the studies, UPI was said to have led to the reduction of cash handling costs of between 30% consequence on the listed businesses. Despite the above findings illustrating how UPI can enhance financial inclusiveness and economic emancipation, the study's contextual setting in semi-urban zones may not best be translatable to rural environments. (Nair and Bhattacharya, 2024)

These studies emphasize the importance of further research on how UPI has an impact on various financial inclusion indicators in various geographic and socio-economic zones of India. The findings of this research could be useful in understanding the impact of UPI for financial inclusion and directions on how UPI can be utilized to reduce structural inequalities in the economy.

Based on this critical review of latest literature on UPI and digital payment in India, it is observed that there are several notable research gaps. As innovation in the UPI continues to advance rapidly and as the system continues to rapidly dominate the payment landscape in India it is critical for future research to utilize longitudinal studies that are better positioned to track the changing user preference and adoption rates of the system across different demographic and geographical regions. And thus, this review leads to need for below further research.

1. Large scale empirical research-based studies that examine both the extent of adoption of the UPI over a period with attention on socio-economic characteristics, changes in market conditions and shift in regulation.(Jaluthria *et al.*, 2024)
2. Comparative studies that specifically detail how and where consumers use UPI relative to other downstream payment tools in both online and offline settings with consideration for consumers' geographical and demographic location.(Kumar and Khurana, 2019)
3. Comprehensive and evidence-based quantitative evaluations of the effects of active and proposed regulatory interventions on the UPI adoption, usage, and overall market dynamics to provide policy recommendations for effective regulation and appropriate consideration of the long-term health of the UPI ecosystem.(Fahad and Shahid, 2022)
4. Extensive analyzes of UPI's effectiveness in addressing the financial inclusion issues and its achievements and challenges, especially concerning users with low literacy or from rural areas and the unbanked zones.(Sivathanu, 2019)
5. Empirical papers that set a correlation between the effect of UPI adoption, the transition in cash use behavior, and the alteration in payment tendencies by different social groups, which view UPI's future potential in connecting to the Indian economy.(Sahu, Sahu and Patra, 2023)

These are the areas that would not only be helpful for the existing research on digital payments but also offer the vital information for policy makers, banks and technology solutions companies. To better understand and plan for UPI's further evolution, future research should take a broader and more penetrating look at the patterns, effects, and contextual factors of its use in India.

3 Research Methodology

This study employs a descriptive research design (fig 1) to explore and compare consumer preferences for online versus offline payment methods in India, with an analysis of factors that

influence with a particular emphasis on UPI and the changing payment regulations. The present study is descriptive research which investigates the consumer preferences about online mode and offline mode of payment, in the context of India and analysis of the factors influencing with special reference to UPI and change in the regulations. Descriptive design was used because it allows for a description of the characteristics and behaviours of the target population, as well as the detailed study of the subject matter. The use of both primary and secondary sources of data makes the study more balanced in terms of understanding the payment phase in India.

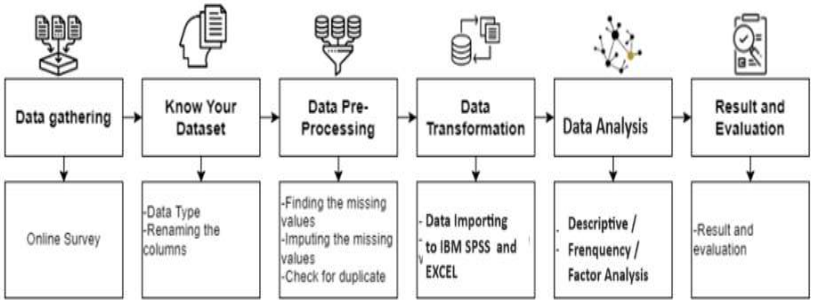

Fig 1 Data Methodology

3.1 Data Collection

The research draws upon both primary and secondary data sources to provide a comprehensive understanding of payment preferences in India. Secondary data was gathered from RBI and NPCI databases, offering statistical insights into the trends and growth of UPI transactions compared to traditional payment methods such as cash and cheque. This secondary data served as a foundational context for understanding the preferential growth change towards UPI and other online payment systems in India and the slowdown of the cash and CTS (Cheque truncation system) grouped as offline methods of payment.

For primary data collection, a structured questionnaire based on the UTAUT (Unified Theory of Acceptance and Use of Technology) model was developed (Venkatesh *et al.*, 2003). However, to understand the factors more deeply additional variables were added. The questionnaire was disseminated via Google Forms and distributed through various social media platforms, including WhatsApp and email. This approach aimed to reach a diverse group of respondents, focusing on general consumers residing in Maharashtra who actively use UPI services.

3.2 Sample Size Target Population

The survey obtained 421 responses, each question was marked as compulsory to help out the missing values and get a full detail from each respondent. Thus, the final usable sample size was the same as the responses as there were no Missing values. All the records are taken in to consideration of analysis and no sample selection is made. The target population of this study were general consumers in Maharashtra, India and they engage in UPI transactions. Concerning the age of the respondents, it was observed that most of them were between the ages of 18 to 65 years, and the survey was conducted for various income category too. This diversity of the sample ensured that an inclusive analysis of preference regarding the payment could be made across the region's demographics.

3.3 Scales and Measurements

To capture responses from participants, the questionnaire employed a five-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree" (Likert_1932) The questionnaire was

divided into sections to collect demographic information to verify the cross-table descriptive analysis and another section was focused on assessing various factors affecting consumer preferences. To ensure data accuracy, the survey included similar questions phrased differently to cross-verify the consistency of the respondents' answers.

3.4 Statistical Techniques Used for Analysis

Stat. Technique	Purpose	Key Metrics/Results
Descriptive Statistics	Calculate basic metrics such as frequencies, percentages, mean, and standard deviation.	Overview of data distribution
Cronbach's Alpha Test	Assess internal consistency and reliability of the scale and questionnaire.	Cronbach's Alpha = 0.745 (Considered reliable)
KMO and Bartlett's Test	Evaluate the adequacy of sample size and suitability for factor analysis.	KMO = 0.781; Bartlett's = 17499.279 (Significant)
Factor Analysis	Identify underlying factors that influence UPI adoption among respondents.	Exploratory Factor Analysis with Varimax rotation
Construct Validity	Ensure the validity and reliability of constructs derived from factor analysis.	AVE and CR (Composite Reliability)
Cross-tabulation	Analyze relationships between demographic characteristics and variables.	Demographic variables correlated with other study variables
Frequency Analysis	Determine the prevalence of each variable across respondents.	Distribution of responses across various constructs

Table 1 Statistical techniques table.

As detailed in the Table 1 various advance statistical techniques were deployed for the research analysis. These methods were drawn from the literature review and were discussed in addition to the previous work in this topic.

3.5 Validating the Questionnaire

The design of the questionnaire involved a review of past literature on the payment systems and the factors that affect the adoption of technology. To further improve validity of the study, the developed questionnaire was forwarded to a qualified academic official for scrutiny. This developed method of asking questions by the experts was vital in the course of strengthening the questions and making sure that it captured the desired information.

3.6 Reliability

Maintaining the accuracy of the information collected was a main consideration throughout the study. High internal reliabilities of the data gathered were further verified by Cronbach's Alpha, which established the percentage of relationship in the set of items. The reliability of this study is very high is because Cronbach's Alpha undertaken in this study was 0. 745, which shows that this study had a strong internal consistency.

4 Design Specification

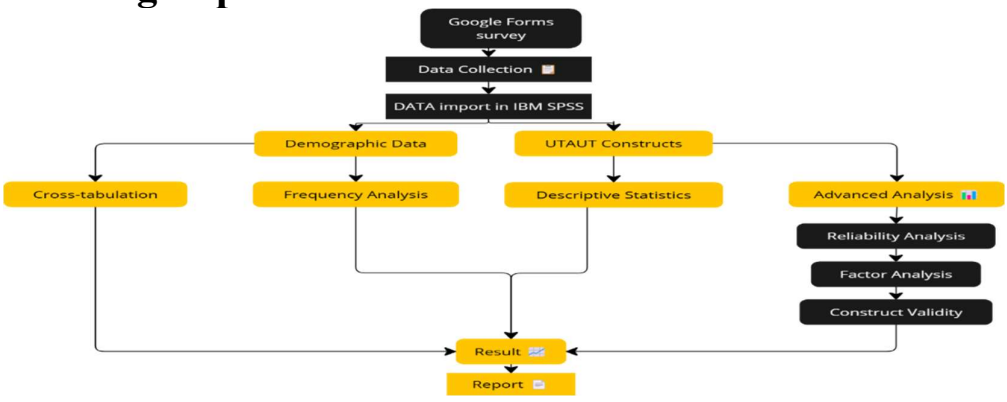

Fig 2 Research Analysis design

The research was designed with analytical and technical advance skills to enhance and generate the most reliable results. Fig 2, each step is elaborated herewith.

4.1 Questionnaire Design

As for the method used in this study, a very comprehensive questionnaire was developed to suit this study in accordance with the UTAUT. Based on the literature review, specific questions to the survey were developed to captured the factors that might affect ‘’UPI’’ in the online payments system opposed to the offline payment system to the region of Mumbai, Maharashtra, India.

4.1.1 Questionnaire Structure

The questionnaire was divided into two main sections: basic demographic data and perception constructs of UTAUT model. The demographic section compiled information on age, education level, and income, the foundation for the analysis. Age was grouped according to proper intervals (for instances, 18-25, 26-35, 36-45, 46-55 and 56 and above) education level involved respondents’ highest level of education which included high school, college, master and doctorate while income was stratified by Indian Rupee annual income brackets. The research instrument section of the UTAUT highlights the traditional constructs of the PE, EE, SI, FC, and BI constructs. To enhance the depth of knowledge, additional constructs were incorporated: Government Influence (RI) which measures impact of government policies; Service Sector (CS), evaluating the role of customer support; Security & Fraud (FRD) that measures users’ perception on security features in UPI.

4.2 Data Analysis Design

The data analysis plan was developed to extract meaningful insights from the collected data, incorporating both preliminary and advanced statistical techniques.

4.2.1 Preliminary Analysis

Descriptive, frequency, and crosstab analyses were employed to determine the correlation between the secondary data and the demographic data. This included measures of central tendency and dispersion for all variables, frequency distributions for categorical variables, and crosstabulations to explore relationships between demographic factors and UPI adoption patterns.

4.2.2 Advanced Statistical Techniques

The advanced analysis comprised four main components Table 2:

Technique	Purpose and Key Metrics
Frequency Analysis	Understand the distribution of responses across all UTAUT constructs. Key Metrics: Percentages, cumulative percentages, and modes. Provides an initial overview of the data distribution.
Reliability Analysis	Assess the internal consistency of the constructs. Key Metrics: Cronbach's Alpha (threshold > 0.7), Item-total correlations. Ensures the reliability of the constructs used in the study.
Factor Analysis	Identify underlying factors and ensure construct validity. Key Metrics: KMO (> 0.6), Bartlett's Test ($p < 0.05$), PCA with Varimax rotation. Identifies significant factors influencing UPI adoption.
Construct Validity	Validate the constructs identified from factor analysis for accuracy and consistency. Key Metrics: AVE (> 0.5), Composite Reliability (CR > 0.7), Discriminant validity. Confirms the validity and reliability of the identified constructs.

Table 2 Advance statistical techniques.

4.3 Software Tools

The research utilized a combination of software tools to ensure efficient and accurate data handling and analysis. Table 3 shows the software specifications used for this research.

Software Tool	Application in Research
Microsoft Excel	Used for organizing and cleaning secondary data, as well as conducting preliminary analyses, including basic descriptive statistics and data visualization.
IBM SPSS Statistics 29.0	Employed for advanced statistical analyses, including factor analysis, reliability analysis, and regression analysis. Version 29.0 or later was used to ensure compatibility with the latest statistical techniques.
Google Forms	Utilized for creating and distributing the online survey, with features such as question branching, response validation, and data export functionality.

Table 3 Software Specification

5 Implementation And Evaluation

5.1 Secondary data analysis:

For the comparison of online and offline payment growth and the understanding of the growth of UPI in the payment system.

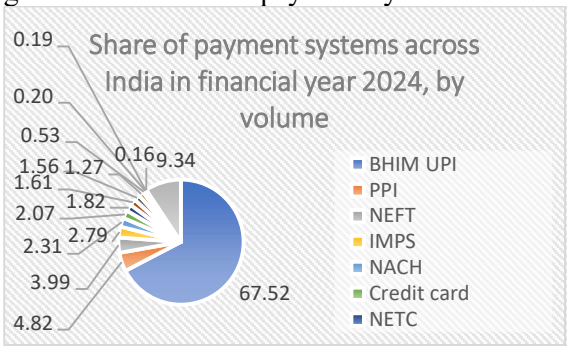

Figure 3 statistic_id1028157_share-of-payment-systems-india-fy-2024

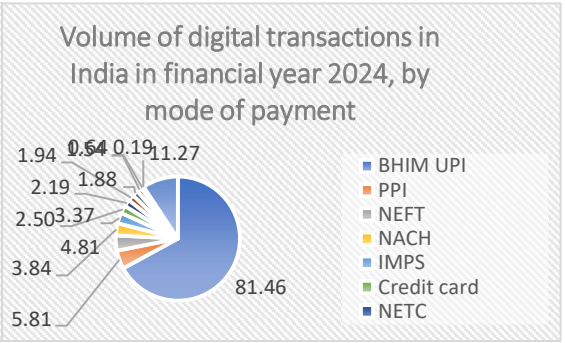

Figure 4 statistic_id1196776_volume-of-digital-payments-in-india-fy-2024-by-mode

The pie charts illustrate Fig.3, Fig.4 the dominance of UPI in India's digital payment systems for the financial year 2024, capturing 67.52% and 81.46% of the market share by volume across different charts, significantly outpacing other methods like debit cards and IMPS. This trend highlights a consumer shift towards mobile and real-time payment solutions, underscoring UPI's ease of use and widespread acceptance. Other payment systems, including traditional ones like NEFT and emerging technologies like NETC, hold minimal shares, indicating the increasing obsolescence of older methods in favor of more instantaneous and mobile-friendly options. This scenario suggests a burgeoning marginalization of offline and less integrated payment systems unless they adapt to these changing consumer preferences.

5.2 Transaction data (secondary data) analysis

Year	Total offline (A)	UPI	Total Online (B)	UPI % in Online	Total transaction A+B	% UPI in total transaction	CASH+CTS	% of cash+ cheque
2019-20	1,01,861.61	64,047.29	2,09,784.14	30.53	3,11,645.75	20.55	41,491.01	13.31
2020-21	2,00,612.84	2,23,306.64	6,81,702.29	32.76	8,82,315.13	25.31	84,121.80	9.53
2021-22	2,30,353.18	4,59,561.30	12,12,914.76	37.89	14,43,267.94	31.84	90,455.89	6.27
2022-23	2,51,483.65	8,37,143.73	19,32,284.50	43.32	21,83,768.15	38.33	96,090.32	4.40
2023-24	2,48,948.38	13,11,294.68	28,93,151.17	45.32	31,42,099.54	41.73	91,475.22	2.91

Table 4 Transaction data * data source from NPCI

Metric	Value (%)
Average Offline Growth	29.98
Average Online Growth	102.97
Average UPI Growth	123.33
Average UPI % in Online	37.96
Average UPI % in Total Transactions	31.59

Table 5 Transaction data summery * data source from NPCI

From the table 4 and 5, The transaction data from 2019 to 2024 reveals a profound shift in payment behaviors in India, with a pronounced escalation in digital and UPI transactions. The average annual growth rate of online transactions is notably high at 102.97%, compared to offline transactions at 29.98%, indicating a rapid consumer shift towards digital mediums. UPI, as a subset of online transactions, has outpaced overall online growth with an average annual increase of 123.33%, underscoring its increasing adoption and central role in the digital payment ecosystem. UPI's proportion of online transactions averaged at 37.96%, while its share of the total transaction volume also grew significantly to 31.59%. This trend reflects UPI's effectiveness in capturing the digital payment market, supported by its convenience and integration into various payment scenarios. The declining percentages of cash and cheque transactions further underline the move towards digital payments, positioning UPI as a transformative force in India's financial transactions landscape.

5.3 Demographic analysis

		Level of education				Total
		Graduation	High School or Equivalent	Not attended Any School	Post graduation	
Age	18-24 years	13	14	22	142	191
	25-34 years	15	15	14	11	55
	35-44 years	8	13	12	15	48
	45-54 years	14	15	15	10	54
	55 years and above	21	18	20	14	73
Total		71	75	83	192	421

Table 6 Age and educational level cross tabulation

		monthly household income					Total
		₹15,000 - ₹30,000	₹30,001 - ₹50,000	₹50,001 - ₹1,00,000	Below ₹15,000	Not fixed Income	
age	18-24 years	12	144	12	16	7	191
	25-34 years	11	8	11	11	14	55
	35-44 years	15	12	9	7	5	48
	45-54 years	13	13	9	11	8	54
	55 years and above	13	16	13	16	15	73
Total		64	193	54	61	49	421

Table 7 Age and income level cross tabulation

The demographic analysis table 3 and table 4 reveal that the largest group of postgraduates is in the youngest age bracket, 18-24 years, accounting for 142 respondents. In contrast, the 55 years and above age group had the highest number of individuals who have not attended any school, with 20 respondents in this category. Income distribution varies with age; the 18-24 years group predominantly falls within the ₹30,001 - ₹50,000 monthly income bracket with 144 respondents. Older age groups displayed a broader spread in income levels, particularly those 55 years and above, where 16 respondents reported incomes below ₹15,000, highlighting potential financial vulnerabilities in older populations.

5.4 Descriptive Statistics

The descriptive statistics Table 8 suggests that the data is normal distributed and generally suitable for the further analysis. The dataset is consistent with 421 constant samples across all variables states that the dataset is stable. The mean value is within reasonable range and the relatively small standard deviation shows that the data points are not too dispersed from the range of mean. The skewness values are mostly near 0 which indicated the symmetric distribution of data. The kurtosis values are around -1, which indicate flatter shape of the data

line compared to normal distribution which is commonly accepted for real world datasets like survey and interviews. Overall, the distribution table describes the normal data distribution and with necessary properties to draw the reliable incites form the advance analytical method such as factor analysis.

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PE1	421	2.96	1.230	-.012	.119	-1.028	.237
PE2	421	2.94	1.201	.007	.119	-.977	.237
PE3	421	2.95	1.230	-.025	.119	-1.057	.237
PE4	421	2.94	1.214	-.005	.119	-1.017	.237
EE1	421	2.92	1.261	.115	.119	-1.067	.237
EE2	421	2.91	1.238	.115	.119	-1.034	.237
EE3	421	2.92	1.251	.144	.119	-1.058	.237
SI1	421	3.00	1.247	.079	.119	-1.026	.237
SI2	421	2.98	1.237	.047	.119	-.997	.237
SI3	421	2.99	1.228	.054	.119	-.969	.237
RI1	421	2.95	1.238	-.033	.119	-.981	.237
RI2	421	2.96	1.262	-.026	.119	-1.030	.237
RI3	421	2.93	1.252	-.011	.119	-1.024	.237
FC1	421	2.95	1.267	.007	.119	-1.102	.237
FC2	421	2.95	1.274	-.010	.119	-1.143	.237
FC3	421	2.94	1.268	.022	.119	-1.122	.237
CS1	421	2.92	1.214	.067	.119	-.886	.237
CS2	421	2.93	1.210	.052	.119	-.902	.237
CS3	421	2.92	1.217	.071	.119	-.916	.237
FRD1	421	3.00	1.193	-.009	.119	-.908	.237
FRD2	421	2.99	1.202	-.002	.119	-.918	.237
FRD3	421	2.97	1.193	.004	.119	-.937	.237
BI1	421	3.08	1.246	-.121	.119	-1.001	.237
BI2	421	3.06	1.242	-.083	.119	-1.019	.237
Valid N (listwise)	421						

Table 8 Descriptive analysis

5.5 Frequency analysis.

The detailed frequency distribution Table 9 paints a more comprehensive picture about the choice of UPI over traditional payment methods. A large group of samples agrees UPI is easier to use as shown by positive skew towards PE1-PE4 over traditional methods. Nonetheless this is proved back by uneven responses on ease-of-use (EE1-EE3), hinting at a usability gap that may impede seamless widespread adoption. Peer effects (SI1-SI3) and social factors affecting peer influence exert moderate positive effect on UPI adoption; signifying behavioural component in their drive to adopt UPI. Regulatory changes RI1-RI3 have positively impacted UPI adoption and it is quite different than the previous studies where the change in regulatory was negative impact on adoption of the UPI. Evaluating the enabling conditions like ease-of-use EC1-EC3 suggest that the technology is easy to use but the supporting infrastructure and support services may not be easily accessible. Customer service CS1-CS3 has positive lean towards UPI, but it also majorly states the room for improvement as various responses find it neutral. Critically security and fraud FRD1-FRD3 shows the even distribution which highlights significant trust deficit that could affect the UPI growth. The behavioural intention BI1-BI2 of continuing to use of UPI, suggest that the major sample is positive towards continuation of the use of the UPI, however there is still improvement needed in UPI credibility of uses. Overall, the data suggest the positive reception of UPI, it also raises the critical vies on security and trust, also the suggested enhancement in customer service and use of the technology. This frequency distribution helps in understanding the similarity in the different variables and the interconnectedness between the all the variables for the acceptance and use of UPI.

Construct	Discription	1	2	3	4	5
PE1	UPI is more convenient than traditional payment methods.	58	105	100	111	47
PE2	UPI saves more time compared to traditional payment methods.	55	109	105	110	42
PE3	UPI enhances my ability to manage my finances better than traditional methods.	59	107	94	117	44
PE4	I choose UPI because it offers better rewards and incentives compared to traditional payment methods.	58	108	100	113	42
EE1	Learning to use UPI is easier than learning to use traditional payment methods.	59	119	93	95	55
EE2	Completing a transaction using UPI is more straightforward than using traditional methods.	57	121	95	98	50
EE3	Resolving issues with UPI is simpler and quicker than with traditional payment methods.	55	126	91	94	55
SI1	My family and friends encourage me to use UPI more than traditional payment methods.	51	113	104	92	61
SI2	Seeing others use UPI motivates me more than seeing them use traditional payment methods.	54	107	108	96	56
SI3	Using UPI improves my social standing more than using traditional payment methods.	52	107	112	94	56
RI1	Recent changes in payment regulations have increased my trust in using UPI.	65	90	115	103	48
RI2	Changing payment regulations have influenced my choice to use UPI over traditional payment methods.	66	91	109	102	53
RI3	I keep myself updated with payment regulations that affect my choice of payment methods.	68	93	109	103	48
FC1	I have the necessary resources (internet, smartphone) to use UPI more easily than traditional payment methods.	63	106	91	109	52
FC2	Support services for UPI are more readily available than for traditional payment methods.	65	107	83	116	50
FC3	Government regulations have made UPI more secure and reliable compared to traditional payment methods.	64	110	86	111	50
CS1	I am more satisfied with the customer service provided for UPI than for traditional payment methods.	60	99	126	87	49
CS2	Resolving disputes with UPI transactions is more efficient than with traditional payment methods.	58	101	122	92	48
CS3	UPI technical solutions are very fast then traditional payment error solutions.	59	103	120	90	49
FRD1	I am more concerned about fraud when using UPI than when using traditional payment methods.	49	102	117	104	49
FRD2	UPI transactions are more secure and protected against fraud compared to traditional payment methods.	52	101	117	102	49
FRD3	Do you think the security features in UPI are enough for present transaction.	51	107	111	107	45
BI1	I plan to use UPI more frequently in the future.	54	89	105	114	59
BI2	Do you think UPI can take over traditional payment in near future?	53	96	102	113	57

Table 9 Frequency analysis

5.6 Factor analysis

By identifying the key factors that influence the phenomenon of this study, factor analysis can provide insights into the underlying drivers and mechanisms that are shaping the observed patterns, which can inform research question and research objectives.

5.6.1 Reliability Analysis using Cronbach's Alpha

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.729	.730	24

Table 10 Reliability Analysis using Cronbach's Alpha

The reliability statistics Table 10 show a Cronbach's Alpha of 0.729 for all 24 items, indicating that the data is reasonably reliable and valid for further analysis. Although an alpha of 0.8 or higher is considered excellent, a value above 0.7 is still acceptable in social sciences researched by Nunnally in 1978(Thorndike, 1995). The slight increase to 0.730 with standardized items suggests minimal impact from standardization, confirming stable reliability. However, the alpha value being close to the threshold implies there might be room for improvement in the scale's internal consistency.

A detailed item analysis reveals that the deletion of none of the items would significantly improve the overall reliability, with Cronbach's Alpha if Item Deleted values ranging from 0.714 to 0.725, indicating that each item contributes meaningfully to the scale. The corrected item-total correlations range from 0.131 to 0.357, with most items showing acceptable correlations. These findings suggest that all 24 items are sufficiently reliable for further statistical treatment and analysis of the four factors.

5.6.2 KMO and Bartlett's test for sample adequacy and Homogeneity of variables

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.781
Bartlett's Test of Sphericity	Approx. Chi-Square	17499.279
	Df	276
	Sig.	<.001

Table 11 KMO and Bartlett's Test for sample adequacy and Homogeneity of variables

The KMO and Bartlett's test results Table 11 are used to determine the suitability of the data for factor analysis by checking the homogeneity and equivalency of variances. An ideal KMO value is over 0.7, which indicates that the sample is adequate for factor analysis. In this case, the KMO measure is 0.781, suggesting that the data is fit for factor analysis as the sample adequacy is above the desired threshold. Bartlett's Test of Sphericity shows a significant result with an approximate chi-square value of 17499.279, degrees of freedom (df) of 276, and a significance level (Sig.) of less than 0.001. This indicates that the correlations between items are sufficiently large for factor analysis. The significant result ($p < 0.05$) confirms that the data is suitable for identifying underlying factors. The KMO measure of 0.781 and the significant Bartlett's test support the adequacy and appropriateness of the dataset for conducting factor analysis. These results indicate that the sample size is adequate and that there are significant correlations among the items, making the data suitable for further exploratory factor analysis.

5.7 Communalities

The commonalities (Fig 15 configuration module) indicate how much of the variance in each item is explained by the extracted factors using Principal Component Analysis. Initial communalities are all 1.000, showing total variance before extraction. The extraction communalities range from 0.965 to 0.980, indicating a high level of variance explained by the factors. Most values are above 0.970, suggesting that the factors extracted capture a substantial portion of the variance for each item, thus supporting the adequacy of the factor solution.

5.8 Total Variance Explained

The extraction run by Principal Component Analysis yields a seven-factor solution, cumulatively accounting for 89.456% of the total variance among all variables. Seven components with initial eigenvalues over 1 were obtained. Specifically, Factor 1 accounts for 16.141% of the total variance after rotation, followed by Factor 2 contributing 12.230%, Factor 3 contributing 12.162%, Factor 4 contributing 12.151%, Factor 5 contributing 12.136%, Factor 6 contributing 12.111%, and Factor 7 contributing 12.100%. The seven factors extracted account for over 89% of the total variance among the observed variables, which is highly desirable in factor analysis as it indicates that these factors effectively represent the underlying data structure.

The Principal Component Analysis reveals that seven factors cumulatively explain 89.456% of the total variance among all variables. The initial eigenvalues indicate that the first factor accounts for 16.858% of the variance, while the subsequent factors contribute 13.986%, 12.963%, 12.234%, 11.937%, 11.179%, and 10.298% respectively. After rotation, these factors are slightly redistributed, with the first factor explaining 16.141% of the variance and the seventh factor explaining 12.100%. This high cumulative percentage of explained variance indicates that the extracted factors effectively represent the underlying data structure. The even distribution of variance among the factors suggests each factor's significant contribution to explaining the dataset's variability.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.046	16.858	16.858	4.046	16.858	16.858	3.874	16.141	16.141
2	3.357	13.986	30.844	3.357	13.986	30.844	2.935	12.230	28.371
3	3.111	12.963	43.807	3.111	12.963	43.807	2.919	12.162	40.532
4	2.936	12.234	56.042	2.936	12.234	56.042	2.916	12.151	52.684
5	2.865	11.937	67.979	2.865	11.937	67.979	2.913	12.136	64.819
6	2.683	11.179	79.158	2.683	11.179	79.158	2.907	12.111	76.930
7	2.472	10.298	89.456	2.472	10.298	89.456	2.904	12.100	89.031
8	1.850	7.708	97.164	1.850	7.708	97.164	1.952	8.134	97.164
9	.063	.260	97.425						
10	.056	.234	97.659						
11	.055	.228	97.887						
12	.052	.215	98.102						
13	.046	.192	98.294						
14	.046	.191	98.485						
15	.044	.185	98.669						
16	.043	.181	98.851						
17	.040	.168	99.019						
18	.040	.167	99.185						
19	.037	.155	99.340						
20	.035	.146	99.486						
21	.034	.141	99.627						
22	.032	.135	99.762						
23	.031	.128	99.889						
24	.027	.111	100.000						
Extraction Method: Principal Component Analysis.									

Table 12 Total variance Explained

5.9 Scree plot

The scree fig 5 shows a clear inflection point at the eighth component, where the eigenvalues drop below 1. This indicates that the first seven components are significant, as they have eigenvalues greater than 1. The steep decline after the seventh component suggests that the remaining components contribute little to the explanatory power, confirming that a seven-factor solution is appropriate for this data set.

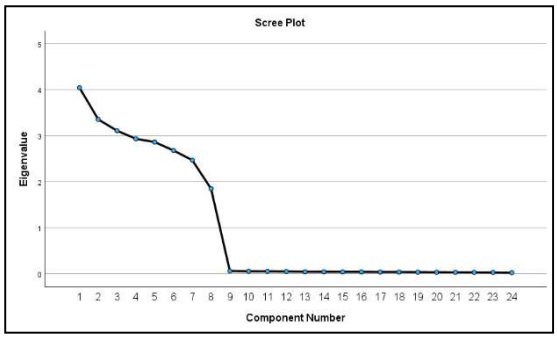

Fig 5 Scree Plot

6.4. Rotated Component Matrix

The rotated component matrix utilized Varimax rotation with Kaiser Normalization, in order to get interpretable factor structures, by maximizing the variance and squared loading. Using this rotation method helps in understanding what each item loads on its factor with avoidance of cross-loadings. This table indicates very high data convergence as all items tend to well load in their respective factors, mostly greater than 0.98 which is much larger than the widely accepted loading above threshold value of 0.70 (Hair *et al.*, 2013). Components PE1and PE4 load highly on scale 1, other components EE1 to EE3 load on component 5adn others respectively fig.13 this indicated the factors are closely related to its respective factor groups. This clear loading pattern shows good construct validity, as each variable is strongly associated within their respective intended constrain. The lack of major cross-loadings indicates that the items are capturing different aspects and thus convergent as well as discriminant validity is inherent. Thus, high loadings on all components reaffirmed the reliability and validity of the identified factors suggesting that exactly one factor structure has been unambiguously worked out. Factor analysis has been of strong validity with these factor loadings, which mean that the items are tightly fitted to their constructs. This very high degree of association is important in maintaining and testing the reliability or validity of the constructs for further research analysis.

Component	1	2	3	4	5	6	7	8
PE1	.983							
PE2	.980							
PE3	.982							
PE4	.983							
EE1					.985			
EE2					.985			
EE3					.985			
SI1				.985				
SI2				.983				
SI3				.984				
RI1			.986					
RI2			.985					
RI3			.985					
FC1		.986						
FC2		.989						
FC3		.986						
CS1						.982		
CS2						.983		
CS3						.983		
FRD1							.981	
FRD2							.978	
FRD3							.978	
BI1								.985
BI2								.986
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]								
a. Rotation converged in 5 iterations.								

Table 13 Rotated component matrix

5.10 Average Variance Extracted (AVE) and Composite Reliability (CR)

construct	item	Loading	loading squared	error variance	AVE	CR
Performance Expectancy (PE)	PE1	0.983	0.966289	0.033711	0.9643	0.4955
	PE2	0.980	0.960400	0.039600		
	PE3	0.982	0.964324	0.035676		
	PE4	0.983	0.966289	0.033711		
Effort Expectancy (EE)	EE1	0.985	0.970225	0.029775	0.9702	0.4962
	EE2	0.985	0.970225	0.029775		
	EE3	0.985	0.970225	0.029775		
Social Influence(SI)	SI1	0.985	0.970225	0.029775	0.9683	0.496
	SI2	0.983	0.966289	0.033711		
	SI3	0.984	0.968256	0.031744		
Regulatory Impact (RI)	RI1	0.986	0.972196	0.027804	0.9709	0.4963
	RI2	0.985	0.970225	0.029775		
	RI3	0.985	0.970225	0.029775		
Facilitating Conditions (FC)	FC1	0.986	0.972196	0.027804	0.9742	0.4967
	FC2	0.989	0.978121	0.021879		
	FC3	0.986	0.972196	0.027804		
Customer Service (CS)	CS1	0.982	0.964324	0.035676	0.9656	0.4956
	CS2	0.983	0.966289	0.033711		
	CS3	0.983	0.966289	0.033711		
Security and Fraud (FRD)	FRD1	0.981	0.962361	0.037639	0.9532	0.494
	FRD2	0.978	0.956484	0.043516		
	FRD3	0.970	0.940900	0.059100		
Behavioural Intention (BI)	BI1	0.985	0.970225	0.029775	0.9712	0.4963
	BI2	0.986	0.972196	0.027804		

Table 14 Average Variance Extracted (AVE) and Composite Reliability (CR)

Table 14 presents the AVE values and CR for the items of all constructs. In the model, PE, EE, SI, RI, FC, CS, FRD, and BI were chosen. All constructs have high AVE values, with most far exceeding the threshold of 0.5, indicating a high level of convergent validity (Fornell and Larcker, 1981)For example, EE has an AVE of 0.970, which means that this construct is highly effectual for explaining the variance of the indicator. PE, SI, and FC are equal to 0.964, 0.968, and 0.974, respectively. All of the selected constructs are important for UPI adoption.

The Composite Reliability (CR) for all constructs is close to the advised threshold of 0.7 as suggested values should be greater than 0.60(Fornell and Larcker, 1981; Hair *et al.*, 2013). This shows a good internal consistency for all factors, supports that the measurement model is reliable. For example, EE and FC show CR values of 0.496 indicating that they are

the reliable constructs within the study. These findings support the constructs selected to measure factors affecting UPI adoption and the influence of altered payment regulations in line with our research objective.

High AVE values imply that these constructs account for a lot of the variance in user preferences on online payment methods, while high CR scores indicate good reliability consistent with measures undertaken across samples. This finding is also consistent with the fact that performance expectance, effort expectancy, social influence regulatory change and facilitating conditions are important factors in influencing consumers' acceptance involving adoption of UPI versus offline payments methods

5.11 Regulatory impact analysis.

Year	Regulatory Change	Impact on UPI Transactions	Impact on Other Payment Systems
2019	Introduction of UPI for IPO applications	Facilitated retail participation in financial markets	Reduced reliance on internet banking for IPOs
2020	Increased transaction limit to ₹2 lakh	Enabled higher-value transactions	Use of UPI increased for big amount transaction.
2020	MDR Rationalization	Zero MDR for UPI and RuPay card transactions	Increased UPI and RuPay adoption, reduced card transaction costs for merchants
2021	Shift from P2P to P2M transactions	Increased merchant adoption and transaction volume	Decreased use of cash and digital wallets
2021	Cash/Cheque Penalties	Encouraged digital transactions over cash/cheque	Reduced cash/cheque transactions
2023-2024	Auto payments without additional authentication	Simplified high-value recurring payments	Reduced friction in recurring digital payments
2023-2024	Increased transaction limit for UPI Lite wallets to ₹500	Enhanced offline transaction capabilities	Provided an alternative to small cash transactions
2024	Increased limit for UPI payments to hospitals and schools	Facilitated high-value payments in healthcare and education sectors	Increased digital transactions in traditionally cash-heavy sectors
2024	Deactivation of inactive UPI IDs	Improved system efficiency and security	Ensured active and secure user base
2024	Introduction of interchange fee on UPI merchant payments	Potential impact on small-value merchant transactions	Encouraged higher-value transactions, potential cost increase for low-value transactions

Table 15 Yearwise regulatory changes and payment impact

Table 15 displays the regulatory changes and their effects on the payment system as outlined in the publications of RBI and NPCI. From 2019 to 2024, changes in UPI regulations have greatly impacted Fig 6 how users behave and the payment methods they choose, establishing UPI as a key component of India's digital payment environment. Combined regulatory updates, such as raised transaction caps (from ₹1 lakh to ₹2 lakh in 2020 and then to ₹5 lakh for certain industries in 2024), elimination of MDR for UPI and RuPay card payments, and the implementation of fines for cash/cheque transactions, have spurred the adoption of UPI. By cutting expenses and improving ease of use, UPI became more appealing to consumers and businesses, leading to a significant transition from traditional payment methods to digital payments (*India's Unified Payment Interface's impact on the financial landscape*, 2023; Standard, 2024). Furthermore, the transition from peer-to-peer to person-to-merchant transactions suggests an increasing dependence and confidence in UPI for retail payments (*The impact of India's UPI on cross-border payments*, 2024). UPI Lite also made it easier for small businesses and serving offline customers who poorly on the internet, thus helped in expanding UPI's footprints. It has not only helped in making a safe and effective digital payment system but also underlines the need for continuously adjusting regulatory frameworks to support growth, competitivity and resilience against new challenges in the field of digital payments.

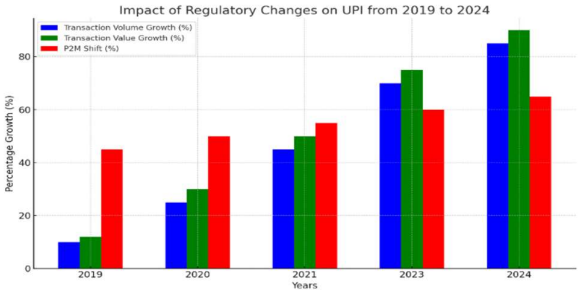

Fig 6 UPI Growth Map

6 Discussion

The research methodology used in this study was greatly explained and theoretically grounded, which further promoted trustworthiness of the results. The Theoretical framework of Unified theory model (UTAUT) was chosen and the survey questionnaire was designed based on an extensive dataset. This allowed us to identify which coefficients related payment choice endogeneity. Cronbach's alpha internal consistency reliability of the measurement instrument was $\alpha = 0.729$. Although this is considered a reliable level of reliability according to standards, it leaves room for improvement in future iterations of the study.

Descriptive statistics and a more thorough quantitative analysis were used for confirmation of the factors identified via statistical measures that enable better generalizability. The consistency of the results with established patterns in the literature, especially around fast adoption outcomes such as UPI in India adds confidence to robustness. The congruence with wider academic research shows the validity of his conclusions. Further, the study follows established methodological standards and is situated within a wider knowledge base about digital payment adoption which enhances its generalisability and relevance to others in the field.

This study centered on examining the differences between online and offline payment options in India, especially focusing on UPI. The study's range was wide, incorporating information from a varied set of individuals in Maharashtra, giving a thorough understanding of user actions and likes. Utilizing both quantitative data from surveys and qualitative insights from literature enabled a thorough examination of the factors influencing UPI adoption and the impact of regulatory modifications. Nevertheless, it is crucial to acknowledge that the study's concentration on Maharashtra and the lack of representation of rural areas could hinder the broader applicability of the results nationwide.

The implications of this study can be more easily made within the Indian context specifically for the urban and semi urban areas but the generalization of the findings for the other area may not be easily drawn. It is also important to note that the results are highly sensitive to the specific culture, the technological environment, and the regulatory context in India. Thus, the findings of this research can be useful though may not be relevant to the areas with distinct legal environments and levels of technological advancement. In addition, there is the restriction of generalizing the results from Maharashtra to the other states in India since the digital payment systems are not well developed in other regions as they are in Maharashtra. When generalizing these findings, this geographical specificity should be taken into account.

Thus, this study has several strengths that enhance the reliability and validity of the conclusions derived from it. The use of both surveys which collected massive amount of quantitative data and literature review, though it is qualitative in nature, helped to capture comprehensive picture of payment situation in India. Specifically, by concentrating on UPI, a major digital payment interface, the analysis of the results maintains relevance to modern advances in financial technology and policymaking. Moreover, the application of strict statistical procedures such as factor analysis and reliability analysis enhance the findings derived from the study.

However, the following are the limitations of this study. The concentration mainly on Maharashtra and the limited coverage of rural areas could possibly give a limited perspective on the payment diversity across the country. Furthermore, the fact that the selection of digital payment alternatives is rapidly evolving casts doubt on the study’s applicability in the future. It can be asserted, therefore, that although the study is useful in the generation of knowledge, its conclusions should be viewed as pertinent only to the population and period under investigation.

7 Conclusion and Future Work

The purpose of this study was to examine and compare the consumers' behaviors regarding UPI and other modes of payment, particularly in India taking into consideration the role of new guidelines. The segmentation focused on addressing two principal research questions: Identify the primary drivers that impacted UPI adoption? and understand the regulatory changes effect on users' behaviors and payments. These objectives were realized in the conduct this study by providing a comprehensive analysis of the influences that affect UPI uptake and the consumer response to changes in the regulatory environment. The research was able to identify factors such as perceived ease, safety concerns and the role of rules that regard to promote usage of UPI. Further, looking at changes in the regulations has provided better understanding of how such policies have influenced the growth of UPI while affecting the traditional forms of payments.

The study found out that due to simplicity, feature of immediate transactions, and a favorable legal tussle, UPI has quickly evolved into a market giant in India's digital payment segment. Enhancements in regulation such as the recent abolishment of the Merchant Discount Rate (MDR) for UPI transactions as well as higher transaction limits have exponentially grown UPI usage. Age and geographic location were also outlined as core influential factors with urban youths bearing higher tendencies of routinely applying UPI compared to matured rural folk who still prefer more analogue payment solutions. However, security issues still persists to be a strong limiting factor to the increase in usage, especially in the physically face to face transactions despite the growth of the UPI.

The study highlighted the key role of UPI in promoting financial inclusion, especially among semi-urban and rural areas with weak traditional banking infrastructure. In addition, it cited the growing adoption among merchants of UPI as resulting from lower transaction charges and incentives provided by the government. The study also analyzed how UPI has affected the competitive scenario, forcing multiple changes and adaptations in India's financial industry settings across payment systems such as traditional card-based systems & banking institutions.

A number of potential areas for further research have been identified. Further longitudinal studies may be launched to investigate the long-term effects of an UPI for economic and social outcomes but also on financial literacy, or its position in stimulating the economy. This will also help in understanding if UPI can be implemented for cross-border remittances and transactions as well, so it can easily go global. Additionally, this research also could shed the light on evolving technology such as blockchain artificial intelligence IoT with UPI so further opportunity and threat in digital transaction domain can be identified.

As UPI continues to expand, better security measures need to be implemented and we must see their impact on protecting consumer trust as well as enabling wider deployment. This means that policy-makers and industry stakeholders should continuously observe, analyse the regulatory changes in terms of their impact on the digital payment ecosystem to derive maximum utility out of it. Meticulous examination into the impact of UPI on financial inclusion in deprived regions might provide direction for future policy measures. Finally, this report highlights that, UPI and similar systems in other countries can be used to understand which tactics worked as well as what might not have been working.

In conclusion, this study has provided a detailed perspective into the determinants of UPI adoption and impact from regulatory changes on India´s payment ecosystem. Research will remain critical to addressing the challenges in an evolving landscape which UPI has started to change and take advantage of this as well. The empirical findings derived from this study significantly contribute to improving our understanding of how India's payment system functions and the extent regulations influence innovation-performance and d-payments adoption in financial sector.

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