

Assessing the Evolution of Unified Payment Interface (UPI) Usage: A Comparative Analysis of Pre and Post-COVID-19 Pandemic Trends

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Abstract:

The Unified Payment Interface (UPI) has emerged as a transformative force in the Indian financial landscape, revolutionizing digital payments and facilitating financial transactions with unparalleled convenience. This paper presents a comprehensive analysis of UPI usage patterns, focusing on the significant changes brought about by the COVID-19 pandemic. Through an extensive research methodology encompassing data analysis, surveys, and case studies, this study reveals a dynamic shift in UPI usage in the wake of the pandemic. Prior to the outbreak, UPI had already gained substantial traction due to demonetization, but the pandemic accelerated its adoption in unprecedented ways. Lockdowns, social distancing measures, and the heightened awareness of hygiene led to a surge in contactless payments, driving more users to embrace UPI as their preferred payment method. The research findings underscore the profound impact of the pandemic on UPI adoption, highlighting trends such as increased transaction volumes, the diversification of use cases, and the growing user base among diverse demographics. Furthermore, the paper delves into the role of government initiatives, financial institutions, and digital payment providers in fostering this evolution. In addition to the growth in UPI usage, this study also explores challenges encountered during

the pandemic, including security concerns and digital literacy issues.

In conclusion, this research illuminates the transformation of UPI usage in response to the COVID-19 pandemic, emphasizing its pivotal role in fostering financial inclusion and shaping the future of digital payments in India. The study provides valuable insights for policymakers, financial institutions, and businesses seeking to adapt to the evolving payment landscape in a post-pandemic era, with implications reaching far beyond the realm of digital finance.

Keywords: COVID-19 pandemic, Digital Payments, Unified payment interface (UPI), Electronic payments.

Introduction:

The Unified Payment Interface (UPI) has transformed the transaction landscape in India, playing a pivotal role in advancing digital payments and financial inclusion. Introduced by the National Payments Corporation of India (NPCI) in April 2016, UPI is a digital payment system that leverages smartphone applications to facilitate instant transactions. Users can perform transactions through various third-party apps like PhonePe, Paytm, Google Pay, Amazon Pay, and Freecharge, among others. This system is designed to be a secure and efficient alternative to physical cash and traditional bank methods.

UPI was initially piloted on April 11, 2016, and banks across India began adopting the interface in August 2016. It integrates with existing systems such as Immediate Payment Service (IMPS) and Aadhaar Enabled Payment System (AEPS) to ensure smooth transactions across accounts. UPI supports a variety of transaction types, including push (payment) and pull (receiving) transactions, barcode payments, and recurring payments like utility bills and school fees. By using a single identifier, UPI allows users to make payments without needing credit or debit cards, net banking, or account details.

UPI has emerged as a transformative force in India's digital payment sector, driving financial inclusion, boosting digital literacy, and contributing to the creation of a cashless economy. Despite having over 900 million mobile users, digital payment adoption remains limited to approximately 40 million users. The pandemic significantly accelerated the use of digital payments,

particularly UPI, due to its essential role in facilitating contactless transactions and mitigating virus transmission.

This study aims to compare UPI usage before and after the COVID-19 pandemic, highlighting the major changes and factors influencing these shifts. The pandemic-induced surge in digital payment adoption, driven by UPI's user-friendly nature, real-time processing, and compatibility with various banking systems, has been notable. The research seeks to uncover the reasons behind this shift and assess UPI's resilience during these challenging times.

Additionally, the study will explore UPI's future potential in India, examining opportunities for its integration into sectors like e-commerce, transportation, and public services. By analyzing UPI's evolution and user adaptation in response to the pandemic, this study aims to contribute valuable insights to the ongoing discussion on digital payment trends and practices in India's rapidly changing financial environment.

Objectives of the Study:

- To study a comparative analysis of UPI usage focusing on significant changes and factors contributing for changes in usage in pre & post COVID-19 situations.
- To identify the reasons for a dynamic shift in UPI usage in the wake of the COVID-19 pandemic.
- To identify the key factors that contributed to resilience of UPI as a payment solution in pre & post COVID-19 situations.
- To identify the future scope of UPI in the Indian perspective.

Literature Review:

The Unified Payment Interface (UPI) has transformed the digital payment landscape in India since its inception in 2016. The National Payments Corporation of India (NPCI) reports that UPI transactions soared to unprecedented levels during the COVID-19 pandemic, indicating a significant behavioral shift towards digital payment solutions among consumers. This trend has been attributed to the growing need for contactless transactions as a preventive measure against the spread of the virus (*Sharma et al., 2021*).

Several key factors contributed to the increase in UPI usage during the pandemic. The rapid adoption of smartphones and the proliferation of internet access across rural and urban India facilitated this transition. Furthermore, government initiatives promoting digital payments, coupled with the convenience and speed of UPI transactions, played a crucial role in its widespread acceptance (*Gupta & Singh, 2022*). Behavioral factors, including increased comfort with technology and a greater preference for cashless transactions, also contributed to this dynamic shift (*Kumar & Sinha, 2021*). Moreover, the proliferation of smartphones and increase in internet penetration played a critical role in enabling users from diverse backgrounds to access UPI services easily (*Nair, 2021*).

The resilience of the UPI payment system can be attributed to its robust technological framework and security features. The UPI system's ability to handle a high volume of transactions without major disruptions was vital during the pandemic (*Gupta & Singh, 2022*). This reliability, combined with the increasing consumer confidence in digital transactions, has positioned UPI as a reliable mode of payment. Furthermore, merchant adoption spurred by the pandemic's economic impacts furthered the platform's integration into everyday business practices (*Mukherjee, 2021*). UPI's robust architecture and security features have underlined its resilience as a preferred payment solution during the pandemic. The system's ability to handle high transaction volumes without significant disruptions highlighted its reliability (*Choudhury, 2022*). Additionally, UPI's interoperability with various banking platforms improved accessibility for users, further solidifying its position in the digital payment ecosystem (*Patel & Jain, 2021*).

Looking forward, UPI is poised for continued growth as the Indian government emphasizes digital financial inclusion. The potential expansion of UPI into new sectors, such as agriculture, education, and healthcare, could enhance its utility and integration into everyday transactions (*Verma, 2022*). The introduction of advanced technologies, including artificial intelligence and machine learning, may further augment UPI's capabilities, paving the way for a more sophisticated payment environment in India.

Research Methodology:

This study uses a quantitative, cross-sectional research design to examine how the use of the Unified Payments Interface (UPI)

has changed before and after the COVID-19 pandemic. To gather primary data, conducted structured questionnaires through personal contact with respondents from selected districts in West Bengal. Additionally, for the secondary data collection, the study reviewed research published by scholars, articles in various journals, and reports from the Reserve Bank of India and the National Payments Corporation of India. Also gathered relevant information from credible websites to support our analysis.

The Chi-Square (χ^2) test, originally developed by Karl Pearson, is used to determine if the observed data aligns with a theoretical distribution. This test evaluates whether the sample data could have come from a particular population. Essentially, the chi-square test is a statistical hypothesis test where the distribution of the test statistic approximates a chi-square distribution when the null hypothesis is true. As the sample size increases, this approximation becomes more precise. Being a non-parametric test, the chi-square test gauges how much the observed data deviates from what was expected based on theoretical predictions. The Chi-Square (χ^2) test requires certain conditions to be valid. First, the observations within the sample must be independent of one another, ensuring that the data points do not influence each other. Second, the data should be randomly drawn from the population to ensure that the sample accurately represents the larger group. Additionally, the sample size must be sufficiently large to provide a reliable approximation of the chi-square distribution. Finally, the data should be presented in its original units rather than as percentages to maintain accuracy in the analysis.

The χ^2 is used in the goodness of fit test to determine how well the observed data conforms to a specified theoretical distribution. In testing for independence, the chi-square test assesses whether two categorical variables are independent of each other. Additionally, the test of homogeneity compares the distributions of categorical variables across different groups to see if they are similar or differ significantly.

Data Analysis:

Analysis (1): Demographic Analysis of the Respondents

Demographic Characteristics	Category	Percentage
Gender	Male	62%
	Female	38%
Age	Below 25	43%
	25-34	19%
	35-44	27%
	45-54	8%
	55 and above	3%
Education Qualification	High School Diploma	7%
	Bachelor's Degree	20%
	Master's Degree	56%
	Ph.D. or other advanced degrees	17%
Occupation	Service	46%
	Home maker	6%
	Retired	2%
	Self Employed	5%
	Student	39%
	Unemployed	2%
Income	Below 15000	43%
	15001-25000	7%
	25001-35000	12%
	35001-45000	9%
	45001-55000	7%
	Above 55000	22%
Residential Status	Rural	15%
	Urban	85%

Table: 1 Demographic profile of respondents

The demographic analysis highlights several key factors about the sample. Firstly, the majority of respondents are male (62%), and most are relatively young, with 43% under 25 years old. Educationally, the sample is highly qualified, with 56% holding a Master's Degree and 17% having advanced degrees. Occupation-wise, a significant portion is engaged in service jobs (46%) and student roles (39%), indicating a focus on education

and employment in service sectors. Income distribution shows a notable concentration of respondents earning below 15,000, while 22% earn above 55,000, reflecting a wide range of economic statuses. Residentially, the sample is predominantly urban, with 85% living in urban areas, suggesting an urban-centric demographic.

Analysis (2): Impact of COVID-19 Pandemic on UPI usage:

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Use UPI for digital payments before the covid-19 Pandemic	24%	20%	19%	13%	24%	100%
Change in UPI usage during the Covid-19 pandemic	52%	25%	20%	2%	1%	100%
Usage level of UPI significantly increased after the COVID 19 pandemic	46%	18%	23%	6%	7%	100%

Ho: Null hypothesis: There is no significant relationship between COVID-19 Pandemic and UPI usage

H₁: Alternative hypothesis: There is significant relationship between COVID-19 Pandemic and UPI usage.

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where:

- O_i = Observed frequency
- E_i = Expected frequency
(Expected Frequency = Total Sample Size / Number of Categories)
= 100/5
= 20

$$\chi^2 = \frac{(58-20)^2}{20} + \frac{(11-20)^2}{20} + \frac{(20-20)^2}{20} + \frac{(8-20)^2}{20} + \frac{(3-20)^2}{20} + \frac{(25-20)^2}{20} + \frac{(34-20)^2}{20} + \frac{(20-20)^2}{20} + \frac{(11-20)^2}{20} + \frac{(10-20)^2}{20} + \frac{(46-20)^2}{20} + \frac{(21-20)^2}{20} + \frac{(13-20)^2}{20} + \frac{(9-20)^2}{20} + \frac{(11-20)^2}{20}$$

$$= 164.40$$

Here degree of freedom (df)

$$= (\text{No of column} - 1) (\text{No of row} - 1)$$

$$= (3 - 1) (5 - 1)$$

$$= (2 \times 4)$$

$$= 8$$

The Chi square value at 8 degree of freedom (df) on 5 % level of significance (α) is 15.507. Therefore, we will reject the Null Hypothesis (H_0) and accept the Alternative hypothesis (H_1), which implies that there is a significant relationship between the impact of COVID-19 and UPI usage.

Analysis (3): Identify the reasons for a dynamic shift in UPI usage in the wake of the COVID-19 pandemic:

Primary reason for changes in UPI usage during the pandemic	Percentage
Safety Concerns (Contactless Payments)	39%
Increased Awareness of Digital Payments	8%
Increased Availability of Digital Payments in Retail Centres	25%
Closure of Physical Stores	12%
No Change	16%

Table: 2 Primary reason for changes in UPI usage during the pandemic

The analysis of reasons for increased UPI usage during the pandemic reveals that safety concerns related to contactless payments were the most significant driver, cited by 39% of respondents. This reflects a strong preference for minimizing physical contact. Additionally, increased availability of digital payments in retail centres was a key factor for 25% of respondents, indicating that easier access to UPI services facilitated its adoption. Closure of physical stores contributed to the rise in UPI usage for

12% of respondents, as they shifted to digital payments due to the reduced availability of in-person shopping options. Increased awareness of digital payments played a minor role, mentioned by only 8% of respondents. Lastly, 16% of respondents reported no change in their payment habits, showing that a portion of the population maintained their pre-pandemic payment methods. Overall, the key factors driving the increased use of UPI were safety concerns and improved availability of digital payment options.

Analysis (4): Identify the reasons for Increased of UPI usage during the pandemic compared to before:

Increased of UPI usage during the pandemic compared to before	Percentage
Bill Payments	8%
Sending Money to Family & Friends	12%
Online Shopping	27%
Contactless Payments at Physical Stores	31%
Donation to Charities or Relief Efforts	4%
Food Delivery or Restaurant Order.	6%
No Change	12%

Table:3 Primary reason for changes in UPI usage during the pandemic

The analysis of UPI usage during the pandemic reveals that contactless payments at physical stores saw the largest increase, with 31% of respondents using UPI more for this purpose, reflecting a shift towards safer, touch-free transactions. Online shopping also experienced a significant rise, with 27% of respondents indicating increased use, driven by the growth in e-commerce during the pandemic. Increases in sending money to family and friends (12%) and bill payments (8%) were notable but less pronounced. Food delivery or restaurant orders and donations to charities saw minimal increases, at 6% and 4% respectively. Additionally, 12% of respondents reported no change in their UPI usage, showing that some individuals maintained their pre-pandemic payment habits. Overall, the key factors driving increased UPI usage were a heightened focus on contactless payments and a surge in online shopping.

Analysis (5): Impact of UPI in the Future of digital payments:

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Usage of UPI will be more in the future	58%	11%	20%	8%	3%	100%
Reliability of UPI digital payments will significantly increase in future	25%	34%	20%	11%	10%	100%
Recommend to use UPI for making digital payments	46%	21%	13%	9%	11%	100%

H₀: Null hypothesis: There is no significant relationship between UPI usage and Future of digital payments.

H₁: Alternative hypothesis: There is significant relationship between UPI usage and Future of digital payments.

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where:

- O_i = Observed frequency
- E_i = Expected frequency
(Expected Frequency = Total Sample Size / Number of Categories)
= 100/5
= 20

$$\begin{aligned} \chi^2 &= \frac{(58 - 20)^2}{20} + \frac{(11 - 20)^2}{20} + \frac{(20 - 20)^2}{20} + \frac{(8 - 20)^2}{20} + \frac{(3 - 20)^2}{20} + \\ &\quad + \frac{(25 - 20)^2}{20} + \frac{(34 - 20)^2}{20} + \frac{(10 - 20)^2}{20} + \frac{(46 - 20)^2}{20} + \\ &= 164.40 \end{aligned}$$

Here degree of freedom (*df*)

$$\begin{aligned} &= (\text{No of column} - 1) (\text{No of row} - 1) \\ &= (3 - 1) (5 - 1) \\ &= (2 \times 4) \\ &= 8 \end{aligned}$$

The Chi square value at 8 degree of freedom (*df*) on 5 % level of significance (α) is 15.507. Therefore, we will reject the Null Hypothesis (H_0) and accept the Alternative hypothesis (H_1), which implies that there is a significant relationship between the relationship between UPI usage and the future of digital payments.

Analysis (6): Improvements required to enhance the UPI user experience in Future:

Improvements required to enhance the UPI user experience	Percentage
Introducing offline UPI payments	33%
Enhancing security measures	7%
Improving transaction speed	8%
Enhancing user- friendly interface	13%
Enhancing Customer Support	12%
Enhancing Incentives & Rewards	10%
Support for international transaction	17%

Table:4 Improvements required to enhance the UPI user experience in Future

The analysis of improvements required for enhancing the UPI user experience highlights several key factors. The most pressing need, identified by 33% of respondents, is the introduction of offline UPI payments, which reflects a demand for functionality in areas with limited internet access. Support for international transactions, noted by 17%, indicates a desire for UPI to accommodate global payments. Enhancements to the user interface and customer support are also important, with 13% and 12% respectively, pointing to the need for greater usability and better assistance. While enhancing incentives and

rewards and improving transaction speed are valued, they are less critical compared to the primary needs. Enhancing security measures, though important, is viewed as a lower priority by 7% of respondents. Overall, the focus is on expanding UPI's accessibility and functionality, with significant emphasis on offline capabilities and international support.

Conclusion:

This research sheds light on how the Unified Payment Interface (UPI) has evolved in India, especially during the COVID-19 pandemic. It shows that UPI has become increasingly important in the country's financial landscape. The pandemic significantly boosted UPI usage, driven mainly by the need for safer, contactless payments and greater availability of digital options in stores.

During this period, people leaned heavily on UPI for contactless transactions at physical stores and online shopping, reflecting a shift towards more convenient and secure payment methods. This shift demonstrates UPI's ability to adapt to changing needs and preferences in a fast-moving economic environment. Looking ahead, the future of UPI appears promising. Many people expect its usage to continue growing and are confident in its reliability. However, there are areas where UPI can improve. For instance, adding offline payment options and supporting international transactions could greatly enhance its reach and functionality. These changes are particularly important for expanding UPI's use in rural areas and for global payments.

For those involved in developing and managing UPI, the findings highlight the need for ongoing investment in technology and infrastructure. Addressing user concerns, such as improving offline functionality and international support, will be key to driving further adoption. Enhancing the user interface and customer support is also crucial for a better overall experience.

In conclusion, UPI has not only managed to thrive during the pandemic but has also become a vital part of India's digital payment system. As the country moves towards a more digital economy, UPI is set to play a central role. To fully realize its potential, continuous improvements will be needed to meet user needs and adapt to changing market demands. Future research could explore how these pandemic-driven changes will affect

long-term digital payment behaviors and how UPI can be further integrated to promote financial inclusion and economic growth.

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