Payment App's Revamping, Perspectives from Text Mining Analysis

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Abstract. The e-payment sector in India is booming. A boost in the mobile payments has been due to the introduction of the UPI (Unified payments interface) by the Indian Government. A study is designed to map out the prevailing perceptions of digital payment users with respect to popular applications. This study uses secondary data which is collected from the opinion shared by the digital payments' application users in various platforms such as social media and complaint forums. Such user-generated data is subjected to a text mining analysis to explore the dormant sentiments and to identify major domains where interventions are required to make the payment applications more user-friendly and acceptable. The study expects that a precise understanding of prevailing perceptions can significantly help the service provider of these applications to innovate the application in a befitting manner that accomplishes the digital India initiative by the policymakers.

Keywords: Mobile Payment Applications, Frequency Analysis, Sensitivity Analysis, Technology, Text mining.

1. Introduction

The mobile payment systems are set to grow rapidly in the long as well as short terms. This is because it sits at the centre of the m-commerce and its value chain. Mobile Network Operators (MNO), retailers, device suppliers, service providers and trusted service managers are the new ecosystem of market participant given rise to by the mobile payment systems that are grounded on the UPI (Unified Payments Interface) technology. Data privacy and standards, e-money and payment services, consumer protection, mobile service regulation are some of the important regulatory challenges arising out of this new technology. Hence it is imperative for the policymakers to know about the key issues faced by the customers in the usage of these technologies and to safeguard the interest of the customers effectively, to have larger participation from the masses.

Mobile payment can be defined as any payment transaction which includes the buying of goods or services that are completed with wireless devices, such as a personal computer (wireless), cellular phone, or personal digital assistant [31]. Here, payment will be done by using a mobile terminal to initiate a transaction over a mobile network. Mobile commerce (MC) can be defined as a superset of Mobile Payments (MP). The focus therein on the customer payment interface

and not on issues in the technical side or the clearing process. The usability of an MP procedure in scenarios other than MC is relevant for its acceptance [18].

The voluntary sharing of resources via end-to-end exchanges on application layer by equal entities denoted as peers over a highly distributed application architecture is a P2P service. A P2P service provides a direct resource exchange by a loosely-coupled set of operations [4]. The UPI enabled mobile payments application can be used for the transfer of money from one individual to another. This application can be used for P2P (Peer to Peer), P2B (Peer to Business) as well as a B2P (Business to Peer) bank to bank transactions, unlike the wallet system that existed earlier. Multiple bank accounts can also be managed under the same application [22].The five main factors involved in a typical mobile-payments system. These include a Payment Service Provider (PSP), a Financial Service Provider (FSP), a Mobile Network Operator (MNO), a payee and payer [30].

Fewer overheads and more convenience are the defining features of mobile payments making it a better alternative over physical cash as, at present, the Reserve Bank of India spends $3.5 Billion per year for physical currency operation cost [29]. Mobile payments also make it possible to track the currency transactions of the individual in real time. Unlike the National Electronic Funds Transfer (NEFT), Immediate Payment Service (IMPS) and Real Time Gross Settlement (RTGS), UPI based mobile payments have no transaction cost and the payments are instantaneous without the customers having to wait for the next payment schedule for the transactions to be complete. Mobile payment also offers users the enhanced security of not having to carry physical cash. However, it still faces limitations regarding the transactional limit of One lakh rupees per account per day and a maximum of 10 transactions allocated to a person for a day [36] which is lesser than that is available for NEFT, RTGS and IMPS. The mobile base payments also offer advantages to the businesses as well as the initial investment required to set up a credit or debit card terminal from a bank also, the checkout process will also be much faster [34].

It is indicated by estimates of the International Telecommunication Union (ITU) that at the end of 2018 51.2 Percent of the global population or 3.9 Billion people were using the internet [32]. The active mobile-broadband subscriptions per 100 inhabitants have been on the rise since 2007 and are slated to reach 111.2,69.3 and 61 per 100 inhabitants among the developed developing and underdeveloped nations in 2018. It is 68.3 for Asia and Pacific, a bit below the world average 69.3 subscriptions per 100 inhabitants. This is primed for change as the mobile internet users in Asia and Pacific is predicted to reach 59.9% in 2019 from 57.2% in 2018 [14]. India currently has 800 million bank accounts that are linked to the mobile number [5]. As of 2018 the number of mobile phone internet users in India is pegged at 358.56 million and is expected to reach 492.68 million by 2022 [19]. India has overtaken China to be the fastest growing e-payment transaction [37]. A boost in the mobile payments has been due to the introduction of the UPI (Unified payments interface) by the Indian Government. In 2018, 3 Billion transactions worth 1lakh crore INR was done through UPI [1].

The major initiative was the launch of BHIM application that uses the UPI by NPCI (National Payments Corporation of India) under the government of India. It helped to popularize such type of applications, as the people trusted a mobile payment application launched by the government. The app became a gateway for the users to explore the more sophisticated applications with more diverse options in the bank to bank transfer scenario. NPCI was also

quick to onboard different banks into the UPI. Now different banks like Bank of Baroda, SBI have their own UPI enabled applications that can be used by their users for the successful transaction of money to different bank accounts. There are many service providers for the mobile payment applications, some of them that have on-boarded successfully to the UPI is Tez, Paytm, Phonepe etc.

The objective of the study is to map out the prevailing perceptions of digital payment users with respect to popular applications. The user-generated data obtained from various platforms such as social media, customer review websites are subjected to a text mining analysis to explore the dormant sentiments and to identify major domains where interventions are required to make the payment applications more user-friendly and acceptable.

Hence the adoption of this technology by the people not only helps them but also the government in reducing expenses. The policymakers should be able to ascertain the various causes for the non-adoption of this new mobile-based payment technology and to come up with possible solutions regarding the same with the help of this research paper.

The consumer perception of digital payment has an impact on the adoption of the e-payment that is significant [28]. Negative perceptions are holding back customers from fully adopting the new cashless transaction system (including e-wallets) in India [21]. It is hence imperative to find out the perceptions regarding the UPI based bank to bank e payment systems.

2. Literature Review

In the literature review, many theories that explain the individual's adoption intention to new technology or applications are available. An important one in this regard is the Technology Acceptance Model (TAM) [6]. As per TAM, the individual's intention to adopt technology is based upon his perception of usefulness and ease of use of the new technology. TAM model has undergone many transformations over a period and many new constructs such as the final version of Technology Acceptance Model [7] in which the perceived usefulness and perceived ease of use have a direct influence on the behavioural intention to use the technology, Technology Acceptance Model 2 (TAM 2) [38] that helped to find the reason users found the technology to be useful in three stages including the 1)pre-implementation 2)one month post-implementation and 3)three month post-implementation and Technology Acceptance Model 3(TAM 3) [39] in which the determinants of perceived usefulness and perceived ease of use are found to be the four different types including individual differences, system characteristics, social influence, and facilitating conditions. These Technology Acceptance Models are deployed to explain the technology adoption intention of individuals. However, as proposed in the self-efficacy model, the confidence in an individual about his ability to effectively use new technology significantly contributes to its adoption intentions [3]. Another aspect which significantly influences the individual is his information adoption intentions. Even if few innovators use new technology and share the positive word of mouth about the same, its adoption by others depends on the preciseness and correctness of such information and the credibility of the individuals who offer their information [20]. Diffusion of any technology occurs from voluntary adoption of positive information shared by early users. For innovation and adoption to happen, several stages such as understanding, persuasion, decision, implementation and confirmation had to be gone through [27]. The factors such as performance

expectancy, effort expectancy, social influence and facilitating conditions have got influence on the user's behavioural intention to use [40]. The technology adoption will also depend on the degree of matching between the task the user wants to accomplish and the technology at hand available for the purpose [10]. The user's perception of their immediate community's attitude to certain behaviour as well as the user's set of belief's about the object of behaviour will be influencing factors in the technology adoption [13].

Now, due to a multiplicity of social media platform which offers the abundant opportunity to individuals to share their beliefs and feelings about a new product, such platforms and their quality advertisements as driers to technology adoption. The extant literature has many pieces of evidence of using user-generated content in social media to understand the dynamism behind technology adoption.

Results from similar studies indicate that the perceived usefulness, perceived ease of use, perceived risk and perceived security are significant indicators of customers" intention to adopt Electronic Payment [26]. It has also been found that benefits are a significant driver of e-payment usage. e-payment provides greater freedom to individuals in paying taxes, licenses, fees, fines, and purchases at unconventional locations and at whichever time of the day, 365 days a year [41]. Another study has found that security concerns re a significant factor affecting the adoption of e-payment services [42]. It has also been found out that making it easier for consumers to access their balance and spending data may induce certain groups of consumers (especially, people who have a low income) to use electronic payment instruments more often [11]. It has also been found out that customers are also willing to change their bank if their banks fail to provide mobile banking services [43]. Faster, No time limit, Convenience and Ease of use of technology are some of the factors that influence the user decision making process with regards to acceptance of new mobile payment systems [35]. Education factor has an important impact on the adoption of mobile payment technology [24].

3. Methodology

A large collection of documents from various sources like books, research papers, articles comprises the text database [27]. These data are mostly available in the semi-structured format wherein the traditional information retrieval alone cannot be applied. The unstructured or semi-structured data comprises more than 80 per cent of today's data [23].

Extraction of knowledge from semi-structured or unstructured textual data is carried out by text mining techniques, which are a significant subset of data mining and has widespread applications in analysing and processing textual documents [33]. Data mining techniques are employed in a structured database or XML files, while text mining is used in the case of unstructured of semi-structured sets of text data [16]. Hence at first, the target website is opened on google chrome. Then the web scraper extension is opened, and a sitemap is created by using the inspect feature. Afterwards, a new selector is then added by specifying the selector id, selector type and enabling the multiple selection options. After saving the selector, the scraped data is accessed via a data preview option. The text is then copied and pasted to an excel file.

We conducted a text mining of 893 reviews posted by the users of the UPI based payment application on various websites.

Table 1. Customer review source and the number of reviews collected from each source.

Source websites	Review collected
Facebook	194
Quora	64
Mouthshut	193
ConsumerComplaints	49
ComplaintBoard	53
Playstore	338
Total	893

Each of the reviews is read manually and keyword coded. The positive, as well as negative keywords in the case of each review, are identified and recorded. Then, the following analysis is carried out:

1. Frequency Analysis: -The number of times an event occurs can be defined as a frequency. Frequency analysis usually deals with measures of central tendency, measures of dispersion and percentile values [8]. It is a descriptive statistical method in which the number of occurrences of each response chosen by the respondents is shown by this analysis [9]. Here, we used a voyant tool to find out the high frequency negative as well as positive keywords.

2. Sentiment Analysis: - Sentiment Analysis is also known as opinion mining. The user's emotion will be classified into several classes such as positive, negative, neutral and mixed. A process of automatic extraction of features by mode of notions of others about a specific product, services or experience which can be more productive with other analytics/mining techniques is called as sentiment analysis [17]. To monitor public opinion and social trends, opinion mining has been used by many researchers recently. It includes activities like election prediction using Twitter data, disease and disaster tracking using internet information, monitoring customer sentiment on a brand, prediction of movie performance using Twitter and unemployment benefits prediction using search information from the internet. To sense opinion trends of public and reduction of potential social risks and conflicts, public opinion monitoring is useful [12].In the sentimental analysis, the subjective information from text documents will be extracted and the writer's sentiment will be decided with respect to the total context sensitive polarity or with regards to the particular aspect of the document [15]. The opinion classification will be carried out based on this, wherein the review will be classified as positive, negative or neutral [2]. Direct opinion and comparison reviews will be utilized for this.

In this study, we mainly focus on UPI based mobile payment application's public opinion monitoring. Sentimental scores of reviews decide the sentimental classification. Based on the number of negative terms and the number of positive terms in the review, the sentimental score is calculated. The range of sentimental score is between -1 and 1. Reviews are classified as positive reviews when sentimental scores are greater than 0, and as negative reviews when the scores are less than 0. Neutral reviews are those with 0 sentimental scores. It means that there are no positive terms and negative terms, or the number of positive terms and negative terms are equal.

Sentimental_Score = (Number of Positive Terms-Number of Negative Terms)/ (Number of positive terms+Number of Negative Terms) .   (1)[13]

After determining the overall sentimental score of the secondary data as per the equation (1), the keywords are then separated into 15 groups based on the area to which the keyword has more affinity to. The contextual similarity is considered while grouping the keywords. Then, the frequency of the groups is analysed by adding up the number of individual keyword occurrences in each group.

Table 2. The different keywords and their groups.

Groups	Keywords
Bank	SBI Bank, GCBB bank, Bank selection, Bank detection, Rural Bank, Cards, Account detection, bank server time, dhanlaxmi bank, Bank server time
Cashback	Invite a friend, Cashbacks, Benefits, Promotion, Referral
Customer care	Customer care, wrong customer care number, Event-based SMS
External factor	Government
Feature	confirm ifsc details, Feature, bank to bank, Free, mode of transfer., low amount transaction, scan and pay, Languages, Request balance, QR, transaction charge, Mode of transfer, USSD, Free, low transaction amount, Wallet, multiple bank accounts, Language, Space, Request money, Transaction history, Pending Requests, Request Money, Split bill, Transaction Limit, options
Market	Market penetration
Onboarding	automatic deregistering, mobile number detection, setting up, Registering, Device binding charge, Onboarding, SIM detection, finding the account, Auditory, Kinesthetics, Visual, device binding, Bank Account detection, bank detection, Authentication error, BSNL number, Instructions, Jio
Performance	Bugs, Mobile data, Crashed, Performance, updates.
Platform	iOS, Windows, Android
Security	Three layered security., remove the passcode, Encryption, Fingerprint lock, Data privacy, biometric transaction process, two passwords, secure, passcode, Risk-free, passcode reset

Service provider	Uber, Irctc, Paytm
Transaction process	Credited, Debited, Details, Refund, refund time, transaction error, transaction pending, Aadhar transaction failed, pull payments, Request money, Transaction failed, Transaction, wrong transaction, cancel the pending transaction, Confirm IFSC details, Transaction Declined, Transaction process time
UPI	UPI registration, UPI pin, custom payment address, UPI address, UPI authentication error
Usefulness	reliable, Efficient, instant, usefulness, Easy to use, Reliable, time-saving, Fast, Easy, efficient, simple transaction process, Useful, User-friendly, Fraud
User interface	alphanumeric, Design and layout, User interface, Design, layout, logo, visual

4. Results

Table 3 . Sentiment analysis observations.

Type of Review	Percentage	Number of Reviews
Total Reviews		893
Negative	72.45%	647
Positive	24.64%	220
Neutral	2.91%	26

It can be seen from the above table 3, that out of the 893 reviews analysed,647 were negative. Hence, people have an overall negative impression (72.45%) about the mobile payments application based on UPI. There were 220 positive reviews, accounting for 24.64% and 26 neutral reviews, accounting only for 2.91% of the total reviews compiled.

Table 4. Positive keywords and their frequency

Term	Raw Frequency	Relative Frequency
Bank to bank	72	0.057692308
Secure	43	0.034455128
User interface	34	0.02724359
Simple	31	0.024839744
Mode of transfer	27	0.021634616
Fast	25	0.020032052
Instant	24	0.01923077

Easy	22	0.017628206
Transaction charge	21	0.016826924
Scan and pay	17	0.013621795

From the above table 4 that lists out the top ten keywords used in a positive light, we can come to a conclusion that people found the direct bank to bank transfer of funds to be the most attractive feature of UPI payment application (5.76%). People are also confident about the security of the application (3.44%). They also feel comfortable with the user interface (2.72%). They found the transaction process to be simple (2.48%). People also like the various methods by which the fund can be transferred from one account to another like account number and IIFSC code, Aadhar number, UPI id or QR code. (2.16%)They also found the transaction process to be fast (2.0%), instant (1.92%), easy (1. 76%). Another factor that motivated people to use these applications is the zero transaction charge that they incur whenever they do a transaction by UPI (1. 68%). In addition, the users liked the ability to pay the money by scanning the QR code (1.36%).

Table 5. Positive keyword groups and their frequency

Groups	Raw Frequency	Relative Frequency
Feature	255	0.428571
Usefulness	141	0.236975
Security	67	0.112605
User interface	62	0.104202
Transaction process	20	0.033613

After grouping the entire list of keywords (Table 5) and analysing them, we came to a conclusion that majority of the customers (42.85%) found the features of the application to be the most positive aspect. People do find the application to be useful (23.69%). Users are also confident about the security of the transaction process involved (11. 2%). Customers also found the user interface to be pleasing (10. 42%). Some users also found the transaction process to be working fine (3.33%).

Table 6. Negative keywords and their frequency

Term	Raw Frequency	Relative Frequency
Debited	251	0.09536474
Credited	250	0.0949848
Customer care	173	0.065729484
Device binding	140	0.05319149
Refund	93	0.035334345
Transaction error	28	0.010638298

Cashback	23	0.008738602
Check balance	22	0.008358663
Transaction	22	0.008358663
Crashed	18	0.0068389056

From the above table 6 that lists out the top ten keywords used in a negative light, we came to a conclusion that customers have the most number of problems in crediting (9.49%) and debiting process (9. 53%). That is the money will get debited from the payer's bank account but due to technical issues, it won't get credited to the payee's bank account. The other important issue faced is the unresponsive customer care of the application provider (6. 57%). Most of the times the calls are getting unanswered. Publication of wrong customer care numbers has also contributed to this effect. Another problem faced was during the device binding process wherein the users mobile gets verified (5.31%). The issues at the Operator, message provider or at the NPCI server end is the main cause of device binding failure. The user also found issues regarding getting their money refunded to their account after a failed transaction (3.53%). They also faced issues regarding the transaction process (1.06%). Customers also faced issues in getting the amount credited to their account as per the various cash back offers offered (.87%). Users also could not check the account balance with their UPI app often, as it ran into errors (.83%). Users also faced transaction issues and errors (.83%). The UPI apps also crashed at times making them less reliable (.68%).

Table 7. Negative keyword groups and their frequency

Groups	Raw Frequency	Relative Frequency
Transaction process	732	0.556231003
Customer care	184	0.139817629
Onboarding	171	0.12993921
Feature	75	0.056990881
Performance	50	0.037993921

After grouping the entire list of keywords, we came to a conclusion (Table 7) that the majority of the customers (55.62%) had a bad experience regarding the transaction process.13.98% found issues with the customer care of the payment service provider (PSP) mobile application. The onboarding process is the next major issue faced by the customers (12. 99%). They also reported some of the application to lack features that they expect like bill payments (5. 69%). Users also faced some issues with the performance of the application (3.79%).

5. Discussions

Based upon the text mining analysis the following approaches can be adopted:

To combat the negative experiences regarding problems, relate to the transaction process (55.62% of customers), users should be given an option to cancel a transaction if transaction

pending is shown for a longer period. This will help to reduce the number of complaints regarding the transaction pending process. In case of an amount getting wrongly credited to another person, a mechanism should be out in place, that will alert the beneficiary so that a refund can be initiated from the beneficiary side so that further confusions regarding this can be avoided. A detailed graphical representation of the transaction process should also be given to the customer which is to be updated as the transaction proceeds, this will help to remove any ambiguity regarding the transaction process involved. The refund mechanism should be improved and a graphic representation as discussed above should also be given as the customer will be aware of the background process involved. Estimated time for crediting the refund amount should also be provided. Instead of displaying the transaction error message, the customers should also be provided with a detailed description of what went wrong and with the possible solutions that the customer can investigate.

To find solutions regarding the customer care that troubled 13.98% of customers, the customer care number should be timely updated on all web pages so that the customer will be able to contact the service provider with ease. Event-based SMS should also be given so that the customer will be kept up to date even if the internet connectivity is very low (e.g.; receiving cash back). In the case of cash backs, the complete requirements that should be satisfied to avail it must be clearly mentioned, and an in-app customer care executive chat option should be provided.

The next major problem faced by 12.99% of users is the onboarding process. Device binding methods that involve no additional costs from the customers such as missed call-based device binding method should be implemented in place of SMS based device binding methods to remove the costs borne by the customers in the device binding process. The auto-verification of the customer mobile number should be avoided, as it is hard for customers (Especially BSNL users) to get their mobile devices successfully verified due to technical issues.

5.69% of users also found the features being offered by the application to be inadequate. Hence, more features should also be added by the UPI based mobile payment application so that customers will be able to directly book tickets (e.g.: railway) in-app without having to leave the mobile payment app ecosystem. A number of regional languages should be adopted by the applications so that customers from different regions will find it easier to use. The option to add multiple bank accounts should be highlighted as customers were unaware of this feature and complaints were recorded regarding this.

Improving the performance of the application will be a welcome change as 3.79% of users had issues in this regard. So, the mobile applications should also be developed keeping in mind the lower range of smartphones as a space requirement is another issue faced by the customers. Audiovisual instructions should also be made available to the customers in addition to the textual instructions. They should be given outside the application (e.g.: on a website) to reduce the application size. Timely updates should also be provided so that the performance and security aspects of the application can be improved up with regards to the changing threats in the mobile payment ecosystem.

6. Conclusion

Hence it can be asserted that the current payment system is riddled with chances to improve. This can be derived from the overall negative impression of this mobile payments technology as to give out by the sentimental analysis done on secondary data, that the users are not happy with the current technology and its nuances. The policymakers should keep in mind these customer woes to make this technology widely acceptable soon. The customer issues which were unearthed by the analysis of secondary data that were obtained from the user reviews collected from the internet highlights different areas of improvement in the future. We were also able to give out the suggestions to each of the issues faced by the customers as seen fit from a technology standpoint. From the textual analysis of the customer reviews, it can be opined that the issues being faced by the customers presently can be solved with minor upgrades to the user interface or the underlying technology being used for the transfer of money in UPI. This paper has tried to underline the major areas in which the customer is facing the issues and has also grouped them into different categories to develop a bird's eye view of the various problems that are being faced by them. By keeping customer issues at the heart of improvements or updates of this mobile payments technology, it will help to garner customer support and goodwill in a short span of time. Hence, it is imperative to address each woe of the customer, in the future updates of the said UPI based mobile applications.

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