

Mobile App Usability Index (MAUI) for Improving Mobile Banking Adoption

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Abstract: India has 790+ million active mobile connections and 80.57 million smartphone users. However, as per Reserve Bank of India, the number of transactions performed using smartphone based mobile banking applications is less than 12% of the overall banking transactions. One of the major reasons for such low numbers is the usability of the mobile banking app. In this paper, we focus on usability issues related to mobile banking apps and propose a Mobile App Usability Index (MAUI) for enhancing the usability of a mobile banking app. The proposed Index has been validated with mobile banking channel managers, chief information security officers, etc.

1 INTRODUCTION

India has 1.26+ Billion people and about 70% of them are mobile users (Conn. B, 2014). The smartphone adoption is approximately 22% of overall mobile phones in India. With the rapid growth rate of 186% the market share of smartphones is expected to be at 32% by the year 2017 as shown in Figure 1 (Statista, 2014). From a general market perspective, decreasing smartphone prices, growing younger population in India and improving technology awareness are some of the reasons for the growth of smartphone adoption. With 240+ million (Conn. B, 2014) Internet users in India, it is estimated that 60% of them access Internet over mobile devices.

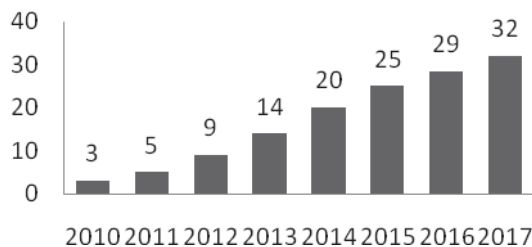


Figure 1: Share of smartphone usage in India (Statista, 2014).

The increasing usage of Internet on smartphones

provides opportunities to banks for improved adoption of mobile banking. In India, about 89 banks provide mobile app banking services to their customers (List of Banks permitted to provide Mobile Banking, 2014). A report published by the Reserve Bank of India (RBI) suggests that a mobile banking transaction costs just 2% of the cost of a branch transaction, one-tenth of the cost of an ATM transaction and half the cost of Internet banking transaction. In other words, the transaction cost of mobile banking is much lower than any other delivery channel in the bank (R.Khan, 2012). This indicates that there are huge opportunities for improved adoption of mobile app banking of banks in India. Customers perform mobile banking using mobile apps, browsers on the mobile devices, Unstructured Supplementary Service Data (USSD), Short Message Service (SMS), Near Field Communication (NFC), mobile wallets, etc. Mobile banking using mobile apps compared to mobile websites. Mobile banking is relatively easy to use for frequent and repeated transaction as the navigation can be menu driven. This conclusion can be intuitively made from increasing transaction count shown in figure 2. The number of mobile banking transactions in Jan'13 was about 9.5 million with an average transaction amount of INR 2,758 whereas the number of transactions in Jun'14 was about 10.7 million with an average transaction amount of INR 3,715 (Banks wise volumes in ECS/NEFT/RTGS/

Mobile Transaction, 2014).

Although there is an increase in the average transaction amount, there are opportunities for improving the adoption of mobile app banking. Currently, the number of mobile banking app transactions is only about 1.3 transactions per smartphone per month. It has to be noted from the various RBI reports that there are some large/medium sized public sector banks having millions of customers with less than 100 mobile banking transactions per month (Banks wise volumes in ECS/NEFT/RTGS/ Mobile Transaction, 2014).

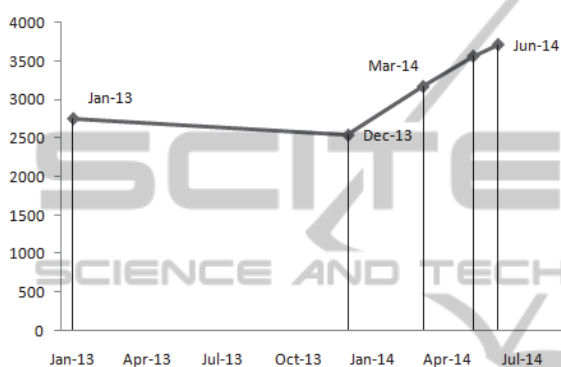


Figure 2: Improved Adoption.

If the number of transactions grows to 3 per smartphone-per month for paying utility bills, mobile top-ups, card payments and other regular monthly usage needs, it can decrease the transaction cost for banks, thereby aiding banks in redirecting investments in other requisite areas. Also, the small cooperative banks (Banks wise volumes in ECS/NEFT/RTGS/ Mobile Transaction, 2014), eager to expand business are directly adopting mobile banking instead of starting with traditional Internet banking portals for desktops.

The major reasons for lesser adoption of mobile banking apps can be listed as: Information security, Network connectivity and Usability. With improving data connectivity (3G and 4G), and with stricter banking security guidelines issued by RBI, Network connectivity and Information Security are currently being addressed at various levels. However, usability parameters for mobile app based banking is not given due importance either by the RBI or by the Bureau of Indian Standards (BIS). BIS is the national standards body of the government of India and responsible for standardization efforts.

In this paper, we propose usability parameters specific to mobile banking applications. We performed a thorough study of the various issues

concerning the usability aspects and proposed parameters that can potentially be adopted by the BIS.

The major contributions of this paper are:

- An index named Mobile App Usability Index (MAUI) that can guide banks to improve usability of their mobile banking apps thereby increasing adoption rates.
- Fine-grained parameters based on the broad factors like time taken to complete a task, user interface display, and error handling.
- Validation of the proposed parameters and index with mobile banking channel managers (business and IT), chief information security officers and also with the mobile app customer base.

2 MOBILE BANKING APP USABILITY CHALLENGES

A survey with a sample of 1434 participants with diverse backgrounds (Chief Information Security Officers of the banks, Mobile Banking Channel Managers and smartphone users - working women and men from Information Technology (IT) and Non-IT companies, homemakers, retired staff of public sector firms, etc.) was conducted using WhatsApp, Facebook, LinkedIn, emails and face-to-face interactions to understand the usability related challenges of mobile banking. The participants of the survey were aware that the authors were involved in banking technology research and hence gave feedback with an expectation for improvement of mobile banking adoption. Additionally, a total of 26,131 comments posted by mobile banking app users on Google play store since Jan 2014 were analysed.

We used Google playstore's public API to fetch comments of major mobile banking apps (public/private). We performed sentiment analysis of the user comments to understand their satisfaction level with mobile banking apps. We used RapidMiner tool for sentimental analysis initially but realized that it was a "golden hammer" and not necessary for the type of analysis we needed. We later resorted to using a simple likert scale (1 to 4) and assessed the positive and negative sentiments of the users.

The typical usability challenges in mobile banking apps can be summarized by some of the comments received during the survey:

"Simplify apps with inbuilt tamper free security

rather answering questions start use of digital signatures assigned to individuals”

“User friendly app which would not be difficult to navigate even when network speed is not great”

“Taking least and only required inputs.. For any operation on mobile banking app..Building trust in users to adopt mobile banking/marketing providing security pin generator token/device..even to farmers..and rest of the banking should be carried out with dtmf/sms based inputs..as these are the easiest to use.. any person can easily adopt it..Separate/dedicated communication channels via service providers should be opened with highest security measures”

Some common comments from Google play store were:

“Screen flickering and UI goes blank sometime”

“Application tends to take much more time then compared to other competitive bank, on 2G it tends to hang does not show proper error messages.”

“Screen with poor UI and color combinations. Less user friendly.”

From the survey and user comments analysis, there was a clear correlation perceived by the users between usability issues and reliability. For example, if the app had difficult activation process, customers lost interest in the app and stated that the mobile banking app was not reliable. On the contrary some other mobile banking apps had a strong positive sentiment and customers were satisfied with the app. The survey results concur with our supposition that better usability leads to better adoption and in turn better revenues for the banks.

3 USABILITY MEASUREMENT

Usability is captured as a set of non-functional requirements in software engineering practices. The user interface designer develops wireframes and mock-ups based on the requirements and available organization standards. In our interaction with the Indian banks’ mobile banking teams, we realized that most of them do not have specific personnel playing the role of user interface designers. Business Analyst or technology teams develop mock-ups or screen designs. In some cases, the interfaces were developed directly without business team/user involvement.

To understand the usability requirements and

factors to measure usability, some of the widely adopted mobile banking apps of major banks (Wells Fargo, Bank of America, Barclays Bank, Citi Bank, and JP Morgan Chase Bank) and Mobile Wallets (Square, Starbucks, PayPal, mPay, etc.) were installed and the usability factors were studied.

As there are no BIS guidelines or assessment factorson usability of mobile applications,the Human Computer Interface and the User experience guidelines for mobile devices available from Apple for iOS(iOS Human Interface Guidelines,2014), Google for Android (Mobile App Design from Android,2014) and Microsoft for Windows Mobile(Usability Guidelines,2014)were studied.Majority of banking apps run on these platforms, hence it covered the entire gamut of mobile banking apps. Also, the usability models suggested by Nielsen and Norman group (Mobile website and application usability) and, People at the Centre of Mobile Application Development (PACMAD) model (Harrison, R Flood and Duce D,2013; Bostr F, 2008 and Seongil L, 2008)were studied. In addition, the five human computer interface laws were analysed:(1) Miller's law of STM (short term memory)(Miller, 1965), (2) Fitts' Law(Fitts. P, 1954), (3) Hick Hyman Law(Rosati L, 2013), (4) Power law of practice(Newell A and Rosenbloom P S, 1993), and (5) Zipf law(Apitz, G., Guimbretière, F. and Zhai, S.,2008). The main reason to study these laws was to get a grasp of the human aspects of remembrance, time taken to make a decision based on the available choices and user expectations on keeping most frequently used as the first option as they have an impact on user perception on usability.

The ISO 9241 manual on “Ergonomics of Human System Interaction – Guidance on World Wide User Interfaces”(Ergonomics of Human System Interaction)was studied. However, the guidelines proposed were generic to web applications rather than mobile apps interfaces.

Like most other non-functional requirements, measuring usability is challenging. In our work, usability is measured based on the following factors:

- (1) Time taken to complete task. Intuitively this can be a measure as the number of clicks.
- (2) User interface display parameters. This refers to the font, colours, etc.
- (3) Error handling. This focuses on the error messages and the techniques to handle them.

The authors are associated with banking technology arm of RBI and have a working relationship with several mobile banking channel managers and

information security officers of the banks. The suggested parameters and index has been validated via a survey of the mobile banking channel managers, information security officers of the banks, some user interface designers and importantly mobile app banking users.

A thorough validation of the parameters can be done after the mobile banking apps are developed using the proposed parameters. This can be done via usability testing of the developed mobile banking apps. Instead of waiting for the development of the apps, we have chosen heuristic approach in this paper to validate the proposed parameters. Our thought stems from the recommendations provided by the Nielsen Norman group (NN/g) (*Mobile Website and Application Usability*), a leading organization that specializes in usability research on heuristics based approach for validating the usability parameters.

4 RECOMMENDATIONS FOR IMPROVING USABILITY

Several researchers and organizations have provided usability recommendations for web applications. Some of the banks, we studied seemed to use these recommendations for developing their mobile banking applications. It is imperative that banks did not develop the user interface of mobile banking apps similar to internet banking sites as the display screens, network connection and user attention span are all different from a desktop/laptop usage. The user interfaces of smartphones vary from 2" to 7", this adds to the challenges of developing user interfaces for consistent usability experience.

As the saying goes, "what gets measured gets managed". After the adoption of the proposed parameters, a lab can be set-up for usability testing of mobile apps using Userzoom, Loop, Magitest, etc. for testing.

We recommend a heuristic based evaluation method that computes an index score called **MAUI (Mobile App Usability Index)**. MAUI can be used for measuring the effectiveness of implementation of Usability parameters for bank's mobile app. The parameters mentioned in this paper are for the following factors:

- (1) Time taken to complete task
- (2) User interface display
- (3) Error handling

4.1 Time Taken to Complete Task

Table 1 mentions the usability parameters for time taken to complete a specific task. A task is considered as specific action that needs to be completed to satisfy certain set of requirements. For example, adding beneficiary account, performing money transfer, making chequebook request, navigating through the screens, etc. are tasks that need to be completed. The time taken to complete the task is measured using specific number of clicks needed on the mobile phone to complete it.

Table 1: Time taken to complete task.

A1 - Account summary (using SIM, IMEI and other device information without disclosing any Personally identifiable information), nearest ATM/Branch, and contact information of call centre (with option of click to call) should be available without login using account number and password
A2 - Maximum five fields should be sought from the customers while completing a form in the screen
A3 - Screen navigation should start with more familiar fields (amount to transfer/deposit, deposit period, beneficiary name, account number, IFSC code, etc.)
A4 - Based on user's previous actions, there should be an option to set user/default favorites
A5- Breadcrumbs should be available to keep users informed on the navigation
A6 - Labels of the fields should be in layman language and unambiguous for customer rather using bank specific terminology
A7 - The option for "Select All" or "Delete All" should be removed
A8 - Banking operation that started on a desktop, branch or ATM should continue over the mobile app without keying in data again
A9 - Mobile app registration should not require going to bank branch and can be loaded from authorized app stores. The registration should be free of any SMS charges
A10 - Sensitive information as date of birth, customer account number that are already known should not be requested in the app
A11 - Related fields should be grouped together (for example, beneficiary, user account details, etc.). Also known fields should be pre-populated

4.2 User Interface Display Parameters

The font size/type, display colours, controls size and

labels can change the user perception on the app. Though each individual has their own liking for a colour, font and other display parameters, the implementation of suggested parameters can enrich user experience with respect to the interface of the mobile banking app. Table 2 provides the parameters for user interface display.

Table 2: User interface display parameters.

B1 - Colour combination in foreground and background should be consistent across screens and contrasting without any gradient/progressing colours
B2 - Text information should be in mixed/sentence case instead of upper case
B3 - Avoid pagination, vertical scrolling and horizontal scrolling
B4 - Text in text boxes should be in single line and not spread across multiple lines
B5 - Measures for size of button, textbox and other controls relative to screen size instead of pixels
B6 - There should be bank logo, title page and frame on every screen
B7 - White spacing between fields should be sufficient to view labels without overlapping
B8 - Language used should be simple and consistent with no long sentences and paragraphs in the screens. Having local languages based on user preference would be highly beneficial for users
B9 - There should be clear character spacing avoiding any overlaps
B10 - Bold text should be used sparingly
B11 - The alignment of fields (left for text fields and right for numbers) should be consistent
B12 - There should be left navigation available for moving between menu options
B13 - There should not be any drag and drop based features
B14 - The image icons should be tested for varying resolutions (ldpi, mdpi, etc) and different OS
B15 - Apps should be built using HTML5 for consistent look

4.3 Error Handling

As the mobile phone screens are smaller in size than desktops and the user attention for detail on smaller

screens is difficult. It is important that apps are more thoroughly tested for various screens and device types and performance for various connectivity options. It is important that appropriate error messages are informed early rather later and thus reducing the call or other modes of escalation to bank's operations team.

Table 3: Error handling.

C1 - System messages should be classified as Information (with text in Green/Blue color), Warning (with text in Yellow color) and Error (with text in Red color)
C2 - If a particular mobile device is not supported, an error message should be displayed instead of allowing the user to install and then showing an error message
C3 - Error messages while filling a form should be displayed next to the fields and button
C4 - The message should provide the reason for error and suggests the next possible action
C5 - Application should maintain user action persistence and recovery from abrupt exits (network connection lost, session timeout, battery down, memory shortage, etc.)
C6 - System messages should be configurable values rather hardcoded for change at a later point of time
C7 - Language of the error message should be in layman language and easy to understand and avoid displaying any bank specific error messages
C8 - Error messages while loading a page should be at the top of the screen
C9 - The help icon should always be available and contextual to the screen
C10 - The app should be tested for varying network bandwidth, device models (make and screen size), flip/bump, back button and other buttons on the device, stylus, trackball/pad, swipe operations, screen rotation, Mobile Keys, Battery consumption and memory usage
C11 - The app should have an option for user to report the error
C12 - The version updates should be done on regular basis and ensured to keep past favorites intact

4.4 Evaluating Usability Parameters Implementation

Some of the usability parameters listed are applicable for web banking applications as well.

Parameters A2-A6 and A11 suggested for “time taken to complete task”, B2 suggested for “user interface display” and C1, C3, C4 and C6-C9 suggested for “error handling” are more relevant for mobile banking interfaces.

Based on the response to the recommendations, the banks should scale the implementation of usability parameters using the spider diagram as shown in Figure 3. In the figure the darker line represents a reference benchmark and grey line is the MAUI values of a banking app. MAUI value can be computed as:

$$MAUI = (P_c/P_n) * scale \quad (1)$$

where P_c is the number of *conformed parameters*, P_n is the *total number of parameters* used for assessing usability. In our paper, for sake of simplicity, MAUI is measured on a scale of 1-10, 10 being the highest and 1 being the least. Since the goal is to provide a basis for standardizing usability rather than measure the relative importance of one parameter over another, each recommendation parameter is treated equally by assigning one point each (at times this may be context driven and relative weights may be assigned to each parameter) and measured against a scaling factor.

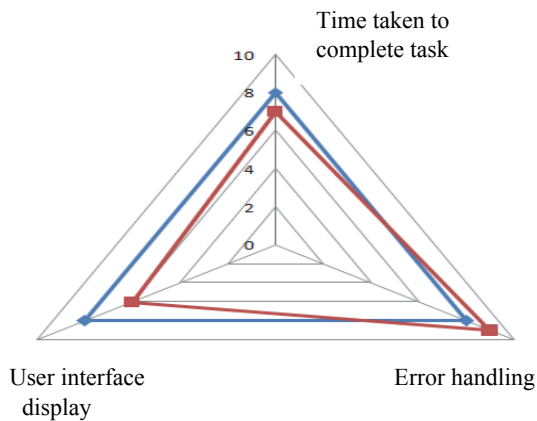


Figure 3: MAUI parameters.

For example, if there are 15 parameters and about 11 parameters are met by the bank, the index can be calculated as $(11/15) * 10$ giving a value of 7.3. The score on time taken to complete task, user interface display parameters and error handling are plotted on a spider diagram shown in Figure 3.

The figure shows a benchmark/desirable score for each of the axis as 8.0. We believe that a threshold value of 8.0 provides a reasonable assurance that the mobile banking app provides good to very good user experience. Precise benchmark values and assessment agencies/organizations to

assess the conformance can be established once the rate of adoption of mobile banking apps shows a steady increase. In addition, conformance of parameters can also be further broken down into multiple levels rather than the binary value of “Yes” or “No” shown in this paper.

5 APPLICABILITY OF RECOMMENDATIONS

The applicability of MAUI is validated through a survey conducted (Google report on the Mobile App Usability survey, 2014) with Chief Information Security officers to ensure that the suggested usability parameters have reasonable security. Mobile banking channel managers having responsibility of running mobile banking business, technology managers from the banks and IT services industry involved in the development of mobile apps for the banks also participated in the survey. As the survey participants consisted of senior decision-making personnel in the banks and other relevant organizations, a detailed survey could have taken away their interest to participate. Hence a short survey for first five key parameters from Table 1, 2 and 3 for each of the focus areas (time taken to complete task, display parameters and error handling) was conducted. There were 51 respondents in total. The responses of the survey are shown in Figure 4.

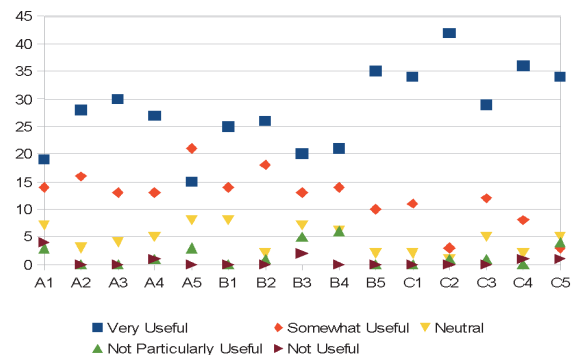


Figure 4: Responses to MAUI survey.

We used Likert scale (Very Useful - 5, Somewhat Useful - 4, Neutral - 3, Not Particularly Useful - 2 and Not Useful - 1) to capture the response on the various parameters. The average score is 4.39/5, the lowest scores are 3.87 and 3.94 and the highest are 4.83 and 4.7. The summary of responses is shown in Figure 6 and the detailed view of results is available at (Google report on the Mobile App Usability

survey, 2014).

Following were some of the comments from respondents.

“it will be really helpful as some of the banks have really good mobile banking apps, while others don't have that good apps. So if it is standardized then user experience will be good”

“These will definitely increase the user experience. Consistency in colors and font will increase usability.”

“This Mobile Banking App Usability parameters if adopted ,it will be very useful for the users. All these parameters are really very useful & helpful for mobile banking users in terms of saving time and ease of operations.”

“Yes these would be very useful. Especially some sort of intelligence from the app with regards to error handling and saving the favourite activities of the user.”

“These features may provide ease of operation to customers. Uniformity across all banks would also be helpful for customers.”

“Good initiative to improve mobile banking”

Some additional comments to enhance/modify the suggested parameters were also provided:

“Vertical scrolling is good but not the horizontal scrolling”

“The first question: ‘Account summary without login’ may not be good idea”

Overall, the survey respondents seemed to agree the need for such parameters. Some of the comments specifically seemed to point out that the parameters can in fact be applied to most Human Computer Interfaces. Also, there were some comments from respondents to ensure security was not compromised while improving mobile banking app usability.

6 CONCLUSIONS

MAUI guides banks to improve usability and thereby increase adoption rates. Banks could use MAUI for baselining the currently deployed app and increase the adoption with an improved MAUI and perform the cost benefit analysis. These parameters will be shared with RBI and BIS for establishing usability standards for mobile apps. The MAUI will further be refined to take the following aspects into consideration:

- Rather than binary conformance value, levels of conformance will be introduced.
- International leading mobile banking applications will be studied and an appropriate threshold MAUI value will be established.

By further refining MAUI, we plan to build a semi-automated tool to measure MAUI.

The accessibility requirements for different age groups and differently abled people would also be part of the future scope for further improving mobile banking apps adoption. Improving usability is a constant journey with changing customer experiences and technology innovation, hence, it is recommended for banks to review the usability requirements on a yearly basis monitoring the feedback on app stores and the customer queries being handled by bank operations team. The MAUI could be extended to apps that banks are planning to deploy for internal stakeholders and also for any organization building mobile apps for enterprise needs. Better usability of mobile apps improves customer loyalty and hence customer stickiness to the bank.

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