

AN EMPIRICAL STUDY TO MEASURE A MULTIDIMENSIONAL SCALE FOR THE SUCCESS OF MOBILE BANKING APPLICATIONS

Dr. Minakshi Gupta, Assistant Professor
U.E.S. College of Management & Technology, Uran
minakshigupta.uescmt@gmail.com

ABSTRACT

Mobile banking is becoming an important part of the e-commerce business nowadays. All the researchers and industry experts are getting interested in exploring the various trends of mobile banking applications because mobile banking facilitates a great number of banking transactions with ease and in less time. But to accept mobile banking services to a large extent, it becomes very much mandatory that various variables required for the success of mobile banking applications should be explored, analyzed, and measured that affect customers' intention to continue the use of M-banking apps. A questionnaire was developed based on various variables extracted from the literature review and various models of information system success. To find out the various variables to create a model Structural Equation Modeling (SEM) was used. It was witnessed in the study that security, reliability, user interface, service quality, response time, and information quality are important constructs for the success of mobile banking applications. All these constructs have an impact on satisfaction and intention behavior.

Keywords: Mobile Banking, applications, service quality, information quality, factors, determinants, Information System Success

Introduction

Various financial innovations have emerged in the commercial banking industry, and banking has shifted from the traditional brick mortar banking system to the new technology-based banking system to satisfy the various needs of the customers and to get a competitive edge among its competitors. Mobile banking is such an innovation. With the help of mobile banking various banking activities like paying off utility bills, investments, balance inquiries, fund transfers, NEFT and others banking services can be performed with greater ease and convenience. Mobile banking is not only used for utility purposes only but for hedonic use also likewise as for booking movie tickets and shopping etc.

Mobile banking is like an innovative tool in the hands of the banking industry to excel in a competitive market to improve the effectiveness and performance efficiency of banks. Due to the technology revolution, the growth of the volume of mobile transactions is increasing manifold. So, banks should pay it becomes necessary on the part of banks that they should pay attention to the successful implementation of mobile banking services (Bouhleb, Garrouch, & Nabil, 2023). Banks should focus on the factors affecting the success of mobile banking services to make them accessible to the larger segment of the population (Majumdar & Pujari, 2022). Many factors contribute to the success of mobile banking applications like user interface, ease of use, reliability, security, user interface, information quality, service quality, and many others.

Literature Review

Mobile banking is accessed by customers to get information regarding their accounts, account balances, and many other financial transactions. If the customer feels that attained information is not good, irrelevant and insufficient, or an outdated user can doubt the service providers' integrity, and ability and this leads to the situation of dissatisfaction among the customers, so to bring customer satisfaction it is must factors required for success mobile banking should be analyzed.

A Model is required to measure the success of any information system (DeLone, McLean, 1992); (Bagayoko, et al., 2020). Among the various models of information system quality the model of De Lone, Mc-lean, 1992 is considered one of the good models (Tate, Sedera, Mclean, & Jones, 2011); (Urbach, Müller, 2011). Initially, this model was given by Mclean and Delone in 1992 that included mainly six variables information quality, system quality, use, user satisfaction, individual impact, and organizational impact (DeLone & McLean, 2016) (Rizqy, Puspitasari, & Saputra, 2022). But from 1992 to 2007, many researchers (Mahmood, Hall, & Swanberg, 2001); (Sedera, Gable, & Chan, 2004); (Bokhari, 2005) suggested that there should be some up-gradation in the model and service quality should be included (Pitt, Watson, & Kavan, 1995); (Tate, Sedera, Mclean, & Jones, 2011) (Jiang, Klein, & Carr, 2002). Moreover, the new construction of intentional behavior and net benefits were also included in the new model of DeLone & McLean (Mehta, Chauhan, & Kaur, 2021), which replaced organizational and individual impact (Seddon, 1999). The findings of various researchers are as under-

DeLone , McLean, (2002) stated that system qualities consist of the qualities of the Information System. The measures of this construct mainly focus on performance characteristics and usability. System quality leads to the success of the system by providing satisfaction and the user's intention to continue using the system. Information quality is defined as the sufficiency, efficiency, and relevancy of the information. It consists of the contents of completeness, personalization, and ease of understanding

Lin , (2011) suggested loyalty as a net benefit that is affected by system quality and information quality. Perceived values (Innovativeness) and intention to continue are similar to net benefits.

Wang, Wang, & Shee, (2007) adopted the D & M model to measure the success of the E-Learning System Success (ELSS). This study showed that the D & M 2003 model is quite sufficient in measuring the success of the ELS in educational institutions, but in this study, pedagogy used by teachers was not studied at all. According to this study technical or system quality mainly consists of initial operations, reliability, ease of use, response time/ speed, user interface, security, compatibility and relative advantage, and functioning and performance.

Taoting, (2010) used three types of qualities viz. information, system, and service quality were to measure perceived innovativeness, satisfaction, and intention of continuing usage in banking apps by applying the DeLone and McLean IS Success Model. Service quality means support from the IT department and IS department personnel like customer care and the help desk. Previously this construct was not part of the original IS success model, it was later added to the Updated D&M model (DeLone & McLean, 2002). The existence of this construct is very disputable in IS literature.

Seddon, (1997) stated that system quality is not an important construct so it should not be included in the model, although many researchers were in favor of including service quality in the IS success model. Assurance, empathy, and responsiveness were taken as a measure of service quality in this study. Aldiabat, Al-Gasaymeh, & Kwekha Rashid, (2019) found that due to the transition of banks from traditional banking to mobile banking, adoption of it has received more attention. This study has analyzed various factors important for proper implementation of mobile banking in the Jordardian banking sector. It was observed in this study that the Support system of service quality is having a significant positive impact on user satisfaction.

Masoner, Lang, & Melcher, (2011) stated that Information quality, perceived usefulness, system quality, and user satisfaction are the main factors that define the success of any information system (IS).

Budiwati , Kurniasih, (2014) used ease-of-use, preferences, security, and response time as constructs of system quality and relevance, accuracy, information diversity, and completeness were taken as the components of information quality. It was witnessed in this study that constructs of system quality had an impact only on user satisfaction, not on use, but information quality significantly affected both use and user satisfaction.

Noh , Lee, (2016) believed that intention to use is more important than user satisfaction. The main emphasis was put on information quality, intention behavior, service quality, and trust. Service quality, system, and information quality affect user satisfaction positively. Tam & Oliveira, (2016) suggested a model to find out the impact of mobile banking on individual performance of individuals by combining D&M model and TTF (Task Technology Fit) models. This study stated that system quality, information quality and system quality all are having a positive impact on user satisfaction: system quality, information quality and TTF affect use of mobile banking.

Hossain (2016) used the information system (IS) success model in the field of Mobile –Health application. It was observed in this study that intention to continue behavior depends upon the perceived value of the system and positive perceived values are having a positive significant impact on user satisfaction.

Khan, Akter & Akter, (2017) observed that variables like security, cost, convenience, trustworthiness, complexity, and network availability were used as variables to measure the intention behavior. These variables are having a more significant influence on the usage behavior of mobile banking customers, but trustworthiness and network problems are comparatively insignificant in this adoption behavior. Boshkoska & Satiroski, (2018) analyzed the relationship of satisfaction with factors like age, qualification, education, computer knowledge, frequency of usage and type of banking services. It was observed that there is no significant relationship between satisfaction and ease of use. On the other hand, age, education, and complexity in usage have significant impact on satisfaction. Elderly people are less inclined to use mobile banking services as compared to young ones. Adoption and penetration of new technology is having a positive impact on the satisfaction level

of customers. So, it is advisable that banks should be innovative, creative and should identify the needs of the customer to serve them in a better way. This will lead to customer satisfaction.

Alalwan, Dwivedi, Rana, & Algharabat, (2018) stated that effort expectancy, performance expectancy, Price value, hedonic motivation and perceived risk all are having significant influence on the behavioral intention of the customers. On the other hand, it was found that there is no significant impact of social influence on behavioral intentions. Ghobakhloo M, (2019) stated that for the success of mobile banking applications post-use trust, Experienced advantage, and user satisfaction are the most critical and important factors. Banks, and financial institutions should focus on these factors to provide a successful mobile banking app.

The objective of the Study

- (1) To determine factors leading to the success of mobile banking apps.
- (2) To find out a model for the success of mobile banking applications.

Research Methodology

This study is mainly empirical. This study focuses on a model to determine the success of applications of mobile banking. Various variables like reliability, functionality, ease of use, understandability, timeliness, security, user interface, and response time were extracted from the literature review. A questionnaire was formed based on those constructs to collect data with the help of convenient sampling, judgmental sampling, and non-probability sampling methods. (Nyataya & Celine, 2017), (Boonsiritomachai & Pitchayadejanant, 2017) (Khan, Akter, & Akter, 2017), (Amin, Hamid, Tanakinjal, & Lada, 2005).

To identify various dimensions Structural Equation Modeling (SEM) was used to establish the relationship of various variables with other variables.

Research Model

Proposed relationships among the various exogenous, endogenous, and mediating variables are shown with the help of a flow diagram. Exogenous variables are reliability, ease of use, security, user interface, response time, Service Quality, and Information Quality. There are two mediating variables; Customer satisfaction and perceived innovativeness, that are having an impact on the intention to continue using. Given here is the proposed model.

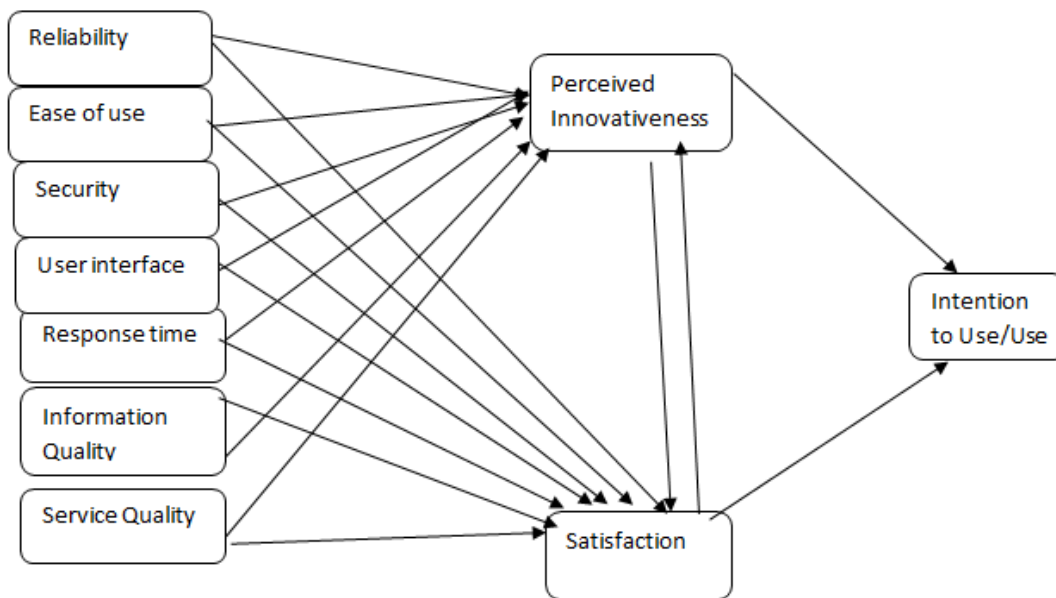


Figure -1 Proposed Model (Source- By author)

Data Collection

Data was collected from 330 respondents with the help of a structured questionnaire. Given table shows the demographical data of respondents.

Variables	Category	Frequency	Percent
Gender	Male	215	65.2
	Female	115	34.8
Age	18 to 35 years	122	36.9
	35 to 55 years	145	43.9
	more than 55 Years	63	9.2
Education	Senior Secondary	6	1.8
	Higher Secondary	17	5.2
	Graduation	146	44.2
	Post-graduation	140	42.4
	Doctorate	21	6.4
Employment	Employed for 30 hours or more per week	120	36.4
	Employed part-time, for less than 30 hours per week	66	20
	Not currently employed	29	8.8
	Student	43	13
	Self-employed	70	21.2
	Other	2	0.6
Banking App	State Bank of India	69	20.9
	Bank of Baroda	45	13.6
	HDFC Bank	56	17.0
	ICICI bank	47	14.2
	Axis Bank	42	12.7
	CITI bank	6	1.8
	Kotak Mahindra Bank	18	5.5
	Union Bank	5	1.5
	Others	42	12.7
History of using Mobile banking App	Less than 1 month	34	10.3
	1-3 months	56	17
	4-6 months	60	18.2
	7-12 months	69	20.9
	More than 12 months	111	33.6
Frequency of usage of the App	Less than once a week	91	27.6
	About once each week	102	30.9
	Several times each week	78	23.6
	About once each day	46	13.9
	Several times a day	13	3.9
	Total	330	100

Table I: Demographic features of Sample (n-330)

Exploratory factor analysis (EFA)

The very first step in establishing and validating any model is exploratory factor analysis (Aga, 2022). The results of the Bartlett test of Sphericity ($\chi^2 = 12613.544$ with $DF=903$, $p < 0.0001$) suggested that the correlation matrix was not an identity matrix and data is suitable (Patel & Patel, 2020). The overall KMO = 0.928 shows sampling adequacy (Hair et al, 2006). It was found in EFA that various constructs of Ease of Use (EOU) and satisfaction are having cross-loadings, so these were removed from the scale to establish reliability and validity. Cronbach's Alpha test was performed to measure the internal reliability of all the dimensions. Table II shows the values of Cronbach's Alpha.

Sr. No.	Factor Names	Cronbach's Alpha	No. of items
1	Reliability	0.897	5
2	Interface	0.913	6
4	Response time	0.904	4
5	Security	0.804	4
6	Information Quality	0.937	13
10	Service Quality	0.996	3
11	Satisfaction/intention	0.902	5
12	perceived innovativeness	0.876	3

Table 2: Reliability of the items

It is clear that Cronbach's Alpha > 0.7 in the case of all the factors. So, reliability is established. All constructs were grouped into 8 factors and all explain 71.652 percent of the variance. Given table-III shows the factor loading of all the constructs and all the constructs loaded in their designated factors significantly.

Factors	Loadings
Information Quality	
I understand the information displayed on my app.	0.689
information is understandable.	0.741
information is not ambiguous.	0.697
information is meaningful.	0.656
information meets my needs.	0.675
information is sufficient for my needs.	0.706
information is complete	0.662
the app provides up-to-date account information.	0.702
Account information is timely.	0.691
the app provides current account information.	0.673
Most online banking functions are included in the app.	0.614
Variety of banking functions.	0.672
All the online banking functions that I want	0.646
Interface	
The information on my app is attractively displayed.	0.671
The menu of my app is well-designed.	0.749
The interface of my app looks good.	0.786
The layout of my app is appealing.	0.76
The app fits the screen size	0.658
Navigation to the functions is straight	0.624
Reliability	
I am not logged out in the middle of transactions.	0.761

The app is not crashing.	0.814
I can easily log in.	0.794
Pages do not freeze.	0.81
No blank screens.	0.821
Satisfaction and Intention to continue	
The app will be used regularly.	0.654
Preference will be given to the app over a visit to the bank.	0.762
Continue to use the app.	0.776
Banking tasks will be done via the app in the future.	0.82
In general, I am satisfied with my app.	0.496
Response Time	
Logging into my app is fast.	0.775
Logging out of my app is fast.	0.821
My app quickly loads all content	0.764
My app processes my transactions quickly	0.679
Service Quality	
The customer service is good.	0.99
The customer service provider/tech support representatives are willing to help me solve problems related to my app.	0.991
The customer service provider/tech support representatives are interested in my feedback related to my app.	0.99
Innovativeness	
My bank is innovative in adopting new technology.	0.624
The overall impression I have of this bank is that they are technologically innovative.	0.689
My bank is a leader in technology	0.726
Security	
Confident about the security of the banking app.	0.694
My app is secure.	0.661
I am not concerned about re-access my account via my app.	0.776

Note: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table 3: Exploratory Factor Analysis

Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) was run in AMOS software. Model fit criteria were checked accordingly from the data collected from 330 respondents. Model fit values of CFA showed good model fit of the model with ($\chi^2 (786) = 1590.941$, $\chi^2/df = 2.024$, $GFI = .822$, $CFI = 0.934$, $SRMR = 0.0483$, $RMSEA = 0.056$) (Lowry & Gaskin, 2014). It is clear from the given details that all the indexes have achieved the required level of values in all three categories of model fit. This is a good model fit.

	CR	AVE	MSV
1. security	0.862	0.681	0.530
2. Info Quality	0.938	0.537	0.526
3. interface	0.912	0.635	0.489
4. reliability	0.898	0.639	0.270
5. Satisfaction/Intention to continue	0.907	0.662	0.496

6. Response time	0.891	0.674	0.530
7. Service quality	0.996	0.989	0.013
8. innovativeness	0.882	0.714	0.526

Note; (χ^2 (786) = 1590.941, χ^2/df = 2.024, GFI = .822, CFI = 0.934, SRMR = 0.0483, RMSEA = 0.056

Table 4: Confirmatory Factor Analysis

Reliability & Validity

Cronbach's alpha and Composite Reliability (CR) are used to check reliability. Cronbach's alpha (Table II) and Composite Reliability values are more than 0.7 (Table IV). So reliability is established.

To establish Convergent validity $AVE > 0.5$ and for Discriminant validity, AVE values are compared with MSV values and correlation values of the constructs. AVE values should be more than the values of MSV and Correlation values among the constructs (Fornell & Larcker, 1981). This is clear in Table-IV and V.

	AVE	1	2	3	4	5	6	7	8
1. security	0.681	0.825							
2. Info Quality	0.537	0.521	0.733						
3. interface	0.635	0.482	0.699	0.797					
4. reliability	0.639	0.372	0.429	0.429	0.799				
5. Satisfaction/ Intention to continue	0.662	0.427	0.704	0.624	0.383	0.813			
6. Response time	0.674	0.728	0.487	0.501	0.520	0.455	0.821		
7. Service quality	0.989	0.012	0.006	0.041	0.035	0.039	0.114	0.994	
8. innovativeness	0.714	0.464	0.725	0.685	0.257	0.690	0.423	0.043	0.845

Notes: Diagonal values are the square root of AVE values, correlation coefficients are significant ($p < 0.001$);

Table 5: Convergent & Discriminant Validity

Dependent Variable		Independent Variable	Estimate	P value
innovativeness	<---	Info quality	.557	***
innovativeness	<---	interface	.332	***
innovativeness	<---	reliability	-.088	.003
innovativeness	<---	Response time	.032	.598
innovativeness	<---	Service quality	-.015	.459
innovativeness	<---	security	.077	.201
satisfaction	<---	Info quality	.363	***
satisfaction	<---	interface	.105	.102
satisfaction	<---	reliability	.059	.041
satisfaction	<---	Response time	.065	.254
satisfaction	<---	Service quality	.023	.228
satisfaction	<---	security	-.026	.658
satisfaction	<---	innovativeness	.338	***

Note-*** shows a significant P value

Table 6: Results of Path Analysis

It is clear from the given data that only information quality and user interface are having a significant direct impact on satisfaction, intention behavior, and innovativeness, but other exogenous constructs of service quality, reliability, response time and security are not significantly affecting intention behavior.

Conclusion

Mobile banking is an important aspect of human life for providing banking services in a more friendly and successful way. Information quality is of prime importance for the adoption of any information system. Customers will adopt mobile banking when they feel that these applications are successful enough to provide the desired services in a more friendly way to them. So customers' perception and satisfaction play a very significant role. Initially, many factors like user interface, security, validity, reliability, response time, information quality, ease to use, functionality, service quality, and trust were used to measure satisfaction and intentional behavior.

It is evident in this study that information quality, security, reliability, response time, user interface, and service quality are important constructs. It is also witnessed that information quality and user interface affects positively innovativeness and satisfaction of the customer while reliability, security, response time, and service quality are not having a significant impact on customer satisfaction. So, application designers should focus on understandability, timeliness, and viability under information quality while designing applications.

Managerial implications

This paper analyzes the various factors that affect the intended behavior and satisfaction level of customers of mobile banking users. This paper is putting efforts to highlight all those factors that are essential for customers for the success of any mobile banking applications. So, this study will be beneficial for the banking fraternity to focus on the various components that are essential for customers and provide better services in that segment. Moreover, this study will be beneficial to the technology personnel while developing mobile banking applications.

Limitations & Future Prospectus

There are certain limitations. First, this study is having limited validity as it uses cross-sectional data and not longitudinal data. Second, the study doesn't focus on individual customers' points of view, as different factors affect individual customers differently. Third, this study focused only on Mobile Banking Apps, so this study cannot be generalized to the various factors of information system success.

This study covered only one aspect of mobile banking i.e. Apps based, further studies may be conducted focusing on the various other aspects of mobile banking like SMS banking and the USSD channel. The same study can be conducted in various other countries focusing on people of various other cultures and educational backgrounds. Further studies can use this model for measuring the success of information systems (IS) in other fields also.

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