

**ENHANCING CUSTOMER SATISFACTION AND TRUST IN MOBILE BANKING X
THROUGH APPLICATION QUALITY AND SECURITY**

Daniel¹, Thoyyibah²

^{1,2}Universitas Bina Nusantara

Email: daniel044@binus.ac.id¹, thoyyibah.t@binus.ac.id²

Abstrak: Perkembangan pesat layanan perbankan seluler telah mengubah cara pengguna berinteraksi dengan platform keuangan, dengan penekanan yang lebih besar pada kualitas dan keamanan aplikasi. Studi ini menyelidiki pengaruh dimensi kualitas—kualitas sistem, kualitas informasi, kualitas layanan—dan keamanan terhadap kepercayaan pengguna dan kepuasan nasabah dalam Mobile Banking X, sebuah layanan perbankan digital di Indonesia. Menggunakan kerangka kerja Modified DeLone & McLean dan metode Structural Equation Modeling – Partial Least Squares (SEM-PLS), studi ini menganalisis respons dari 132 pengguna aktif. Hasil menunjukkan bahwa keamanan dan kualitas layanan secara signifikan memengaruhi kepercayaan pengguna, sementara kepercayaan itu sendiri sangat memengaruhi kepuasan nasabah. Sebaliknya, kualitas sistem dan kualitas informasi tidak menunjukkan dampak yang signifikan terhadap kepercayaan maupun kepuasan. Temuan ini menekankan peran mediasi kepercayaan dan pentingnya keamanan dalam meningkatkan pengalaman pengguna. Wawasan ini berkontribusi pada pemahaman yang lebih mendalam tentang perilaku pengguna dalam layanan keuangan digital dan memberikan rekomendasi untuk meningkatkan strategi perbankan seluler.

Kata Kunci: Analisis, Mobile Banking X, SEM-PLS, Modified DeLone & McLean.

Abstract: *The rapid development of mobile banking services has shifted the way users interact with financial platforms, placing greater emphasis on application quality and security. This study investigates the influence of quality dimensions—system quality, information quality, service quality—and security on user trust and customer satisfaction within Mobile Banking X, a digital banking service in Indonesia. Using the Modified DeLone & McLean framework and the Structural Equation Modeling – Partial Least Squares (SEM-PLS) method, the study analyzes responses from 132 active users. Results show that security and service quality significantly influence user trust, while trust itself strongly influences customer satisfaction. In contrast, system quality and information quality did not show a significant impact on either trust or satisfaction. The findings emphasize the mediating role of trust and the importance of security in enhancing user experience. These insights contribute to a deeper understanding of user behavior in digital financial services and provide recommendations for improving mobile banking strategies.*

Keywords: *Analysis, Mobile Banking X, SEM-PLS, Modified Delone & Mclean.*

INTRODUCTION

Last decade smartphone became important use daily user device, and number of smartphone user Increasing rapidly. These personal device allow user to access the various internet service. These service become important stuff in modern information society, making smartphone apps become a need for users in daily transactions. According to report from statista the number of mobile apps has significantly increase from 16.000 apps in 2009 to 2.893.806 app in 2021.

The rapid development in technology has significantly transformed the financial industry, driving change in service and business model within the sector . One of the uses of technology in the financial world is the emergence of mobile banking provided by banks for user transaction needs using only mobile devices. With rapid development in financial technology has altered global financial framework and economic behaviour of people.

In the financial field, there has been a change from manual banking services to online-based banking services. In the last 4 decades, banking and payment processes have undergone significant changes, where customers can make contactless transactions, transfers, and payments using their own mobile devices. This progress not only improves convenience but also contributes to broader socio-economic development. Based on data from the databooks website, it is stated that in August 2023, the value of digital banking transactions nationally reached 5.1 quadrilateral trillion rupiah, this transaction increased by 11.9% compared to the previous year.

Despite the use of mobile banking has been widely adopted, mobile banking still faces several challenges, especially in terms of service quality. Customer satisfaction and the effectiveness of the mobile banking system are crucial to ensure the sustainable use of mobile banking. with rapid development of information technology, its also impact to the increase in cybercrime. With good security in online transactions and can maintain the customer's personal information, it can effect to customer satisfaction and trust of customer in using mobile banking. With great service and security being the main key in meeting customer expectations and increasing customer loyalty, the evaluation process is important to find out how the dimensions of information system quality and security can affect trust, customer satisfaction and the overall success of the mobile banking platform.

Mobile Banking X is a digital banking application developed by one of the private banks

in Indonesia. This application is designed to make it easier for customers to carry out various financial transactions, such as interbank transfers, e-wallet top-ups, and other banking services, only through smartphone devices. As part of the digital transformation, Mobile Banking X continues to be developed to provide fast, secure, and easy-to-use services. On the Google Play Store, the app has been downloaded by more than 500,000 active users. However, there are still various complaints from users regarding their experience in using the Mobile Banking X service.

The concept of mobile banking is to utilize information technology solutions for financial services, in order to improve the efficiency of financial markets and banking transactions for customers [8]. In order to evaluate the implementation of information technology in financial services can be considered successful, reliable measurement is required. The Structural Equation Modelling (SEM) method is used to be able to analyze the structural relationships between variables, the SEM method has been widely applied to evaluate and adopted [6] and the SEM model of the information system used in this study is a modified delone and mclean that can offer solutions and will be used in this study to assess the significant impact of the quality dimension (information quality, service quality) and security for mobile banking applications.

From prior studies such as Examining the role of consumer satisfaction within mobile eco-systems: Evidence from mobile banking services is focusing on quality dimension to trust and customer satisfaction in mobile banking. Other study in "An empirical investigation on actual usage of educational app: Based on quality dimensions and mobile self-efficacy" examined how quality dimensions, personal innovativeness and self-efficacy influenced intention to use, which then affected actual use, with trust and perceived risk as moderators. In contrast, this study tests trust as a direct predictor of actual use and includes security as an independent variable, which was not considered in the prior research despite its importance in protecting personal and financial data. But there are few study about the effect of security and trust can directly impact the success of mobile banking with using modified delone and mclean framework.

In this study, we will adopt Strucutral Equation Modelling – Partial Least Square (SEM-PLS) with theoretical framework modified delone and mclean to measure the impact or influence of quality dimensions such as system quality, information quality, service quality and security

on customer satisfaction and customer satisfaction in using mobile banking. In the previous research titled Examining the role of consumer satisfaction within mobile eco-systems: Evidence from mobile banking services, it focused more on the influence of trust on customer satisfaction, With limitations of the influence of the quality and security dimensions, it can contribute directly to customer satisfaction and trust. This research aims to fill the gap identified in previous studies.

RESEARCH METHODS

In this study, the target population is customers in Indonesia who use mobile banking services X, especially those who have used the service in the last 30 days. The sampling technique used is purposive sampling, because this study specifically targets respondents who have certain characteristics, namely active users of mobile banking X.

To determine the number of samples needed, this study uses the Slovin formula with a margin of error of 10%. Based on data listed on the Google Play platform, the number of active users of the X mobile banking application reached 500,000 users. Using the Slovin formula, the minimum number of respondents required in this study is 100 people [36].

$$n = \frac{N}{1 + N(e)^2}$$

Ket:

n = Minimum sample quantity

N = Number of population

E = Error margin

In this study, primary data was obtained through the distribution of questionnaires to respondents who are active users of Mobile Banking X. Questionnaires were distributed online using the Google Form platform. The preparation of the question items in the questionnaire refers to several references from previous journals. There are a total of 27 questions. The duration of data collection starts from July 12, 2025 – 31 July 2025

In this study, a quantitative approach was used with a data collection method through surveys. This approach was chosen with the aim of measuring the relationship between latent variables, especially in the context of digital financial service use. The quantitative approach

allows researchers to process statistical data to produce generalizable conclusions.

The population in this study was active mobile banking users X. purposive sampling technique was used to determine the sample, with the criteria of respondents who had used mobile banking X at least 1-5 transactions per month. The number of respondents that were successfully collected was 100 respondents. The selection of purposive sampling was carried out so that only respondents who had experience in using mobile banking X were part of the sample.

Data is collected using an online questionnaire by utilizing google form as a medium for making questionnaires and disseminated through social media and application user groups. The questionnaire is designed to measure respondents' views on several latent variables (system quality, information quality, service quality, trust, and customer satisfaction).

Each question item will use a 5-point likert scale, from "strongly disagree" to "strongly agree". The question is compiled based on the Delone and McLean model which has been widely used in several research evaluations of an application.

Outer Model (Measurement Model)

The respondent data collected was 132 respondents. From these results, it is continued with the outer model process to begin to measure the level of validity and also the realism of each variable. Using the SMART-PLS tool, the results of loading factor, Average Variance Extracted (AVE), and composite reliability were obtained as follows:

Table 1.2 Outer Loading

	Outer loadings	Keterangan
CS1 <- Customer Satisfaction	0,854	Valid
CS2 <- Customer Satisfaction	0,874	Valid
CS3 <- Customer Satisfaction	0,752	Valid
IQ1 <- Information Quality	0,811	Valid
IQ2 <- Information Quality	0,795	Valid
IQ3 <- Information Quality	0,796	Valid
IQ4 <- Information Quality	0,841	Valid
S1 <- Security	0,830	Valid
S2 <- Security	0,884	Valid

S3 <- Security	0,763	Valid
S4 <- Security	0,739	Valid
S5 <- Security	0,846	Valid
SEQV1 <- Service Quality	0,775	Valid
SEQV2 <- Service Quality	0,858	Valid
SEQV3 <- Service Quality	0,806	Valid
SEQV4 <- Service Quality	0,722	Valid
SEQV5 <- Service Quality	0,739	Valid
SQ1 <- System Quality	0,721	Valid
SQ2 <- System Quality	0,709	Valid
SQ3 <- System Quality	0,808	Valid
SQ4 <- System Quality	0,782	Valid
SQ5 <- System Quality	0,687	Valid
T1 <- Trust	0,803	Valid
T2 <- Trust	0,754	Valid
T3 <- Trust	0,741	Valid
T4 <- Trust	0,773	Valid
T5 <- Trust	0,793	Valid

Source: Smart-pls

In the calculation of the loading factor carried out, it was found that each outer loading indicator was above 0.6, from this calculation it can be concluded that the indicator used in this research is valid and meets the threshold of outer loading. The following is the calculation of the extracted variance extracted

Table 1.3 Average Variance Extracted (AVE)

	Average variance extracted (AVE)
Customer Satisfaction	0,686
Information Quality	0,658
Security	0,663
Service Quality	0,611

System Quality	0,552
Trust	0,598

Source: Smart-pls

Based on the results of the calculations that have been carried out, it was found that each of the six variables has an Average Variance Extracted (AVE) value of more than 0.5, so it can be stated that the above variable is valid. The following is the calculation of the composite reliability.

Table 1.4 Composite reliability

	Cronbach's alpha
Customer Satisfaction	0,769
Information Quality	0,826
Security	0,871
Service Quality	0,840
System Quality	0,796
Trust	0,832

Source: Smart-pls

Based on the results of the calculations that have been carried out, it was found that that the six variables have an alpha value above 0.6, so it can be concluded that the variables are reliable. The following is the calculation of the cross loading.

Table 1.5 Fornell-Larcker criterion

	Customer Service	Information Quality	Security	Service Quality	System Quality	Trust
Customer Satisfaction	0,829					
Information Quality	0,590	0,811				
Security	0,722	0,696	0,814			
Service	0,619	0,694	0,780	0,782		

Quality						
System Quality	0,558	0,777	0,723	0,673	0,743	
Trust	0,734	0,703	0,909	0,797	0,719	0,773

Source: Smart-pls

Based on the discriminant validity test using the Fornell-Larcker Criterion, four constructs Customer Service, Information Quality, System Quality, and Trust meet the criteria for discriminant validity. This is indicated by the square root of AVE (diagonal value) being higher than the correlations with other constructs.

However, two constructs Security and Service Quality do not meet the discriminant validity criteria, as their correlations with other constructs (particularly Trust) are higher than their respective square root of AVE values.

Inner Model (Structural Model)

After assessing the outer model (measurement model) to evaluate the validity and reliability of respondents' responses, the analysis proceeded to the inner model (structural model) to examine the level of influence and significance of independent variables, including the mediating effects on the dependent variable.

Table 1.6 Path coefficient

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
Information Quality -> Customer Satisfaction	0,141	0,142	0,091	1,546	0,122
Information Quality -> Trust	0,051	0,046	0,050	1,019	0,308
Security -> Customer Satisfaction	0,287	0,300	0,168	1,709	0,088
Security -> Trust	0,687	0,683	0,061	11,285	0,000

Service Quality -> Customer Satisfaction	0,014	0,014	0,087	0,163	0,871
Service Quality -> Trust	0,187	0,186	0,062	3,022	0,003
System Quality -> Customer Satisfaction	-0,060	-0,058	0,113	0,526	0,599
System Quality -> Trust	0,057	0,066	0,056	1,020	0,308
Trust -> Customer Satisfaction	0,406	0,390	0,185	2,199	0,028

Source: Smart-pls

Based on the path coefficient results, it was found that several relationships between independent variables and the dependent variable were statistically significant, including the mediating role of the *trust* variable. A relationship is considered significant if the t-statistic value is ≥ 1.96 and the p-value is ≤ 0.05 .

First, the *security* variable has a significant influence on *trust*, with a coefficient value of $\beta = 0.687$, $t = 11.285$, and $p = 0.000$. Second, the *service quality* variable also significantly influences *trust*, with a coefficient of $\beta = 0.187$, $t = 3.022$, and $p = 0.003$. Furthermore, the *trust* variable has a significant effect on *customer satisfaction*, with $\beta = 0.406$, $t = 2.199$, and $p = 0.028$.

Therefore, it can be concluded that *security* and *service quality* significantly contribute to the formation of *trust* as a mediating variable, which in turn significantly affects *customer satisfaction*.

Table 1.7 R-squared (R²)

	R-square	R-square adjusted
Customer Satisfaction	0,564	0,546
Trust	0,850	0,846

Source: Smart-pls

Based on the analysis of the R-Squared (R^2) values, it can be concluded that the structural model has a strong explanatory power for the endogenous variables, namely *Customer Satisfaction* and *Trust*.

For the *Customer Satisfaction* variable, the R^2 value of 0.564 and the adjusted R^2 of 0.546 indicate that 56.4% of the variation in customer satisfaction can be simultaneously explained by the independent variables (*System Quality*, *Information Quality*, *Security*, *Service Quality*, and *Trust*). This is considered a sufficient value, indicating that the model has a strong predictive capability for customer satisfaction.

For the *Trust* variable, which serves as a mediating variable, the R^2 value of 0.850 and the adjusted R^2 of 0.846 indicate that 85% of the variation in trust can be explained by *System Quality*, *Information Quality*, *Security*, and *Service Quality*. This is also considered a very strong value, suggesting that the *trust* construct is well explained by its predictor variables.

Table 1.8 F-squared

	f-square
Information Quality -> Customer Satisfaction	0,015
Information Quality -> Trust	0,006
Security -> Customer Satisfaction	0,030
Security -> Trust	0,991
Service Quality -> Customer Satisfaction	0,000
Service Quality -> Trust	0,080
System Quality -> Customer Satisfaction	0,003
System Quality -> Trust	0,007
Trust -> Customer Satisfaction	0,056

Source: Smart-pls

Based on the analysis of the Effect Size (f^2), it can be determined how much each independent variable contributes to the dependent variable after being included in the model. The interpretation for each path is as follows:

- Information Quality → Trust shows a small effect size with an f^2 value of 0.006, indicating a very weak contribution to *trust*.
- Security → Trust shows a large effect size with an f^2 value of 0.991, indicating a

very strong contribution to *trust*.

- Service Quality → Trust has a small to medium effect size with an f^2 value of 0.080, indicating a moderate contribution to *trust*.
- System Quality → Trust shows a small effect size with an f^2 value of 0.007, indicating a very weak contribution to *trust*.
- Information Quality → Customer Satisfaction shows a small effect size with an f^2 value of 0.015, indicating a very weak contribution to *customer satisfaction*.
- Security → Customer Satisfaction has a small to medium effect size with an f^2 value of 0.030, indicating a modest contribution to *customer satisfaction*.
- Service Quality → Customer Satisfaction shows a negligible effect size with an f^2 value of 0.000, indicating a very weak or no contribution to *customer satisfaction*.
- System Quality → Customer Satisfaction shows a small effect size with an f^2 value of 0.003, indicating a very weak contribution to *customer satisfaction*.
- Trust → Customer Satisfaction has a small to medium effect size with an f^2 value of 0.056, indicating a moderate contribution to *customer satisfaction*.

Tabel 1.9 Q-squared

	SSO	SSE	Q ² (=1-SSE/SSO)
CS1	132,000	91,838	0,304
CS2	132,000	80,856	0,387
CS3	132,000	78,526	0,405
T1	132,000	47,684	0,639
T2	132,000	76,353	0,422
T3	132,000	61,698	0,533
T4	132,000	82,743	0,373
T5	132,000	69,319	0,475

Source: Smart-pls

Based on the Q-Squared (Q^2) analysis, it can be concluded that the model has strong predictive relevance for the indicators of the endogenous variables, namely *Customer*

Satisfaction and *Trust*. A Q^2 value greater than zero indicates that the model has predictive relevance for the observed indicators. The higher the Q^2 value, the greater the model's ability to predict the actual values of these indicators.

Table 1.10 VIF

	VIF
CS1	2,428
CS2	2,478
CS3	1,236
IQ1	1,924
IQ2	1,998
IQ3	1,718
IQ4	2,290
S1	2,193
S2	2,842
S3	1,719
S4	1,588
S5	2,416
SEQV1	1,781
SEQV2	3,281
SEQV3	2,578
SEQV4	1,521
SEQV5	1,647
SQ1	1,720
SQ2	1,567
SQ3	1,884
SQ4	1,961
SQ5	1,517
T1	1,821
T2	1,744

T3	1,811
T4	1,923
T5	2,094

Source: Smart-pls

Based on the analysis of the Variance Inflation Factor (VIF), the degree of multicollinearity among indicators within the model can be evaluated. VIF values are used to determine whether there is a high correlation among indicators within the same construct, which—if excessive—can affect the stability of model estimations. The following is a breakdown for each variable:

- For the indicators within the Customer Satisfaction (CS) construct, the VIF values range from 1.236 to 2.478, indicating no multicollinearity issues. This suggests that the CS indicators are statistically independent in explaining their latent variable.
- In the Information Quality (IQ) construct, the highest VIF value is 2.290 (IQ4), indicating that there is no excessive multicollinearity among its indicators.
- For the Security construct, the highest VIF is 2.842 (S2), with all other indicators ranging from 1.588 to 2.842, suggesting that multicollinearity remains within acceptable limits.
- The Service Quality (SEQV) construct has VIF values ranging from 1.521 to 3.281, which indicates that there is no critical multicollinearity among the indicators.
- In the System Quality (SQ) construct, the VIF values range from 1.517 to 1.961, suggesting that multicollinearity is not a concern.
- Finally, the Trust (T) construct has VIF values ranging from 1.744 to 2.094, indicating that there is no excessive multicollinearity among its indicators.

Tabel 1.11 Significant

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
Information Quality ->	0,162	0,163	0,090	1,796	0,073

Customer Satisfaction					
Information Quality -> Trust	0,051	0,046	0,050	1,019	0,308
Security -> Customer Satisfaction	0,566	0,562	0,095	5,956	0,000
Security -> Trust	0,687	0,683	0,061	11,285	0,000
Service Quality -> Customer Satisfaction	0,090	0,088	0,092	0,979	0,328
Service Quality -> Trust	0,187	0,186	0,062	3,022	0,003
System Quality -> Customer Satisfaction	-0,036	-0,032	0,111	0,327	0,743
System Quality -> Trust	0,057	0,066	0,056	1,020	0,308
Trust -> Customer Satisfaction	0,406	0,390	0,185	2,199	0,028

Source: Smart-pls

The significance test results in the structural model were conducted using the Partial Least Squares (PLS) approach. The significance of relationships is assessed based on the criteria of $t\text{-statistic} \geq 1.96$ and $p\text{-value} \leq 0.05$. Based on these results, several relationships were found to be statistically significant.

Firstly, Security has a significant influence on two variables: Customer Satisfaction ($\beta = 0.566$, $t = 5.956$, $p = 0.000$) and Trust ($\beta = 0.687$, $t = 11.285$, $p = 0.000$), highlighting the important role of security in shaping both trust and customer satisfaction. Furthermore, Service Quality also has a significant influence on Trust ($\beta = 0.187$, $t = 3.022$, $p = 0.003$), but its direct effect on Customer Satisfaction is not significant ($p = 0.328$).

In addition, Trust has a significant effect on Customer Satisfaction ($\beta = 0.406$, $t = 2.199$, $p = 0.028$), reinforcing its role as a mediating variable. On the other hand, paths such as *Information Quality* → *Customer Satisfaction* and *System Quality* → *Customer Satisfaction* show p-values greater than 0.05, indicating no statistically significant relationships.

Overall, these results indicate that Security and Service Quality are important determinants in building Trust, which in turn significantly influences Customer Satisfaction. This emphasizes that trust serves as a key variable in mediating the effect of service quality on customer satisfaction within the analyzed model.

RESULTS AND DISCUSSION

This research using descriptive statistic approach to analyze the relationship between quality dimension (system quality, information quality, service quality) and security to customer trust dan continue to customer satisfaction in using Mobile Banking X. the data analysis method used is Structural Equation Modelling – Partial Least Square (SEM-PLS), which is suited for evaluating complex relationship model.

The sample size for this research is 132 active users of Mobile Banking X, the sampling method that used in this research is purposive sampling, especially active users who have used it for at least less than 6 months, have made transactions 1-5 times every month. The instrument of this research is online questionnaire using a 5 point likert scale to asses 6 main variables.

Tabel 1.12 Significant

	Original sample (O)	T statistics (O/STDEV)	P values	Conclusion
Security -> Customer Satisfaction	0,566	5,956	0,000	Significant
Security -> Trust	0,687	11,285	0,000	Significant
Service Quality -> Trust	0,187	3,022	0,003	Significant
Trust -> Customer Satisfaction	0,406	2,199	0,028	Significant
Information Quality -> Customer Satisfaction	0,162	1,796	0,073	not significant
Information Quality -> Trust	0,051	1,019	0,308	not significant
Service Quality -> Customer Satisfaction	0,090	0,979	0,328	not significant

System Quality -> Customer Satisfaction	-0,036	0,327	0,743	not significant
System Quality -> Trust	0,057	1,020	0,308	not significant

Source: Smart-pls.

CONCLUSION AND SUGGESTIONS

This research shows that security and service quality are the most significant influence factors in building user trust in mobile banking applications, and continue to effect customer satisfaction. The use of the SEM-PLS approach combined with the Modified DeLone & McLean framework has proven effective in modeling these relationships. However, not all quality dimensions showed a significant effect, such as system quality and information quality, this variabel did not have a impact on trust or customer satisfaction.

The insignificant results related to system quality and information quality raise questions about whether these outcomes were due to measurement design, sample characteristics, or questions on the questionnaire that are too general. Future research should consider expanding demographic and exploring other influencing factors such as perceived risk, digital literacy, or user experience design. These efforts will help generate a more comprehensive understanding of user behavior and further strengthen the applicability of the Modified DeLone & McLean model in the context of mobile banking.

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