

# THE IMPACT OF SERVICE DELIVERY TECHNOLOGY ON BANK PERFORMANCE: EVIDENCE IN VIETNAM

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**Abstract** - This study investigates the impact of service delivery technology on bank performance by using the sample data of 21 Vietnamese commercial banks over the period 2007-2019. The study uses return on equity (ROE) and net interest margin (NIM) as a dependent variable representing bank performance. A set of variables including mobile banking (MB), internet banking (IB), and implementation degree of ATMs functions as a proxy for service delivery technology. The research results indicate that there is a significant positive impact of mobile banking (MB) and online banking (IB) on bank performance. In addition, this study has not found an impact on ATM implementation for bank performance.

**Key words** - Mobile banking; internet banking; ATM; banking performance; technology of service provision.

## 1. Introduction

Today, in the digital age with fierce competition in the economy in general and in the banking sector in particular, customers now tend to switch from traditional channels to digital channels and the multi-channel model is becoming popular in the banking industry. Financial institutions in general and the banking industry in particular are experiencing rapid changes through technological innovation. Technological innovation or more specifically, service delivery technology is essential in the current economic context. Innovation is the competitiveness of all businesses in general and is especially important in the banking sector. Innovating to attract and satisfy customers with new benefits, differentiated products and more utilities. Especially, banks have largely implemented service delivery technology as a way of augmenting the services traditionally provided by bank personnel. Implementation results from the need to reduce the cost of delivering service primarily through personal and the corresponding need to meet the challenge posed by technological innovative competitors [1], [2], [3]. Research by Frei, Harker & Hunter [4], Sinkey [5], Lewis et al. [6] Allen and Gale [7], Solans [8], Batiz-Lazo et al [9], Roberts & Amit [10], Porter [11] and more show the importance and power of service delivery technology. Specifically, some researchers show that the factors representing service Delivery Technology of banks such as e-banking, ATM networks and more have brought significant effects to bank performance. Therefore, technological innovation, or more specifically, service delivery technology is an important task in the economy in general and the banking industry in particular, aimed to improve efficiency and create competitive advantages. Especially, in the current situation, E-commerce is growing, thus leading to an increase in online payment demand.

By recognizing the importance of Service Delivery Technology in the banking sector, I would like to

contribute to the literature in Vietnam by providing a more in-depth insight into the impact of Service Delivery Technology on bank performance. Bank performance in this study focuses on bank profitability measured via return on equity (ROE) and net interest margin (NIM).

Firstly, this study studies the impact of Service Delivery Technology on bank performance on the Innovation Diffuse Theory (IDT). The Innovation Diffuse Theory (IDT) was officially introduced by Bradley and Stewart in 2003 and it confirms that companies are involved in disseminating innovation to gain a competitive advantage and reduce costs. It also helps to understand customers' behavior in adopting or not accepting innovation [22].

The studies show different results, and here are a few studies that find the positive impact of Service Delivery Technology on bank performance. For example, Hernando and Nieto [23] conducted research on the change in the performance of banks in Spain from 1994 to 2002 when applying internet banking. The results show that the use of internet banking has a positive impact on the profitability of banks after only one and a half years of application [23]. Besides, Onay et al. shows that internet banking has a positive impact on the performance of the banking system in Turkey [12]. Alber carried out an investigation into the banks in Saudi. The result shows that the most important determinants of "profit efficiency" are "availability of telephone banking services" and "number of ATMs" [24]. In addition, Sumra et al. [25] examined the relationship between e-banking and profitability of 12 banks in Pakistan. The results show that e-banking has increased the profitability of banks even if only applied in a short time. The application of e-banking helps them increase the number of new customers and retain old customers [25]. Njoroge [26] studied the specific impact of the application and increased the use of mobile banking on banking performance with a data sample of 34 banks out of 44 potential banks. The regression model results show that mobile banking has a positive impact on bank performance across all variables [26]. Jegede shows that the development of ATM terminals has improved the performance of Nigerian banks [15]. Kathuo [14] shows that the number of mobile banking transactions has significantly increased in the last five years since the introduction of M-banking. The study thus concludes that banks that have adopted M-banking services have to a large extent increased their customer outreach, and hence have improved their financial performance [14]. In Vietnam, Dinh et al. [27] also studied the impact of internet banking

on the profitability of Vietnamese banks over the period 2009 - 2014. The result indicates that internet banking has a positive influence on bank profitability through an increase in income from service activities. However, the impact level was low and had a lag time of over 3 years, which is longer than findings from previous studies [27]. In addition, Siddik et al. indicates that e-banking began to make a positive contribution to banks' return on equity with a time lag of two years while a negative impact was found in the first year of adoption [28].

In addition, Sujud et al. conducted a study on the impact of bank innovations on the profitability and returns on assets (ROA) of Lebanese commercial banks. The result also indicates that there is a positive effect [29]. Kiragu investigated the top 5 banks in Kenya through interviews and questions. This indicates that bank profits have increased after the introduction of electronic banking [30]. In Kenya, Barasa et al. [13] also conducted an investigation into that relation. The result shows that internet banking positively affects the financial performance of commercial banks in Kenya [13]. Vekya [17] studies the relationship between electronic banking and the profitability of banks in Kenya over the period of 2007-2015. The result shows that there is a significantly positive relation between ATM & POS transactions & bank profitability. Yang et al. [31] investigated the impact of the full adoption of e-banking system on bank performance. The results revealed that e-banking improves banking performance on ROA, ROE and OM. On the contrary, e-banking has a slight impact on Chinese bank performance with respect to NIM and efficiency ratio [31].

On the contrary, many studies have shown negative results. In India, Malhotra et al. [32] examined the relationship between internet banking with bank performance and risk. The multiple regression results show that the profitability and offering of Internet banking do not have any significant relationship; otherwise, internet banking has a significant and negative relationship with the risk of the banks [32]. Besides, Victor et al. investigated 11 commercial banks in Nigeria over the period of 2001-2013. Research shows that investing in e-banking & ATM services do not improve bank performance [33]. Mensah conducted the study through the annual financial data of 20 rural banks in Ghana from 2011-2014. Therefore, investment in IT has little effect on the performance of rural banks [34]. Mahboub [17] investigated the impact of investments in information technology and the community on the operation of 50 Lebanese banks for 2009-2016. They discover that the terminals automated teller machines (ATM), internet banking (IB), telephone banking (TB) and point of sale (POS) terminals do not significantly affect the operation of the bank. However, the application of MB and provision of debit and credit cards (BC) to customers significantly and directly affect the operation of banks in Lebanon [17].

## 2. Research methodology

The first hypothesis (H1) is that mobile banking (MB) has a significant positive impact on bank performance. Secondly, (H2) is that internet banking (IB) has a

significant positive impact on bank performance. Finally, the hypothesis (H3) is that there is a positive relationship between the implementation degree of ATMs and bank performance. This article uses unbalanced data sources to examine the impact of service delivery technology bank performance. Data were collected from 2007-2019. Data from the website, annual reports and FiinGroup of 21 commercial banks were mobilized to collect all the data needed for empirical research. In particular, all variables are winsorized at the 1st and 99th percentages to eliminate the effect of outlier observations. Research techniques include descriptive statistics, regression analysis and robust tests.

To test the relationship between service delivery technology and bank performance, the article uses the following regression model:

$$\begin{aligned} ROE_{it} &= \alpha + \beta_1 MB_{it} + \beta_2 IB_{it} + \beta_3 ATM_{it} + \beta_4 CAR_{it} \\ &\quad + \beta_5 EFF_{it} + \beta_6 AQ_{it} + \beta_7 SIZE_{it} + \theta + \delta + \varepsilon \\ NIM_{it} &= \alpha + \beta_1 MB_{it} + \beta_2 IB_{it} + \beta_3 ATM_{it} + \beta_4 CAR_{it} \\ &\quad + \beta_5 EFF_{it} + \beta_6 AQ_{it} + \beta_7 SIZE_{it} + \theta + \delta + \varepsilon \end{aligned}$$

In this study, bank performance is measured by means of ROE and NIM. In particular, ROE is the ratio of return to equity, which is an indicator of the bank's efficiency in using its financial capital. This measure has been used in a number of previous studies on banking ([12, 23, 28, 32]). Apart from ROE, various scholars around the world ([12, 26, 28, 31]) used another method, namely net profit margin (NIM) representing bank performance. Onay et al. [12] argued that Government intervention might inflate ROE, which may lead to inconsistent results. To avoid such an inconsistent result, NIM was used to measure the performance of banks. NIM is the net interest income divided by total earnings assets [35]. The net interest margin measures the gap between the interest income the bank receives on loans and securities and interest cost of its borrowed funds. It reflects the cost of bank intermediation services and the efficiency of the bank. The higher the net interest margin, the higher the bank's profit and the more stable the bank is. Thus, it is one of the key measures of bank profitability.

The variables representing the service delivery technology used in this article are mobile banking (MB), internet banking (IB), and implementation degree of ATMs (ATM). In particular, MB, IB are dummy variables, receiving the value 0 if the bank does not provide the MB / IB application, 1 if there is MB/ IB. Control variables included capitalization (CAR), cost efficiency (EF), asset quality (AQ), bank size (SIZE). In which, CAR is a ratio of total equity to total assets, EFF is a ratio of operating expenses to operating revenue, AQ is a ratio of nonperforming to total loans and SIZE is the logarithm of total assets.

## 3. Research results

### 3.1. Descriptive statistics

Descriptive statics is firstly investigated in the study to describe features of a specific data set by giving short summaries about the sample and measures of the data.

**Table 1.** Descriptive statistics

	N	Mean	Std. Dev	Min	Max
ROE	266	0.1084519	0.0875701	-0.5633	0.565
NIM	270	0.0292516	0.0150572	0	0.0888018
MB	259	0.6061776	0.4895422	0	1
IB	259	0.7528958	0.432163	0	1
ATM	259	387.4324	502.979	7	1917
CAR	263	0.1028122	0.0797423	0	0.9799595
EFF	262	0.8428256	5.334928	0.1881495	0.8683025
AQ	270	0.0169672	0.0149663	0	0.114
SIZE	261	31.68199	1.962845	19.15082	34.93752

Source: Research results

The results of Table 1 show that the mean value of the variables MB (Mobile banking) and IB (Internet banking) are 0.606 and 0.753, respectively. It shows that most commercial banks in Vietnam offer MB and IB applications for customers. Regarding the average number of ATMs of 387.4324, which is considered to be quite high, it shows that commercial banks in Vietnam also invest quite heavily in ATM networks, with a max value of 1917 ATMs. The average values of ROE is 0.1085 (10.85%). Compared to the results of the industry average, it can be seen that the ROE value of the commercial banks examined in this article is higher than that of other banks. Usually, successful banks have a NIM of about 3% to 4%. The average value of the NIM of Vietnamese commercial banks is approximately 3%. These results can reflect the performance level of banks in Vietnam.

### 3.2. Correlation analysis

**Table 2.** Correlation matrix

	ROE	NIM	MB	IB	ATM	CAR	EFF	AQ	SIZE
ROE	1.000								
NIM	0.099	1.000							
MB	0.048	-0.196	1.000						
IB	-0.108	-0.150	0.406	1.000					
ATM	0.297	-0.045	0.297	0.097	1.000				
CAR	-0.125	0.445	-0.449	-0.300	-0.297	1.000			
EFF	-0.496	-0.064	-0.070	0.045	-0.048	-0.042	1.000		
AQ	-0.065	-0.014	0.147	0.075	0.046	-0.051	-0.073	1.000	
SIZE	0.013	-0.235	0.261	0.166	0.487	-0.454	-0.044	0.155	1.0

Source: Research results

Table 2 illustrates the correlation matrix of both dependent and independent variables. All of the correlation coefficients in Table 4.2 are less than 0.8. According to the empirical rule, it can be concluded that the independent variables in the equation are not multi-collinearity.

**Table 3.** Variance inflation factors

Variable	VIF	1/VIF
MB	1.49	0.671000
IB	1.23	0.809917
ATM	1.40	0.713243
CAR	1.75	0.570405
EFF	1.03	0.973614
AQ	1.05	0.952411
SIZE	1.58	0.634390
Mean VIF	1.35	

Source: Research results

According to the experience of many previous researchers, VIF <2 is good to conclude whether multi-phenomenon occurs. Looking at Table 5, it is easy to conclude that no multi-collinear phenomena occur.

### 3.3. Regression results

**Table 4.** Regression results

Variable	POOLED OLS		FEM	
	ROE	NIM	ROE	NIM
MB	-0.0133 (0.0110)	-0.0006 (0.0021)	0.0279** (2.41)	0.0043* (1.77)
IB	-0.0224** (0.0113)	-0.0003 (0.0022)	0.0255* (1.92)	-0.0013 (-0.48)
ATM	0.0001*** (0.0000)	0.0000** (0.0000)	-0.0000 (-0.12)	0.0000*** (2.66)
CAR	-0.3528*** (0.1013)	0.1182*** (0.0195)	-0.3562*** (-3.49)	0.0956*** (4.46)
EFF	-0.0081*** (0.0008)	-0.0001 (0.0002)	-0.0086*** (-12.82)	-0.0002 (-1.22)
AQ	-0.4340 (0.3012)	0.0185 (0.0581)	-0.0207 (-0.08)	-0.0160 (-0.28)
SIZE	-0.0121*** (0.0033)	-0.0010 (0.0006)	-0.0122** (-2.59)	-0.0003 (-0.35)
Constant	0.5471*** (0.1068)	0.0474** (0.0206)	0.5622*** (3.73)	0.0240 (0.76)
Observations	251	251	251	251
R-squared	0.3922	0.2156	0.5752	0.2493

Source: Research results

For the results of Pooled OLS, we see that internet banking (IB) has a negative impact on return on equity (ROE) with a correlation coefficient of -0.0224 but not statistically significant. Besides, there is no relationship between mobile banking (MB) and bank performance. On the contrary, ATM also has a positive relationship with both variables representing bank performance (ROE, NIM).

For the results of FEM, looking at the above result table, we can easily see that the MB variable has a positive impact on the bank performance (ROE, NIM) with correlation coefficients of 0.0279 and 0.0043 respectively. Besides, there is a positive relationship between IB (internet banking) and ROE (return on equity). These results are consistent with previous research results of Hiyam Sujud & Boutheina Hashem (2017), Kiragu [30], Kathuosolomon Munyoki (2015), R.M. Mahboub [17], Ndirangu Bernard Njoroge [26], Sana Haider Sumra et al. (2011). The existence of IB (Internet banking) has a positive impact on ROE (return on equity). While the research has not found its relationship with NIM (net interest margin), which represents bank performance, there exists ROE (0.0255) with a 10% significance level. These results are in accordance with many previous research results of Hernando & Nieto [23], Ceylan Onay et al. [12], Hiyam Sujud et al. [29], Van Dinh et al. [27], Clare Barasa et al. [13], Siddik et al. [28], Kiragu [30]. This research results also find out a positive relationship between ATM and NIM at 1% of the significant level.

Finally, as for control variables, this research finds out the inverse relationship between capitalization (CAR) and

return on equity (ROE) and between capitalization (CAR) and net interest margin (NIM). Specifically, capitalization (CAR) has a negative relationship with return on equity (ROE), capitalization (CAR) has a positive effect on net interest margin (NIM). Besides, this research finds a negative impact between cost efficiency (EFF) and bank size (SIZE) on return on equity (ROE).

### We have to select the model based on the F- test

*Hypothesis:*

H<sub>0</sub>: Pooled OLS model is more reasonable.

H<sub>1</sub>: FEM model is more reasonable.

**Model 1(ROE):** F test that all  $u_i=0$ :  $F(20, 198) = 6.24$   
Prob > F = 0.0000

**Model 2(NIM):** F test that all  $u_i=0$ :  $F(20, 198) = 5.49$   
Prob > F = 0.0000

Based on the Prob value of both models which is 0.0000 less than the significance level of 5%, it rejects hypothesis H<sub>0</sub>, accepting the hypothesis H<sub>1</sub>.

Therefore, the model of FEM is more suitable.

According to many previous economic studies, the appropriate estimation method for financial data is FEM due to the following reasons:

**Firstly**, financial data is usually table data (observations on a given index will include cross-observations and observations over time).

**Secondly**, as for the factors affecting the dependent variables considered in the model, there are many other aspects/factors of the bank affecting ROE, NIM but the study cannot cover all the aspects. Because of this aspect, the use of the FEM model is more appropriate because it fixes the impact of these aspects, meaning that whether banks are large or small with different capital structures, the dynamics of unobserved factors for the dependent variable are the same. In contrast, for REM, it allows these effects to change, so all these effects will be reflected in the REM model's error.

From the above reasons, we find that the FEM model is the most appropriate model.

*Table 5. Hypotheses acceptance*

	Variable	Expectation	Actual relationship	Acceptance
<b>H1</b>	Mobile banking (MB)	+ and significant	+ and significant	Yes
<b>H2</b>	Internet banking (IB)	+ and Significant	+ and Significant	Yes
<b>H3</b>	Implementation degree of ATMs (ATM)	+ and significant	+ and Significant	Yes

### 3.4. Robust test

Here come a number of additional analyzes to assess the reliability of the results recorded in the previous content. The results of empirical studies are statistically significant in the proposed regression models, but there are still some endogenous problems affecting the results.

The endogenous problem is the opposite effect of the

performance variable on the ATM variable. In particular, this can happen if customers tend to choose reputable commercial banks with high profitability to trust transactions. Therefore, this makes the number of customers of those commercial banks increase, leading to an increase in customers' transaction demand, thus the impact requires banks to increase the demand for investment in the ATMs system of commercial banks. These banks will expand the ATM network to meet customers' needs. In order to minimize the opposite effect of the performance variable on the factor representing Service Delivery Technology, the research models look at adding the lag values of the ATM variable in the model. Specifically, the ATM variable will receive a lag value (t-1 value).

*Table 6. FEM results with a lag variable*

Variable	(1) ROE	(2) NIM
<b>MB</b>	0.0266** (2.23)	0.0053** (2.13)
<b>IB</b>	0.0262* (1.92)	-0.0028 (-0.97)
<b>LAG_ATM</b>	-0.0000 (-0.23)	0.0000 (0.05)
<b>CAR</b>	-0.3778*** (-3.25)	0.1218*** (5.05)
<b>EFF</b>	-0.0086*** (-12.60)	-0.0002 (-1.06)
<b>AQ</b>	0.0243 (0.09)	-0.0402 (-0.68)
<b>SIZE</b>	-0.0123** (-2.56)	-0.0002 (-0.18)
<b>Constant</b>	0.5695*** (3.68)	0.0205 (0.64)
<b>Observations</b>	242	242
<b>Number of id</b>	21	21
<b>R-squared</b>	0.5746	0.2210
<b>Year dummies</b>	YES	YES
<b>Adjusted R-squared</b>	0.492	0.0706

*Source: Research results*

The results also show a positive impact of mobile banking (MB) and internet banking (IB) on bank performance (ROE). In particular, the study has not found a relationship between the lag value of ATM and bank performance. For control variables, cost efficiency (EFF) and bank's size (SIZE) have a negative impact on bank performance. Capitalization (CAR) has a negative relationship with ROE and has a negative relationship with NIM.

### 4. Conclusion

The research results show the positive effects of mobile banking (MB) and internet banking (IB) on bank performance. These results show that investment in service delivery technology through mobile banking and internet banking has yielded the expected results. Mobile banking as well as internet banking have a positive impact on bank performance. Besides, the relationship between ATM and

bank performance has not been found. However, the relationship between the implementation degree of ATMs and bank performance has not found in this study.

This study has some main implications. First, the bank managers should consider boosting the application of modern technology in banking service supply. By doing this, it may improve the quality of current banking services, provides new benefits for customers such as simplifying procedures or saving time for different types of banking activities. As a result, this may help to enhance the performance of commercial banks in the long term. In fact, in the era of technology 4.0 today, most banks have caught up with the trend of conducting technology in banking by providing electronic banking services for their customers. This study supports this trend.

Second, the government's legal framework should promote the commercial banks to apply modern technology in delivering banking services. This encourages the banks to replace gradually traditional transaction methods by mobile, internet or other modern service delivery channels. In return, this may contribute to the government's strategy into reducing cash transactions, controlling illegal behaviors such as corruption or money laundering in the economy.

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