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## ICT and Bank Performance: Empirical Evidence from Vietnam

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**Abstract:** The development of new information and communication technologies has led to a fundamental transformation of commercial banks currently and in the future. This article studies the impact of ICT on the performance of commercial banks. By using data from 20 Vietnamese commercial banks in the 2007-2019 period and the ICTIndex set of indicators for commercial banks, we see that readiness for IT development and application has had a significant impact on bank performance, among other factors such as the size of the bank, the ratio of equity to total assets and the ratio of deposits to loans.

**Keywords:** Bank Performance, ICTIndex, Factors, Digital Transformation, Management Information System.

**JEL Classification:** M15, G20, O32

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### INTRODUCTION

The 4th industrial revolution is based on digital technology and integrates all intelligent technologies to optimize processes and production methods with technologies that have profound effects on the economy, society of countries in the world, including Vietnam. Banks are one of the pioneers in applying technology in their business operations and bringing about certain results. Banks have enhanced the ability to apply modern technology to upgrade the quality, features, utilities... of their products and services, thereby increasing competitive advantage, reducing manual manpower, reducing product distribution costs and enhancing profit; Digital transformation has opened up opportunities for banks to reach and serve a large number of customers, promoting comprehensive financial development.

This research focuses on the impact of readiness for IT development and application for the promotion of operational efficiency and stability of Vietnamese commercial banks. An index to assess the readiness of banks for IT development and application (ICTIndex) is determined through component indicators such as: technical infrastructure, human infrastructure, internal IT application and online services of banks. In which, three factors belonging to technical infrastructure, human infrastructure and online services to serve customers are assessed to have a positive correlation with profitability. In particular, online customer service is closely correlated with a bank's profitability. Those are the short-term beneficial factors of digital transformation. The fourth factor of ICTIndex is the internal IT application which is considered as a long-term factor that has a negative impact on the profitability of banks in the first time. That is due to the inconsistency between banks on investment expenditures in implementing internal IT applications such as core banking, basic application deployment, and electronic payment, therefore, the average profitability of the banking industry has decreased. Using table data from 20 banks listed on the Vietnamese stock market from 2007 to 2019, we see a significant impact of ICTIndex on the bank performance. The remaining of the article is as follows: Part 2 covers the research overview, while Part 3 explores research questions and research models. Section 4 presents empirical data and analysis. The article ends in Part 5.

### LITERATURE REVIEW

Bank performance is a research topic of great interest to many researchers. Research of Saeed, Gull, and Rasheed (2013) in which the evaluation of the impact of capital structure on the bank performance in Pakistan in the period (2007-2011) has found a reciprocal relationship between the factors determining capital structure and the bank performance. The research results confirm a strong positive dependence of short-term debt on capital, total debt on capital and bank size on all profitability ratios. But the long-term debt on capital is negatively related to profitability ratios.

According to Goddard, Molyneux, and Wilson (2004) a study of European banking performance from 199 to 1998 showed that the ratio of equity and liquid assets to total assets has a negative impact while the market concentration has a positive effect on the profitability of bank.

Research of Wahidudin, Subramaniam, Kamaluddin, and Abd Mutalib (2012) on Asian banks for the 2004-2009 period has discovered that the impact of internal factors in banks (short-term capital management, equity, liquidity,

size) is similar on the returns of both Islamic and ordinary banks, but there is a difference from the effects of macro factors.

Research of Sufian, Kamarudin, and Noor (2012) analyzed the factors affecting the performance of Malaysian commercial banks in the 1995-1999 period around the 1997 East Asian financial crisis. The research used non-parametric DEA analysis to measure operational efficiency and Tobit regression analysis to evaluate the factors affecting the performance of Malaysian banks. The dependent variable of the model is the performance of commercial banks according to DEA, the independent variables include: (i) Bank size is measured by the natural logarithm of total deposits; (ii) Ratio of outstanding credit to total assets; (iii) Ratio of provision for bad debts over total assets; (iv) Total non-interest income over total assets; (v) Total non-interest expenses on total assets; (vi) Ratio of equity to total assets.

According to research by Samad (2015) Banks of Bangladesh in the 2009-2011 period by POLS REM method, pointed out that Liquidity risk, equity and operating costs have a positive impact while the impact of credit risk is negative to bank profits.

Research of Agu and Aguegboh (2020) used data of 35 African banks in the 2013-2015 period by GMM (generalized method of moment) method, showed that ICT had largely affects the bank performance in the short term; In the long term, these investments become very beneficial to improve the bank performance.

In Vietnam, there are also many studies on bank performance. Research of Võ Minh Long (2019) on operation of 20 Vietnamese banks in the 2008-2017 period, performed by regression method using FEM (firm estimate), showing that the size of the bank, the ratio of cost to revenue, the ratio of equity to total assets and the ratio of deposit to loan both have impact on performance.

Research of Batten and Vo (2019) on 35 Vietnamese banks in the 2006-2012 period by FEM, REM method, showed that the size, level of risk capital safety, productivity and operating costs have a positive impact while the manager's ownership ratio has a negative effect on the bank performance.

## RESEARCH METHODS

### Research Models

According to the overview research, despite using many different approaches in terms of research methods, scope and objectives, in general both domestic and foreign authors aim to analyze how the influencing factors to the bank performance. In the world and in Vietnam, the technology factor is one of the factors that the authors are interested in researching about its impact on the bank performance in recent times. This research aims to investigate the relationship between the readiness for IT development and application (ICTIndex) and the performance of commercial banks in Vietnam. To review our research questions, we use tabular data and suggest models to test relationships based on an overview of research results. The research model is presented as follows:

$$ROA = \beta_0 + \beta_1 * ICTIndex_{i,t} + \beta_2 * Size_{i,t} + \beta_3 * ETA_{i,t} + \beta_4 * NPL_{i,t} + \beta_5 * DLR_{i,t} + e_{i,t} \quad (1)$$

In equation [1], we use ROA as a measure of the bank performance. To measure the readiness for IT development and application, we use the ICTIndex of the Ministry of Information and Communication implemented from 2006 until present. Bank size (Size) is calculated by the natural logarithm of total assets. Equity to assets (ETA) is calculated by the ratio of equity to total assets. Non-Performing Loan (NPL) is calculated as the ratio between overdue debt and total loan outstanding. Deposit / loan ratio (DLR) is calculated by the ratio between customer's deposits and loans.

### Data

Research data is collected from the annual financial statements of 20 joint stock commercial banks operating in the 2007-2019 period. ICTIndex data is taken from data of the Ministry of Information and Communication for commercial banks at the same period. Thus, this research has 260 observations (20 banks \* 13 years = 260), which has been synthesized, processed and designed using STATA 14 software. Descriptions of the data are shown in Table 1.

**Table 1: Descriptive statistics of data**

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	260	.8095633	.5946223	-1.280512	3.161356
ICTIndex	260	.498712	.1244259	.0708	.8114
SIZE	260	29.39548	6.150661	11.30723	34.81112
ETA	260	.1018679	.0759266	.0213676	.8083186
NPL	260	2.242714	1.491913	.2301082	11.40172
DLR	260	1.159091	.2957969	.2949716	2.689085

**EMPIRICAL ANALYSIS**

Correlation coefficient analysis. There is a very low correlation between pairs of independent variables. Therefore, the variables in the model have no signs of multicollinearity phenomenon.

**Table 2: Correlation coefficients between variables**

	ROA	ICTindex	SIZE	ETA	NPL	DLR
ROA	1.0000					
ICTindex	0.1785	1.0000				
SIZE	-0.2865	0.0222	1.0000			
ETA	0.2785	-0.2649	-0.0302	1.0000		
NPL	-0.1744	-0.0497	0.1727	-0.0952	1.0000	
DLR	-0.2975	-0.0431	-0.0712	-0.2969	0.1621	1.0000

Verification of multi-collinearity phenomenon: The result is VIF < 3. Therefore, the variables in the model do not have the multicollinearity phenomenon.

**Table 3: Multicollinearity test**

Variable	VIF	SQRT VIF	Tolerance	R-Squared
ROA	1.38	1.17	0.7252	0.2748
ICTindex	1.18	1.09	0.8474	0.1526
SIZE	1.16	1.08	0.8616	0.1384
ETA	1.30	1.14	0.7688	0.2312
NPL	1.07	1.04	0.9313	0.0687
DLR	1.22	1.10	0.8218	0.1782
Mean VIF	1.22			

The research continues to perform regression analysis with the goal of measuring the trend and impact level of the independent variables on the dependent variables by methods such as: Pooled OLS, FEM, REM, FEM with robust analysis and perform tests to choose the appropriate regression method. Regression results by methods of Pooled OLS (1), FEM (2), REM (3), FEM (with robustness) (4) according to Table 4.

- 1) F-test result, with Prob>F = 0.0000 <  $\alpha$  ( $\alpha = 1\%$ ): Hypothesis  $H_0$  is rejected: FEM will be more suitable than Pooled OLS.
- 2) Hausman test result, with: Prob>chi2 = 0.0000 <  $\alpha$  ( $\alpha = 1\%$ ): Hypothesis  $H_0$  is rejected: FEM will be more suitable than REM.
- 3) The results of model testing have the phenomenon of variance change and autocorrelation. The research uses FEM model - the firm estimation to overcome the above defects. (Model 4 in Table 4).

**Table 4: Results of regression analysis according to the models**

	(1)	(2)	(3)	(4)
	ROA	ROA	ROA	ROA
ICTindex	1.128*** (4.08)	1.103*** (3.79)	1.128*** (4.08)	1.103** (2.56)
SIZE	-0.0279*** (-4.05)	-0.0259*** (-3.13)	-0.0279*** (-4.05)	-0.0259** (-2.65)
ETA	2.244*** (5.05)	2.262*** (4.92)	2.244*** (5.05)	2.262** (2.67)
NPL	-0.00206 (-0.10)	0.00251 (0.12)	-0.00206 (-0.10)	0.00251 (0.11)
DLR	-0.685*** (-5.68)	-0.779*** (-6.06)	-0.685*** (-5.68)	-0.779*** (-6.08)
_cons	1.639*** (5.56)	1.687*** (5.44)	1.639*** (5.56)	1.687*** (4.59)
N	260	260	260	260
R-sq		0.351		0.351

t statistics in parentheses

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

According to the FEM model with robustness, then:

Firstly, the regression coefficient of ICTIndex variable is 1.103. It shows: Readiness level for IT development and application has a positive impact on performance with a reliability of 95%.

Secondly, the regression coefficient of SIZE variable is -0.0259. It shows: Bank size has a negative impact on performance with a reliability of 95%. This result is inconsistent with the research's expectations but with the support of Nouaili, Abaoub, and Ochi (2015)

Thirdly, The regression coefficient of ETA variable is 2.262. This result shows that the ratio of equity to total assets has a positive impact on performance with a reliability of 95%. When the equity is high, banks will be proactive in all activities, which will increase performance This finding is consistent with the author's expectation and supported by the author Rahman, Hamid, and Khan (2015).

Fourthly, The regression coefficient of DLR variable is -0,799. It shows: Deposit-to-loan ratio has the opposite effect to performance with a reliability of 95%. This finding is consistent with the author's expectation because the current performance of commercial banks has a big shift from credit to technology-based payment services.

Fifthly, The regression coefficient of NPL variable is 0.00251. It shows: There is insufficient scientific evidence on the relationship between NPL and ROA. This result is consistent with the research results of Võ Minh Long (2019).

## CONCLUSION

The research considered how the readiness level for IT development and application effect on the bank performance. Using tabular data from 20 commercial banks on the Vietnamese stock market from 2007 to 2019, we find some interesting points. Investing in information technology will fundamentally change a bank's business model and promote the bank to operate more efficiently. Banks with large financial potential will be proactive in stronger digital transformation activities, thereby increasing the bank performance. The bank size has a negative impact on the bank performance because in the development trend, banks focus on developing digital banking products and services based on technology, so the cumbersome scale apparatus will be a major obstacle in the operations of commercial banks in the future. Another interesting finding is that the deposit-to-loan ratio has a negative impact on performance and is statistically significant. That also pointed out the development trend of

Vietnamese commercial banks that banks are tending to move quickly to retail banking services, digital-based payment services. The bank performance no longer depends mainly on the performance of the credit segment. There are many possible ways for future researches. The impact of technology on the performance of state-owned and private banks can be considered. In addition, it is possible to study the impact of digital transformation and AI application on the bank performance.

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