

## FINANCIAL INNOVATION IN CONVENTIONAL BANKING IN INDONESIA

Sholikha Oktavi Khalifaturofi'ah<sup>1</sup>

<sup>1</sup> STIE Perbanas Surabaya, Indonesia

### ABSTRACT

This study aims to examine the relationship between the level of cost efficiency and financial innovation in conventional banks in Indonesia. The data used is panel data from conventional banks during the period 2009-2017. The research method used is the multinomial logit regression method. The dependent variable used is financial innovation consisting of a dummy application of ATMs, internet banking, and mobile banking. The explanatory variables used include cost efficiency, bank size, number of branches, bank age, and ownership. The research results show that cost efficiency, bank size, number of branches, and bank age have a significant effect on financial innovation. An efficient bank, a large bank size, a small number of branches, and a young bank age have an influence on financial innovation in conventional banks by providing ATMs, internet, and mobile banking. Bank ownership has no significant effect on financial innovation in conventional banks.

**Keywords:** cost efficiency, financial innovation, logit regression, conventional banks

## INOVASI KEUANGAN PADA PERBANKAN KONVENSIONAL DI INDONESIA

### ABSTRAK

Penelitian ini bertujuan untuk menguji hubungan antara tingkat efisiensi biaya dengan financial innovation di bank konvensional di Indonesia. Data yang digunakan adalah data panel dari bank konvensional selama periode 2009-2017. Metode penelitian yang digunakan yaitu metode regresi logit multinomial. Variabel terikat yang digunakan adalah inovasi keuangan yang meliputi dummy penerapan ATM, internet banking, dan mobile banking. Variabel penjelas yang digunakan meliputi efisiensi biaya, ukuran bank, jumlah cabang, usia bank, dan kepemilikan. Hasil penelitian menunjukkan bahwa efisiensi biaya, ukuran bank, jumlah cabang, dan usia bank berpengaruh signifikan terhadap inovasi keuangan perbankan. Bank yang efisien, ukuran bank yang semakin besar, jumlah cabang yang sedikit, dan usia bank yang muda akan mempengaruhi inovasi keuangan pada bank dengan menyediakan ATM, internet, dan mobile banking. Kepemilikan bank tidak berpengaruh signifikan terhadap inovasi keuangan bank.

**Kata-kata Kunci:** efisiensi biaya, inovasi keuangan, regresi logit, bank konvensional

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**Korespondensi:** Sholikha Oktavi Khalifaturofi'ah, S.E., M.M. STIE Perbanas Surabaya, Jln. Nginden Semolo No. 34-36, Surabaya, Jawa Timur, Indonesia. Email: sholikha@perbanas.ac.id

**Submitted:** March 2020, **Accepted:** March 2020, **Published:** March 2020

ISSN: 1412 – 3681 (printed), ISSN: 2442 – 4617 (online), Website: <http://Journal.feb.unpad.ac.id/index.php/jbm>

## INTRODUCTION

In the 4.0 industrial era, all aspects of life are starting to move towards digital. The potential for digital development, especially in the banking world, is very rapid. One of the bank's efforts to achieve performance optimization is to innovate. Innovation is a change and development towards something better. Financial innovation must be carried out by banks to improve services to customers. Financial innovations in banking can be in the form of providing facilities that can facilitate customer transactions.

Financial innovations in banking put more emphasis on the service sector. In this case, the innovations carried out by banks are in the form of providing ATM (Automatic Teller Machine), internet banking, and mobile banking. Previously, ATM was a banking breakthrough so that customers did not need to come to the branch office to make a deposit, cash withdrawal, or other transactions. Now, the development of technology makes all aspects of life easy, fast, and comfortable. Transactions relating to banking can be done using a smartphone. Banking has begun to move to digitalization, where mobile banking and internet banking are needed for banking transactions.

Financial innovation affects the efficiency and performance of the company (Nizar, 2019). According to Nkem and Akujinma (2017), financial innovation can improve efficiency in banking. Then Nizar (2019) explained that financial innovation occurs in response to market imperfections or market inefficiency. This includes

market imperfections, need of market player, agency problems and asymmetric information, transaction fees, searching, and marketing. It means that financial innovation aims to reduce costs and provide the benefit of the improvement of market inefficiency (Tufano, 2003). To deal with it, banks with lower efficiency will improve financial innovation.

Also, there is a positive and significant relationship between company size and financial innovation (Alsharkas, 2014). The greater the size of the company, the greater the impetus held by banks to innovate (Malhotra and Singh, 2007).

Banks with a younger age are more likely to apply financial innovation than those with older age (Malhotra and Singh, 2007). Banks with high capitalization also tend to be more able to innovate. This is because innovation will reduce the cost of providing fixed assets for customers (e.g. branch offices). So, the smaller the number of branch offices, the higher the financial innovation in banking will be. This is done as a form of the opportunity cost for banks in providing branch offices to aspects of internet banking or mobile banking.

Banks with government and private ownership also have different points of view in assessing innovation. According to Malhotra and Singh (2007), private-owned banks are more able to innovate by implementing internet banking than state-owned banks. This result is reinforced by Alsharkas (2014), who explains that private-owned companies are more innovative than state-owned companies.

The average cost efficiency of Indonesian banks was likely to incline over 2002-2010 (Anwar, 2019). According to Anwar (2019), the average SFA cost efficiency scores obtained by the standard pooled method are more than the average SFA cost efficiency scores obtained by Battese-Coelli 1992 (BC92) method. SFA cost efficiency score is between 0 and 1. Compared to Data Envelopment Analysis (DEA), the main advantage of SFA is that it allows us to distinguish between inefficiency and other stochastic shocks while calculating efficiency scores (Pasiouras et al., 2009; Semih Yildirim & Philippatos, 2007; Djalilov and Piesse, 2019).

Measured using the stochastic frontier approach (SFA), the average cost efficiency scores for ASEAN countries range from 0.7922 to 0.8108, and the average profit efficiency scores range from 0.3009 to 0.3385 (Nguyen, 2018). The Indonesian banking industry is inefficient in its intermediation function (Widiarti et al, 2015). So it is necessary to see how the cost-efficiency impacts financial innovation.

This study aims to analyze the effect of cost efficiency, bank size, the number of branch offices, bank age, and bank ownership on financial innovation in conventional banks in Indonesia. Some paper explained that financial innovation has the good and bad sides (Nizar, 2019). The good side of financial innovation is financial innovation can increase economic growth. This happens because the existence of financial innovations will make it easier for banks to serve customers. However, the bad side of financial innovation will

create financial fragility. Mainly this is related to banking crimes such as fraud, skimming, and hackers. Therefore, research is needed on financial innovation, especially in banking.

## LITERATURE REVIEW

### *Financial Innovation*

Financial innovation can be defined as a market change for consumers and business debt (Wachter, 2006). Financial innovation has a variety of activities, such as (1) creating new financial products with payoffs that are desired/agreed by consumers (product innovations), and (2) providing new financial services (process innovations), such as ATMs, cash cards, and combo cards. Examples of financial innovations found in banking are financial innovations in the field of services, which include the provision of ATMs, mobile banking, and internet banking (Nkem and Akujinma, 2017).

According to Jacque (2001), the results of financial innovation can be classified as follows: (1) innovation in financial intermediaries (e.g., venture capital funds); (2) innovation in financial instruments (e.g., collateralized mortgage obligations or credit derivatives); (3) innovation in financial markets (e.g., insurance derivatives); (4) innovation in financial services (e.g., e-trading or e-banking); and (5) innovation in financial techniques (e.g. V @ R or LBOs).

Innovations made at the company usually follow the Bandwagon effect theory. Bandwagon effect theory describes the interaction of demand and preference. The Bandwagon effect is one of the

effects of wanting to create an innovation because other companies have also applied the innovation (adoption). For example, if bank A has made financial innovation in the form of mobile banking, bank B and bank C will make innovation in a similar form after learning that the innovation has a significant impact on the financial performance of the bank.

### *Cost Efficiency*

There are two approaches used in determining efficiency. The first is the traditional approach and the second is the frontier approach. According to the traditional approach, efficiency is measured using a financial ratio, referred to as operating costs to operating Income (Khalifaturafi'ah, 2018). Measurement of efficiency using operating costs to operating income is rarely used. Research on efficiency often uses frontier approach (Anwar, 2019; Nguyen, 2018; Khalifaturafi'ah, 2018)

The most popular approaches to estimate bank efficiency is non-parametric (with Data Envelopment Analysis/DEA) and parametric (with Stochastic Frontier Analysis/SFA). DEA involves the concept of efficiency, and Farrell (1957) had decomposed efficiency into technical efficiency and allocative efficiency.

Technical efficiency measures the ability of a bank to produce a given set of outputs with minimal inputs, independently of input prices under the assumption of variable returns to scale. Allocative efficiency measures the ability of a bank to choose optimal input proportions at given input prices. (Hauner, 2005).

The overall measure of technical efficiency can be disaggregated into three components: 1) pure technical efficiency due to producing within in isoquant frontier; 2) congestion due to over-utilization of inputs, and 3) scale efficiency, due to deviations from constant returns to scale (Fujii et al. 2014).

Though both methods are widely used in the literature, the parametric techniques are considered to be preferable to measure economic efficiency (Nguyen, 2018). Therefore, the present study uses the SFA proposed by Aigner et al. (1977) to measure cost efficiency.

According to Hadad et al (2003), there are three approaches that can be taken in determining the input and output components, especially in the banking world: (1) the production approach, which sees banks as producers of deposits and loans. In this approach, the input component includes expenses, while the output component includes revenues; (2) the intermediation approach, which sees the banking sector as an intermediary institution that converts financial assets from surplus units to deficit units. In this approach, the input component includes expenses while the output component includes the total loan credit and financial investment assets. This approach is used in this research; (3) asset approach, which sees the banking sector as a financial institution that provides loans. The asset approach is similar to the intermediation approach, which places assets as output components (Hadad et al., 2003). Cost efficiency in this study uses an intermediation approach, which views banks as collectors of funds

that are then intermediated to loans and other assets (Nguyen, 2018).

### ***Bank Size***

Overall, banks are classified according to their SIZE. For example, banks are classified according to BUKU 1, BUKU 2, BUKU 3, and BUKU 4. Banks with BUKU 1 have core capital of less than IDR 1 Trillion; BUKU 2 has a core capital of IDR 1 Trillion up to less than IDR 5 Trillion; BUKU 3 has core capital of IDR 5 Trillion up to less than IDR 30 Trillion; and BUKU 4 has a core capital of more than IDR 30 Trillion. The size of the bank influences the bank's decision to innovate. Innovation requires costs. Therefore, banks with greater total assets tend to be more likely to innovate (Malhotra and Singh, 2007).

### ***Number of Branches***

Financial innovation is also influenced by BRANCH (the number of branches) Branch is closely related to bank penetration into the market. The more number of branches, the higher the innovation needed to be able to accommodate the needs of customers. Therefore, a bank will increasingly innovate if there are more branches in the bank (Malhotra and Singh, 2007).

### ***Bank Age***

Specifically, banks are also influenced by the length of the bank's standing. The length of the bank's standing is related to the age of the bank. Older banks will tend to find it more difficult to adapt to technological advancements. This is

different from younger banks. Younger banks are more likely to accept changing times and technological developments. Therefore, banks with a younger age will tend to be easier to innovate financially (Malhotra and Singh, 2007).

### ***Ownership***

Financial innovation is also influenced by policies in banking related to bank ownership. Based on its ownership, banks are divided into 3 types: state-owned banks (BUMN), private-owned banks (PRIVATE), and foreign-owned banks (FOREIGN). Private-owned banks will find it easier to implement financial innovations such as the use of internet banking (Malhotra and Singh, 2007; Alsharkas, 2014). This is because private-owned banks are demanded to be more able to innovate in order to improve their performance and profitability.

### ***Research Hypotheses***

Based on the description stated above, the hypotheses in this study are:

H1: Cost efficiency, company size, number of branches, bank age, and ownership simultaneously influence banking financial innovation

H2: Cost efficiency influences banking financial innovation

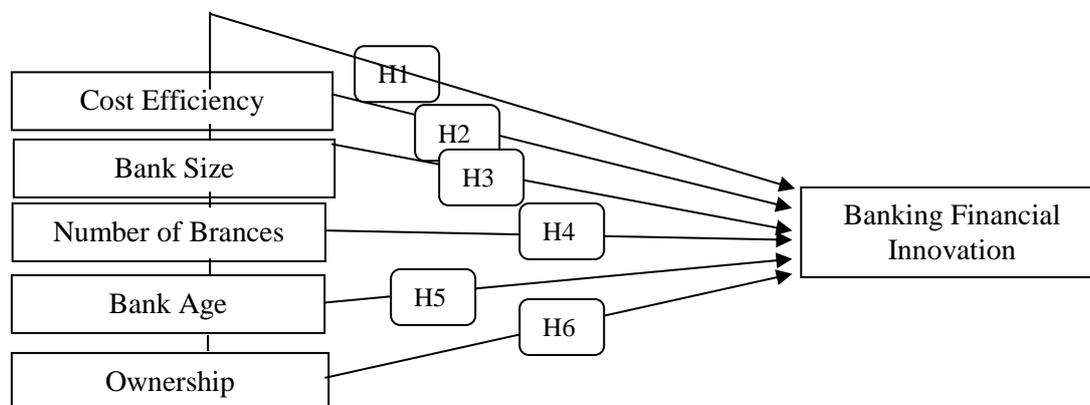
H3: Bank size influences banking financial innovation

H4: The number of branches influences banking financial innovation

H5: Bank age influences banking financial innovation

H6: Ownership influences banking financial innovation

Figure 1 is a framework in this research.



**Figure 1. Research Framework**

## METHODS

The data analysis method used in this study is the multinomial logistic regression method. Models with multinomial logistic regression are models with dependent variables consisting of two categories. In this study, there are four categories consisting of dummy application of ATMs, internet banking and mobile banking. The population in this study is all conventional commercial banks registered with the Financial Services Authority of the Republic of Indonesia (OJK). Sampling is done using purposive sampling method. The samples used are conventional commercial banks which published annual financial reports in 2009-2017.

From the criteria above, it is obtained 23 conventional commercial banks, both government and private conventional commercial banks. These samples not only from large banks (BUKU 3 and 4) but also from small banks (BUKU 2). It means that the author wants to collect more data in order to get the information well. But, the weakness is that the data becomes heterogeneous. From these

samples, 207 observations are obtained, which can be used as research data. The independent variables used are cost efficiency, LnSize, LnBranch, LnAge, and Ownership.

Data on cost efficiency are obtained by the researcher from previous studies on cost efficiency. SFA cost efficiency is used, considering that in the measurement of economic or cost efficiency of a bank, it involved input prices as well as output quantities in the model (Anwar, 2019). In estimating cost efficiency, this study uses a translog-function for the total cost as an objective of the function along with some outputs and prices of inputs variables. The variable of cost efficiency model uses total cost (TC), price of labour (P1), price of funds (P2), total loans/finance (Q1), and securities and investment (Q2). The model used is presented in the equation as follows:  $LnTC = a + b1LnP1 + b2LnP2 + b3LnQ1 + b3LnQ2$ .

Company size is measured by Ln total assets. The number of branches is measured based on the number of branches in the banking system. Bank

age is measured using Ln (current research period - the year of the bank's standing). Moreover, bank ownership is a variable with the type of data category. Banks with private ownership are valued

by 1, while banks with government ownership are valued by 0.

**Table 1. Operational Definition and Variable Measurement**

Dependent Variable	Definition	Measurement
<b>Financial Innovation</b>	Application of ATMs, internet banking, and mobile banking at conventional commercial banks during 2009-2017	Dummy 0 = no ATM 1 = with ATM 2 = with ATM and internet banking or mobile banking 3 = with ATM, Internet banking, and mobile banking
<b>Independent Variable</b>	<b>Definition</b>	<b>Measurement</b>
<b>Cost Efficiency</b>	$LnTC = a + b1LnP1 + b2LnP2 + b3LnQ1 + b3LnQ2$	Output SFA, the score between 0 and 1
<b>Company Size</b>	Company size is measured by total assets	Ln (Total Assets)
<b>Number of Branches</b>	Number of domestic branches including branch offices, sub-branch offices, and cash offices.	Ln (Number of Branches)
<b>Age</b>	Bank age	Ln (research year - the year the bank was established)
<b>Ownership</b>	Bank ownership is measured by dummy	Dummy 1 = private ownership Dummy 0 = government ownership

Source: Processed Data (2019)

The analysis used in this study includes the G test, which is a simultaneous test of the effect of all independent variables on the dependent variable. Then the data diversity test is done to show how much the contribution of the independent variables to the dependent variable. Finally, a partial test is carried out using the Wald test on the parameter estimation. Here are some tests conducted with the hypothesis:

a. Simultaneous Test (G Test)

The simultaneous test aims to determine the effect of independent variables, consisting of cost efficiency, bank size, number of branches, bank age, and ownership on the dependent variable of banking financial innovation

simultaneously. A simultaneous test is done by looking at the Sig value of the fitting information model. If Sig < 0.05, then H0 is rejected (H1 is accepted), meaning that the independent variables simultaneously influence the dependent variable.

- b. Analysis of the Coefficient of Determination
- Analysis of the coefficient of determination aims to determine the diversity of data that shows how much the contribution of independent variables to the dependent variable. The coefficient of determination analysis is done by looking at the R2 value of the Pseudo R-square. In multinomial logistic regression, there are three R2 values: Cox and Snell, Nagelkerke, and McFadden. In this

study, the R2 value is seen from Nagelkerke R2. If the value of Nagelkerke R2 approaches 1, it indicates that the contribution of the independent variable to the dependent variable is good.

c. Partial Test (Wald Test)

Partial test aims to determine the effect of independent variables, consisting of cost efficiency, bank size, number of branches, bank age, and ownership, on banking financial innovation partially. Partial test is done by looking at the Wald or Sig value from the estimate parameter. If the Wald value > Chi square table or Sig < 0.05, then the independent variable partially has an effect on the dependent variable.

## RESULTS AND DISCUSSION

### *Simultaneous Test (G Test)*

The simultaneous test is seen based on the Sig value of the model fitting information. Based on information in Table 2, the Sig value of the model fitting information is 0.00 (sig value < 0.05) or chi square count (237.817) > chi-square table (df 15,  $\alpha$  0.05 = 25.00), which means that H0 is rejected and H1 is accepted. This shows that the independent variables of cost efficiency, bank size, number of branches, bank age, and ownership simultaneously influence the dependent variable of banking financial innovation.

**Table 2. Simultaneous Test Model Fitting Information**

Model	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	525.446	535.444	519.446			
Final	317.629	377.618	281.629	237.817	15	0.000

### *Analysis of the Coefficient of Determination*

The coefficient of determination is seen based on the Nagelkerke R2 value of pseudo R2. Based on information in Table 3, the value of Nagelkerke R2 is 0.743, which means that the independent variable contributes 74.3% in explaining its effect on the dependent variable, while the remaining 25.7% is influenced by other variables outside the model.

**Table 3. Coefficient of Determination Pseudo R-Square**

Cox and Snell	0.683
Nagelkerke	0.743
McFadden	0.458

### *Partial Test*

The partial test is seen based on Sig value of the estimated parameters. Based on the information in Table 4, the multinomial logistic model is obtained in the first logistic regression equation model as follows.

$$\text{Ln} \frac{p=0}{p=1} = 144.641 - 47.880 \text{ CE} - 7.986 \text{ LnSIZE} + 2.878 \text{ LnBranch} + 3.327 \text{ LnAge} - 7.667 \text{ Own}$$

If the values of all independent variables are zero, the opportunity for banks not to innovate (having no ATM) is  $6.56E + 62$  (exponential of 144,641) higher than the opportunity for banks to

innovate (having an ATM, internet banking and mobile banking).

The second logistic regression equation model is as follows:

$$\text{Ln} \frac{p=1}{p=2} = 52.563 - 4.448 \text{ CE} - 4.330 \text{ LnSIZE} + 1.555 \text{ LnBranch} + 5.047 \text{ LnAge} - 0.325 \text{ Own}$$

If the values of all independent variables are zero, the opportunity for banks to innovate (having ATM alone) is  $6.73E + 22$  (exponential of 52,563) higher than the opportunity for banks to innovate (having ATM, internet banking and mobile banking).

The third logistic regression equation model is as follows:

$$\text{Ln} \frac{p=2}{p=3} = 0.642 - 14.224 \text{ CE} - 1.229 \text{ LnSIZE} + 0.735 \text{ LnBranch} + 1.008 \text{ LnAge} + 0.547 \text{ Own}$$

If the values of all independent variables are zero, the opportunity for banks to have ATMs and internet banking or mobile banking is 1.90 (exponential of 0.642) higher than the opportunity for banks to innovate (having ATM, internet banking and mobile banking).

**Table 4. Partial Test (Parameter Estimates)**

Financial Innovation		B	Wald	Df	Sig.	Exp(B)
No ATM	Intercept	144.641	24.939	1	0.000	
	CE	-47.880	6.762	1	0.009	1.606E-21
	LnSIZE	-7.986	30.559	1	0.000	0.000
	LnBranch	2.878	11.528	1	0.001	17.776
	LnAGE	3.327	1.142	1	0.285	27.868
	[OWN=.00]	-7.667	.	1	.	0.000
With ATM	[OWN=1.00]	0 <sup>b</sup>	.	0	.	.
	Intercept	52.563	30.357	1	0.000	
	CE	-4.448	0.725	1	0.395	0.012
	LnSIZE	-4.330	35.749	1	0.000	0.013
	LnBranch	1.555	10.242	1	0.001	4.736
	LnAGE	5.047	21.254	1	0.000	155.629
ATM and Interne t /mobil e bankin g	[OWN=.00]	-0.325	0.102	1	0.750	0.723
	[OWN=1.00]	0 <sup>b</sup>	.	0	.	.
	Intercept	0.642	0.007	1	0.935	
	CE	14.224	6.544	1	0.011	1505250.607
	LnSIZE	-1.219	8.041	1	0.005	0.295
	LnBranch	0.735	3.069	1	0.080	2.085
e	LnAGE	1.008	3.025	1	0.082	2.741
	[OWN=.00]	0.547	0.749	1	0.387	1.728
	[OWN=1.00]	0 <sup>b</sup>	.	0	.	.

Reference category is ATM, Internet & Mobile banking

Based on Partial Tests through Parameter Estimates in Table 4, it can be explained that:

**Logit 1 (Financial Innovation: No ATM)**

- The cost efficiency (CE) variable has a negative and significant effect on banking financial innovation (for not having ATM). The coefficient value of this variable is -

- 47.880 and significant at  $p < 0.05$  with exp (B) value of  $1.606E-21$ . The higher the cost efficiency of the banks, the lower the opportunity for banks not to innovate (with no ATM), or  $1.606E-21$ , compared to those that innovate with ATM, internet banking and mobile banking
- b. The LnSize variable has a negative effect on banking financial innovation (for not having ATM). The coefficient value of this variable is  $-7.986$  and significant at  $p < 0.05$  with exp (B) value of  $0.000$ . The greater the size of the banks, the lower the opportunity for banks not to innovate (with no ATM) compared to those that innovate with ATM, internet banking and mobile banking.
  - c. The LnBranch variable has a positive influence on banking financial innovation (for not having ATM). The coefficient value of this variable is  $2887$  and significant at  $p < 0.05$  with an exp (B) value of  $17.776$ . The greater the number of branches, the higher the possibility for banks not to innovate (with no ATM), or  $17.776$ , compared to those that innovate with ATM, internet banking and mobile banking.
  - d. The LnAge variable has a positive effect on banking financial innovation (for not having ATM). The coefficient value of this variable is  $3.327$  and is not significant at  $p < 0.05$  with an exp (B) value of  $27.868$ .
  - e. Ownership variable has a negative effect on banking financial innovation (for not having ATM). The coefficient value of this variable is  $-7.667$  and not significant at  $p < 0.05$  with an exp (B) value of  $0.000$ .

***Logit 2 (Financial Innovation: With ATM)***

- a. The cost efficiency (CE) variable has a negative effect on banking financial innovation (for having ATM). The coefficient value of this variable is  $-4.448$  and not significant at  $p < 0.05$  with exp (B) value of  $0.012$ .
- b. The LnSize variable has a negative effect on banking financial innovation (for having an ATM). The coefficient value of this variable is  $-4.330$  and significant at  $p < 0.05$  with exp (B) value of  $0.013$ . The greater the size of the banks, the lower the opportunity for the banks to innovate (with an ATM) or  $0.013$  compared to those that innovate with ATM, internet banking and mobile banking.
- c. The LnBranch variable has a positive effect on banking financial innovation (for having an ATM). The coefficient value of this variable is  $1.555$  and significant at  $p < 0.05$  with an exp (B) value of  $4.736$ . The more number of branches, the higher the opportunity for the banks to innovate (with an ATM) or  $4.736$  compared to those that innovate with ATM, internet banking, and mobile banking.

- d. The LnAge variable has a positive effect on banking financial innovation (for having ATM). The coefficient value of this variable is 5047 and significant at  $p < 0.05$  with an exp (B) value of 155.629. The older the banks, the higher the opportunity for the banks to innovate (by having an ATM) compared to those that innnovate with ATM, internet banking and mobile banking.
- e. The ownership variable has a negative effect on banking financial innovation for having an ATM. The coefficient value of this variable is -0.325 and not significant at  $p < 0.05$  with an exp (B) vaule of 0.723.

***Logit 3 (Financial Innovation: With ATM and internet banking / mobile banking)***

- a. The cost efficiency (CE) variable has a positive effect on banking financial innovation (for having ATM and internet banking / mobile banking). The coefficient value of this variable is 14.224 and significant at  $p < 0.05$  with exp (B) value of 1505250.607. The more efficient the banks are, the higher the opportunity for the banks to innovate by having ATM and internet banking / mobile banking compared to those that innovate with ATM, internet banking and mobile banking.
- b. The LnSize variable has a negative effect on banking financial innovation (for having an ATM and internet banking /

mobile banking). The coefficient value of this variable is -1.219 and significant at  $p < 0.05$  with exp (B) value of 0.295. The greater the size of the banks, the lower the opportunity for the banks to innovate (by having ATMs and internet / mobile banking) or 0.295, compared to those that innnnovate with ATM, internet banking and mobile banking.

- c. The LnBranch variable has a positive effect on banking financial innovation (for having an ATM and internet / mobile banking). The coefficient value of this variable is 0.735 and is not significant at  $p < 0.05$  with exp (B) value of 2.085.
- d. The LnAge variable has a positive effect on banking financial innovation (for having an ATM and internet / mobile banking). The coefficient value of this variable is 1.008 and not significant at  $p < 0.05$  with exp (B) value of 2.741.
- e. The ownership variable has a positive effect on banking financial innovation (for having an ATM and internet / mobile banking). The coefficient value of this variable is 0.547 and not significant at  $p < 0.05$  with an exp (B) value of 1.728.

***The Effect of Cost Efficiency on Financial Innovation***

Based on information in Table 4, cost efficiency variable is a measure of the probability for banks to innovate, especially for banks to innovate having ATM, internet and mobile banking as well as ATM

and internet or mobile banking. Based on logit 1, the more efficient the bank is, the more innovative it will be to create an ATM, internet and mobile banking compared to banks that do not have ATM. Cost efficiency encourages banks to save costs. The more efficient the bank manages its revenue and costs, the greater the opportunity for the bank to increase its innovation in other forms (not just ATMs).

Based on the results of logit 3, cost efficiency has a positive effect on banking financial innovation. The more efficient the bank is, the greater the tendency for the bank to innovate in the form of ATMs and internet or mobile banking rather than to innovate in the form of ATMs, internet and mobile banking. This shows that bank with financial innovation in the form of ATMs and internet or mobile banking is cost-efficient banking. This finding coincides with previous studies (Nkem and Akujinma, 2017; Arnaboldi and Rossignoli, 2015).

#### ***The Effect of Bank Size on Financial Innovation***

Based on information in Table 4, bank size is one of the most influential variables in banking innovation in the form of ATMs, internet, and mobile banking rather than the innovations underneath. This shows that the greater the size of the bank, the greater the tendency for the bank to innovate completely. This means that banks will innovate not only by providing ATMs for customers or making internet banking but also by providing mobile banking as an alternative to facilitate customer transactions.

The greater the size of the bank, the higher the financial innovation of the bank. In this era of industry 4.0, the challenge of banking is to innovate by providing digital banking. Banks with the highest total assets are usually better able to innovate, for example, by providing services for funding/lending electronically using mobile banking. This is because innovations carried out by banks also require costs, and banks with high total assets tend to be better able to reach all of these innovations. This finding coincides with previous studies (Alsharkas, 2014; Raza et al, 2017). Alsharkas (2014) suggest a positive and statistically significant relationship between firm size and innovation.

#### ***The Effect of the Number of Branches on Financial Innovation***

Based on the results above, the number of branches becomes a measure in the probability for the banks to innovate by having an ATM or not having an ATM rather than having all forms of innovation or ATM, internet, or mobile banking. The number of branches represents banking expansion. The greater the number of branches, the wider the banks to expand their market share. From the results of logit 1 and logit 2, it can be seen that the greater the number of branches, the higher the banking innovation in the form of an ATM or not having an ATM compared to having an ATM, internet, and mobile banking. Banks with a large number of branches indicate banks with low financial innovation. The more innovative the bank is, the smaller the number of branches because the banks

no longer need a large number of branches to serve customers. This means that banks only need to innovate in ATMs, internet, and mobile banking, not in building a large number of branches.

The number of branches and the development of banks in the digital age are significantly related. Before industry 4.0, having a large number of branches was a high achievement obtained by banks. However, in industry 4.0, high bank achievement is judged by how innovative the bank is. This can be seen in whether digital banking is already available or not. ATMs, internet, and mobile banking will reduce the number of branches. On the other hand, this change in achievement is the bank's journey to efficiency because bank expansion can be done not by physical, but non-physical achievements.

This finding similar to previous studies (Raza et al, 2017). They showed that banks that have a small number of branches focus on Internet Banking for attracting more customers.

#### ***The Effect of Bank Age on Financial Innovation***

Based on information in Table 4, bank age variable is a measure of the probability for banks to innovate to have an ATM rather than to have ATM, internet and mobile banking. Based on logit 2, the results show that the older the bank, the more banking innovation will be in providing ATMs rather than ATMs, the internet and mobile banking. In other words, a long-standing bank will have more ATMs than a newly established bank. However, banks with a younger age will tend to innovate higher in the provision of ATMs, internet, and mobile

banking. Banking development is also influenced by technological development. The younger the age of the bank is, the higher the demand for innovation for the survival of the bank itself. This finding coincides with previous studies (Malhotra and Singh, 2007). Nevertheless, this result contradicts with Raza et al (2017) that older banks have adopted internet banking rapidly as compared to new banks.

#### ***The Effect of Ownership on Financial Innovation***

Based on information in Table 4, ownership variable is not a measure of the probability for banks to innovate whether they do not have an ATM or have an ATM and internet / mobile banking. Ownership, in this case, can be divided into two: government ownership and private ownership. Banks with government ownership are banks with BUKU 3 and 4, which generally have total assets of more than 5 trillion. Government ownership and private ownership are not a measure of banks to innovate.

According to descriptive statistics, state-owned banks generally tend to have the opportunity to innovate higher than private-owned banks, with the note that the banks are in the same size. State-owned banks and private-owned banks are no different in terms of innovation. Almost all private-owned banks also innovate like state-owned banks, in the provision of ATMs, internet and mobile banking. However, there is not enough evidence to show that ownership in this study has a significant influence on banking financial innovations. This result contradict with Malhotra and Singh (2007)

that private banks tend to be more innovative than state-owned banks.

### CONCLUSION, LIMITATION, AND SUGGESTION

Based on the results of the analysis and interpretation of the data, it can be drawn conclusions as follows:

First, cost efficiency has a significant effect on banking financial innovation based on logit 1 and logit 3. The more efficient the banks are, the more innovative the bank will be in providing ATMs and internet / mobile banking compared to ATMs, the internet, and mobile banking. The more efficient the banks are, the fewer the banks that have no ATM compared to those that have an ATM, internet, and mobile banking. It means that at least banks have financial innovations in ATMs, internet / mobile banking. If banks use ATMs, internet, and mobile banking, the cost efficiency of the bank will decrease because the costs to be incurred by banks for financial innovations will be greater than applying only two-products innovations.

Second, bank size has a significant effect on banking financial innovation. The greater the size of the bank, which is judged by the greater total assets, the more innovative the bank will be in terms of providing facilities to customers. The probability of banks to perform banking financial innovation includes ATMs, the internet, and mobile banking with increasingly large banking size.

Third, the number of branches has a significant effect on banking financial innovation, without

ATMs and with ATMs, rather than with ATMs, internet banking, and mobile banking.

Fourth, the bank age has a significant effect on banking financial innovation for ATMs rather than ATMs, internet banking, and mobile banking. The older the age of the bank, the greater the probability for the bank to innovate by providing ATMs more than by providing ATMs, the internet and mobile banking. The younger the age of the bank, the greater the probability for the bank to innovate by providing ATMs, internet banking and mobile banking rather than providing ATMs alone.

Finally, the ownership does not have a significant effect on banking financial innovations, with the absence of ATMs, the presence of ATMs, and the presence of ATMs and internet / mobile banking rather than ATMs, internet, and mobile banking.

This study has limitations, one of which is that the measurement of financial innovation is based only on the dummy variable. It is recommended that further research measure the banking financial innovations using quantitative data, such as the number of transactions in the use of the internet and mobile banking, or the growth of banking innovation both in the process and output. In addition, it is suggested that further research uses a larger sample, especially in another company. To innovate, banks need to pay attention to efficiency, total assets, number of branches, and age in conducting operational activities.

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