

Digitalization and Efficiency: Technology-based Service of Indonesia Sharia Commercial Banks

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Firsty Izzata Bella

*Islamic Economics Department, Faculty of Economics and Business,
Universitas Airlangga, Surabaya, East Java
firsty.izzata.bella19@feb.unair.ac.id*

M. Fikri Himmawan

*Islamic Economics Department, Faculty of Economics and Business,
Universitas Airlangga, Surabaya, East Java
himmawanfikri@gmail.com*

ABSTRACT

This study aims to assess the technology-based service effectiveness on bank profitability as well as to evaluate the efficiency and stability of Islamic Commercial Banks in Indonesia. The model was analyzed by using multiple linear regressions with generalized least square estimation technique and Data Envelopment Analysis (DEA) with data are gathered from Q1 2017 to Q2 2020. The exogenous variables included were Branchless Banking (BB), Third-party Funds (DPK), and Technology Service Quality (TSQ), with banking operational income (PENDOP) as endogenous variable. The DEA method analyses the VRS and CRS scale while using output orientation. Using the inputs of DPK, operational expenses, and total funding, with the outputs of operational earnings and total assets. The main finding suggests that DPK played as a dominant variable, following by TSQ and BB on bank operational income. Moreover, the results of the DEA models showed in four quadrants in each CRS and VRS model. Overall, according to the CRS result, the banks are evenly dispersed around all quadrants. While from the VRS result, commercial sharia banks are mainly dispersed around the first and fourth quadrants.

Keywords: Digitalization, Efficiency, Technology-based Service, Commercial Sharia Bank JEL Classification Code(s): G21, L21, L25, O14



INTRODUCTION

Banking is one of the financial service sectors as a collector and channel of public funds to support the implementation of national development in the context of increasing equitable development. Funds collected by banks

from surplus units then operated through a credit channeling mechanism to business actors which will have a positive impact on economic movement and labor absorption as well as opening up investment opportunities both on a national and international scale. In addition to the function of collecting and distributing funds, banks are also entitled to provide banking services to their customers.

In 2019, the publication of the State of the Global Islamic Economy Report 2019/2020 by Thomson Reuters stated that Islamic banking becomes the most essential sector in developing the world's Islamic economy and finance with a contribution of 71%, or equivalent to USD 1,72 trillion of the total industrial assets. Based on this report, Indonesia ranks the 5th position as a player in the global Islamic Economics and Finance arena, experiencing a significant increase from the 10th position in the previous year.

Nonetheless, Islamic banking in Indonesia as of July 2020 only owned 9,68% of the total assets of the banking industry. This is a challenge to maximize the performance of Islamic banking to overtake its conventional competitors which require strategies to increase total assets and services provided to customers and prospective customers, one of which is through digitization and efficiency of banking services. The phenomenon of digitalization can minimize input because banks are not required to open branches and maximize service usage through smartphones in transactions including virtual submissions, this benefit is in line with the policy in POJK No.19 of 2014 concerning branchless banking services for inclusive financial purposes. Thus, the input represented from these costs can maximize output which in this case is reflected with the operating income and the addition of total assets. With the existence of a countercyclical policy (branchless banking), as a series of digitalization in the financial and banking sectors, it is hoped on its ability to foster financial inclusiveness.

Currently, a new hope arose when it is announced that there are three State-owned Association banks (Himbara), namely Bank BRI Syariah, Bank BNI Syariah, and Bank Mandiri Syariah (BSM) which have signed a Conditional Merger Agreement (CMA) related to the merger plan of Islamic commercial banks on Monday, 12th of October 2020 (Sulaeman, 2020). This strategy received a lot of support from the government to experts, one of which is the Financial Services Authority (OJK). According to the Chairman of the OJK Board of Commissioners Wimboh Santoso, he mentioned that "this sharia banks merger action will increase efficiency and competitiveness according to OJK's goals to build a banking industry

that is competitive and can provide better service quality and to make the best contribution in economic development” (Kontan, 2020). With this merger, technology-based services are one of the strategies that must be strengthened in banking operations.

It is also stated that traditional banks with legacy modes are faced with the urgent challenge to digitally transform their service, since both consumers and businesses’ need for availability, access, and control of digital banking service (The Jakarta Post, 2020). Strengthening the Islamic financial sector as well as utilizing and reinforcing the digital economy are two of the four main strategies carried out through the 2019-2024 Indonesian Sharia Economic Master Plan initiated by the National Sharia Finance Committee (KNKS) to make Indonesia as the center of the world’s sharia economy (KNEKS, 2018). Hence, research on the combination of the banking sector and digitization needs to be carried out in addition to supporting the strategies formulated by the KNEKS, as well as disseminating the Islamic religion, one of which is the financial sector which is widely used by the public.

In modern times with the beginning of the digital era 4.0, digital facilities are used as one of the offered strategies for customers and prospective customers in opening accounts and making transactions through the banking sector. A research conducted by the social media management platform Hootsuite (2020) in collaboration with social marketing agency, We Are Social, entitled “Digital 2020: Indonesia” depicted that as many as 64% or 175,4 million Indonesians are internet users. This figure indicates that more than half of Indonesian have the opportunity to access banking services through smartphones. Additionally, the existence of government support through the issuance of the Financial Services Authority Regulation (POJK) No.12 of 2018 concerning the Implementation of Digital Banking Services by Commercial Banks can be utilized as a reference for banks in providing this service.

The presence of digital banking or electronic banking facilities will reduce operational costs and increase bank’s profitability, but remained on providing convenience to customers through the ease and speed of conducting transactions (Stoicaa *et al*, 2015). As for the customer side, it provides benefits in the form of time and cost since it can be accessed quickly, anywhere, and anytime as long as the phone is connected to the internet network (Susanto, 2017). Therefore, both parties can get benefit from the presence of this facility. Nevertheless, it must be noted that the regulator should continue

updating the applicable regulations, while the bank can continue to innovate in providing digital banking services.

Several previous studies revealed that digital banking services give a positive impact on profit efficiency (Margaretha, 2015) and the quality of banking services (Chrismastianto, 2017; Susanto, 2017). Apart from Indonesia, research on digital banking services has also been studied in several countries such as Thailand from 15 years ago (Jaruwachirathanakul, Bussakorn; Fink, 2005), in Ghana, West Africa (Kwateng, Kwame Owusu; Osei-Wusu, Edna Edwina; Amanor, 2020), in Pakistan (Raza, Syed Ali; Umer, Amna; Qureshi, Muhammad Asif; Dahri, 2020), and so on. In measuring the efficiency, stability, and performance of banks, the majority of previous researchers applied the DEA method (Al-Khasawneh, Jamal Ali; Bassadat, Karima; Aktan, Bora; Thapa, 2012; Kwateng, Kwame Owusu; Osei-Wusu, Edna Edwina; Amanor, 2020; Puteh, Anwar; Rasyidin, Muhammad; Mawaddah, 2017; Sakti, Muhammad Rizky Prima; Mohamad, 2018). Apart from DEA, Panel Regression Analysis through the random effect model (REM) and fixed-effect model (FEM) is also utilized in measuring bank performance (Dinh, Van; Le, Uyen; Le, 2015). Therefore, this study uses two analytical methods, namely Panel Regression and DEA to measure the partial and simultaneous influence between digital banking services on bank income as well as measuring the level of efficiency and stability of sharia commercial banks in Indonesia.

The results of this study are expected to be useful for many parties, for academics to conduct further research on digital-based banking services. As for the banking sector, this research can be used as an internal evaluation and innovation of services offered to customers, as well as a consideration in developing strategies to increase efficiency and profitability performance. As for policymakers, this research is expected to be useful in determining policies for increasing efficiency and digital-based services in banking.

LITERATURE REVIEW

Digital banking, which was initially an application with standard transaction features, has been changed into an application with a variety of functions, ranging from opening savings and investment accounts, withdrawal without cards, rela-time gross settlement, redeem points, shopping, and several other types of transactions (Mufarikh *et al.*, 2020). It encompasses and cover all banking activities (internet banking and mobile banking) but in online

ways (Kusumawati & Rinaldi, 2020). Specifically, Chrismastianto (2017) mentioned that digital banking is a form of financial technology that has several strengths as explained in namely 1) Ease of accessing banking service data and conducting transactions anytime and anywhere, 2) Ability to reach people to disadvantaged, frontier and outermost areas (3T) in Indonesia where no bank branch offices are available, 3) Save on bank operational and marketing costs, 4) Better known by the public by collaborating with other financial technology service providers. Besides, the level of security for customer data and funds must be improved to minimize potential abuse (fraud) as well as support for strengthening and equitable distribution of internet access in the regions.

The role of financial technology in the financial ecosystem has become a momentum for banks to innovate. The limited number of ATMs and bank branch offices is a challenge for the banking industry (Anestia, 2020). By maximizing the role of digital banking, including the presence of branchless banking, it is hoped that it can improve the efficiency of banking performance, especially Islamic banking. A guidebook entitled "Wise on Electronic Banking compiled by OJK (2015) emphasizes that the presence of digital banking services supported by developments in technology, social media, and people's lifestyles provides benefits to the banking industry, including generating income from fee-based income, reduce transaction costs, develop business, and increase customer trust and loyalty

Puteh, Rasyidin, and Mawaddah (2017) stated that the concept of efficiency can be interpreted as a concept in achieving results by optimizing the use of existing resources. Efficiency in a productive perspective is limited to a review of the relationship and operation of the production process that is reflected through input and output. In general, the efficiency in the production concept tends to assess operations, so it is seen from a long and cost perspective. Bank efficiency is one of several important indicators in analyzing bank performance and can also be used as a means to further increase monetary effectiveness. By identifying the allocation of input and output levels, the causes of inefficiency can be identified. The optimal level of output is the goal expected by the bank by using existing inputs or even minimizing the level of input (Widiarti, Astoeti Wahjoe; Siregar, Hermanto; Andati, 2015).

Moreover, Hardianto and Wulandari (2016) mentioned that there are three concepts to measure efficiency, namely technical efficiency, cost efficiency, and allocation efficiency. Technical efficiency is the ratio

between the input that has been used to get a certain output. The production process will be called efficient if output increases without the need for additional inputs. Furthermore, this concept will be used in measuring bank performance. Meanwhile, cost efficiency is a concept that uses input pricing, while allocative efficiency is used to measure a bank's ability to use input in optimal proportions.

According to a study, the size of a bank is not an important factor in increasing banking efficiency, in contrast, the use of technology accompanied by knowledge and skills of personnel can provide technical efficiency growth in banks (Omar, Mohd Azmi; Rahman, Abdul Rahim Abdul; Yusof, Rosylin Mohd; Majid, 2006). In line with the results of the above research, Susanto's (2017) study also concluded that the use of internet banking and mobile banking as measured through software, databases, personnel, and service procedures has a significant impact on the level of service through the level of reliability, responsiveness, assurance, empathy, and intangible factors. In this study, the use of technology was measured through the Branchless Banking (BB) variable as a dummy variable and the Technology Service Quality (TSQ) which was measured through the digital banking output variable and yearly page views.

Research conducted by Stoicaa, Mehdian, and Sargu (2015) applied the DEA and PCA approaches in examining the impact of digital banking on bank performance in Romania, the results show that the majority of the banks applied a combination approach in their operational strategies, namely digital banking services, and cost reduction strategies.

Al-Khasawneh, Bassedat, Aktan, and Thapa (2012) compared the cost and income efficiency of Islamic and conventional banking operating in Arab-African countries in 2003-2006. By using the non-parametric DEA method, the results show that the cost efficiency of Islamic and conventional banks is remained the same, on the other hand, Islamic banking generally shows a more efficient income. Moreover, it was also stated that a country that implements a dual banking system has the possibility to be more successful than a country that simply adopts Islamic banking because customers can easily adjust their needs.

RESEARCH METHOD

This research uses a quantitative approach with multiple regression models using panel data and Data Envelopment Analysis (DEA) to test bank

efficiency. Secondary data is collected through quarterly reports of Islamic commercial banks from the first quarter of 2017 to the second quarter of 2020. The sample selection used refers to the purposive sampling method as Islamic commercial banks which are listed and supervised by the Indonesian Financial Services Authority (OJK). In total, 14 Islamic commercial banks are analyzed, the description of the banks are summarized in Table 1.

The panel Regression method is considered suitable because the research applied a combination of cross-section and time-series data, in addition to including several variables. This research model applies the same model as the research used by Nastiti and Kasri (2019). Specifically, the general formulation of panel data regression uses the following equation.

$$PENDOP = \alpha + \beta_1 DPK + \beta_2 TSQ + \beta_3 BB + \varepsilon$$

Furthermore, for the empirical test, the general equation above is converted into a natural logarithmic (Ln) model and can be formulated through the equation below.

$$\ln(PENDOP) = \alpha + \beta_1 \ln(DPK) + \beta_2 \ln(TSQ) + \beta_3 BB + \varepsilon$$

Both variable bank operational income (PENDOP) and third-party funds (DPK) are measured in Rp million and collected through quarterly reports of each Indonesian Commercial Sharia Banks as listed in Table. 1 provided on each bank's official website. Furthermore, technology service quality (TSQ) is measured through the digital banking output variable and yearly page views of each bank's website. While branchless banking (BB) as a dummy variable with some categories: banks that neither operate mobile banking (m-banking) nor have carried out initial public offering (IPO)= 0; Banks that already have m-banking but have not yet conducted IPO = 1; Banks that have operated m-banking and have performed IPO = 2

Table 1. Sample Description

No.	Commercial Sharia Bank
1	Bank Syariah Mandiri (BSM)
2	Bank Rakyat Indonesia Syariah (BRIS)
3	Bank Negara Indonesia Syariah (BNIS)
4	Bank Central Asia Syariah (BCAS)
5	Bank Muamalat Indonesia (BMI)

6	Bank Panin Syariah (BPS)
7	Bank Syariah Bukopin (BSB)
8	Bank Mega Syariah (BMS)
9	Bank Victoria Syariah (BVS)
10	Bank Pembangunan Daerah Nusa Tenggara Barat Syariah (BPD NTBS)
11	Bank Tabungan Pensiunan Nasional Syariah (BTPNS)
12	Bank Aceh Syariah (BAS)
13	Bank Pembangunan Daerah Jawa Barat dan Banten Syariah (BJBS)
14	Maybank Syariah (MS)

Source: Financial Service Authority (OJK)

The DEA method uses Constant Return to Scale (CRS) and Variable Return to Scale (VRS). CRS efficiency assumes that the change of value in the inputs is also proportional to the change in the outputs. Adversely, VRS efficiency assumes that changes in outputs are not proportional to the changes in the inputs, the resulting outputs may be smaller or larger than the inputs (Yulita, I; Rizal, 2016). The variables used as input and output are shown in Table 2.

Table 2. Variables Input and Output of DEA

No	Variables	Symbol
Outputs		
1	Operational Income	PENDOP
2	Total Assets	TASSET
Inputs		
1	Third-Party Funds	DPK
2	Operational Cost	BIOP
3	Total Financing	TFIN

Source: Author's own

RESULTS

Descriptive Statistics

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Table 3. Descriptive Statistics Analysis

Variables	Minimum	Maximum	Mean	Std. Deviation
PENDOP	7.506	5.747.030	728.952	1,048,281
TASSET	659.857	114.746.985	22.094.329	26,479,488
DPK	16.823	101.915.689	18.250.963	23,203,325
BIOP	2.130	4.460.319	562.358	802,223
TFIN	58.867	75.445.553	14.597.575	17,916,196

Source: Processed data (2020)

The descriptive above are using million Rupiahs as the base unit since financial reports are in thousands or millions so the standard deviation is also in the hundreds of thousands. Moreover, since the commercial sharia banks are having mixed ownership, state-owned banks commonly have bigger value in all variables thus contributes to the big maximum value. Adversely, private-owned banks majorly contribute to the minimum value, hence the disparity between the state-owned and private-owned banks further contribute to the deviation level.

Panel Regression Analysis

To determine the research model between the Random Effect Model (REM), Fixed Effect Model (FEM), or Common Effect Model (CEM), the Breusch-Pagan Test, Chow Test, and Hausman Test are carried out with the results as shown in the following table.

Table 4. Determination of the model used

Determination of Research Model	Chow Test	Hausman Test	Breusch-Pagan Lm Test
Common Effect Model (CEM)			0,0000***

Fixed Effect Model (FEM)	0,0000***
Random Effect Model (REM)	1,0000

Source: Processed data (2020)

First, the Chow test results indicate a probability value below 0,05 at the significance level of α 5% ($0,0000 < 0,05$). Then, H_0 is rejected, meaning that the FEM model is better than the CEM model. Second, the Hausman Test results show that the probability of F-statistics (1,0000) is greater than 0,05, with significance ($1,0000 > 0,05$). Thus, the results of the study confirm that the REM model is better than the FEM model. Third, the Breusch-Pagan Lagrange Multiplier (LM) test with an F-statistics probability of 0,000 or less than the significance level α ($0,000 < 0,05$), this shows that H_0 is rejected and H_1 is accepted, which means that the REM model is better than the CEM model. To sum up, the best estimation model is the random effects model (REM) that will be used in the next analysis process.

Furthermore, to ensure the robustness of the model, a classic assumption test was carried out on panel data regression analysis (Gujarati, 2004) to test the validity of the research results and consisting of multicollinearity diagnostics and normality tests. The autocorrelation test in the Generalized Least Square (GLS) method was not carried out because it was only carried out on time-series data, by using panel data in this study, the autocorrelation test was not mandatory to do (Gujarati, 2004).

Table 5. Multicollinearity test

Variables	BB	DPK	TSQ
BB	1	0,1062528635919124	0,3694622171996798
DPK	0,1062528635919124	1	0,3405225143084504
TSQ	0,3694622171996798	0,3405225143084504	1

Source: Processed data (2020)

From the results of the multicollinearity diagnosis, it was found that the Pearson correlation coefficient value was smaller than 0,80 ($VIF < 0,80$),

consequently, it is noticeable that there was no multicollinearity problem in the data used for this study. Furthermore, the normality test with a Jarque-Bera value of 2,405943 and a probability of 0,300301 > 0,05 implies that H1 is rejected, meaning that the data is normally distributed.

Furthermore, the following table summarizes the results of the REM used in this study. At the level of probability between variables shows a value smaller than α (<0,05), therefore, each independent variable (BB, DPK, TSQ) partially has a significant positive effect on the dependent variable (PENDOP). Specifically, DPK has the greatest influence on PENDOP, namely 12,6%, followed by TSQ with 2,22% influence, and the least influence is BB of 1,01% with the criteria: banks that neither operate mobile banking (m-banking) nor have carried out initial public offering (IPO) = 0; Banks that already have m-banking but have not yet conducted IPO = 1; Banks that have operated m-banking and have performed IPO = 2. This is due to avoiding the near singular matrix, which means that there are two or more highly correlated variables resulting in multicollinearity.

Table 6. Panel Data Regression Test Results

Dependent Variable: LOG(PENDOP)
 Method: Panel EGLS (Period random effects)
 Date: 10/13/20 Time: 01:47
 Sample: 2017Q1 2020Q2
 Periods included: 14
 Cross-sections included: 14
 Total panel (balanced) observations: 196
 Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1,156944	0,931488	1,242039	0,2157
BB***	0,123317	0,121010	1,019070	0,0195

LOG(DPK)***	0,563397	0,044439	12,67804	0,0000	Digitalization and Efficiency: Technology
LOG(TSQ)***	0,188214	0,084728	2,221385	0,0275	
R-squared	0,618882	Mean dependent var	5,451554		
Adjusted R-squared	0,612927	S.D. dependent var	1,490890		
S.E. of regression	0,927560	Sum squared resid	165,1905		
F-statistic	103,9271	Durbin-Watson stat	1,718889		
Prob(F-statistic)	0,000000				

Source: Processed data (2020)

Based on the above output, it can be found that the Adjusted R square value of 0,612927 which means that the variables of BB, DPK, and TSQ have a simultaneous effect on the PENDOP variable by 61,2%, and the remaining 38,8% is influenced by other variables outside the model. Therefore, the researcher argues that further research is required in future studies by adding the independent variable (X) to increase the percentage of simultaneous influence on the dependent variable.

As for the simultaneous significance test, it can be seen that the independent variable has a significance of 0,000, which means that it is smaller than the significance level used, namely 5% or 0,05. This means that all the independent variables used in this study simultaneously affect the dependent variable. Or H_0 is rejected, the variables BB, DPK, and TSQ simultaneously have a significant effect on PENDOP.

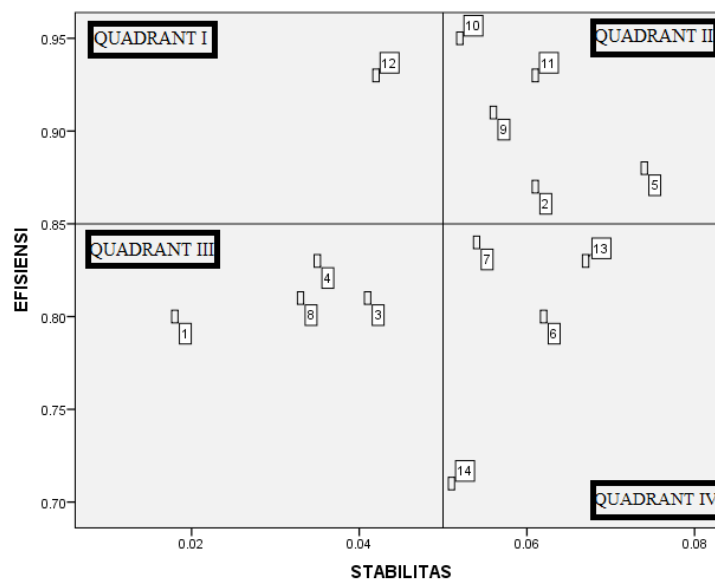
DEA Analysis

In Figure 1, commercial sharia banks are evenly dispersed around all quadrants. The first quadrant shows only one bank with high efficiency and stability namely BAS. The second quadrant consists of banks with high efficiency but low stability with BRIS, BMI, BVS, BPD NTBS, and BTPNS categorized in it. The third quadrant defines banks with low efficiency and high stability and is comprised of BSM, BNIS, BCAS, and BMS. Lastly, the

fourth quadrant contains BPS, BSB, BJBS, MS as banks with low efficiency and stability.

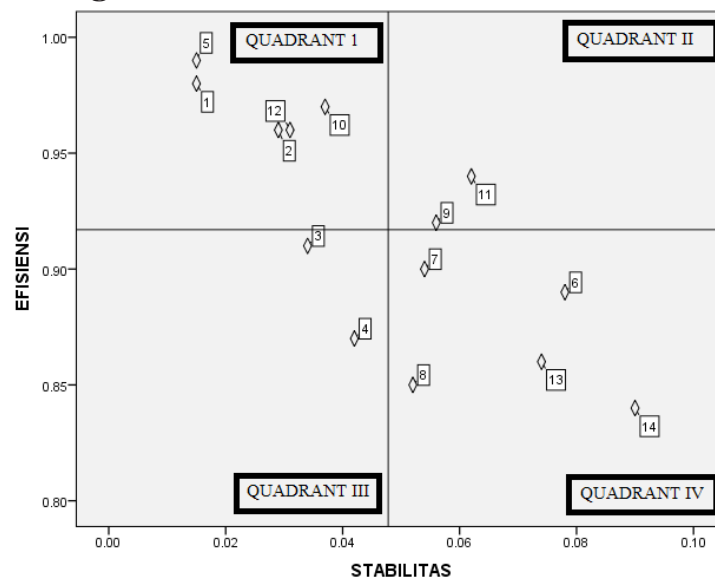
After analyzing the CRS model, the following analysis is the VRS model. The comparison between CRS and VRS is needed as CRS only measure the outputs which proportional to available inputs, expressing a constraint between outputs and inputs. Differing from the CRS model, the VRS model put forward the variables. In the output-oriented specification, VRS will assess the inputs to maximize the available outputs.

Figure 1. Constant Return to Scale (CRS) Quadrant



Source: Processed data (2020)

Figure 2. Variable Return to Scale (VRS)



Source: Processed data (2020)

From the VRS results, commercial sharia banks are mainly dispersed around the first and fourth quadrants. The first quadrant shows banks with high efficiency and stability, consisted of BSM, BRIS, BMI, BPD NTBS, BAS. The second quadrant consists of banks with high efficiency but low stability with BVS and BTPNS categorized in it. The third quadrant defines banks with low efficiency and high stability and is comprised of BNIS and BCAS. Lastly, the fourth quadrant contains BPS, BSB, BMS, BJBS, and MS as banks with low efficiency and stability.

Table 5 summarizes the average value of the mean value and standard deviation value of each bank from the quarterly data used in the study. The mean value represents the efficiency level. It shows that the average mean value on the CRS and the VRS models is 0,85 and 0,92 respectively. It can be inferred that all commercial sharia banks are having 85% efficiency if assessed with the CRS model and 92% efficiency in the VRS model. On the other hand, the VRS model assessment inferring an average efficiency of commercial sharia banks with a value of 92%. In the CRS model, MS has the lowest while BPD NTBS has the highest average value. In the VRS model, MS also has the lowest while BMI has the highest average value.

Table 7. Average CRS and VRS Summary

Unit Name	CRS		VRS	
	Mean	Std. Dev.	Mean	Std. Dev.
BSM	0,80	0,018	0,98	0,015
BRIS	0,87	0,061	0,96	0,029
BNIS	0,81	0,041	0,91	0,034
BCAS	0,83	0,035	0,87	0,042
BMI	0,88	0,074	0,99	0,015
BPS	0,80	0,062	0,89	0,078
BSB	0,84	0,054	0,90	0,054
BMS	0,81	0,033	0,85	0,052
BVS	0,91	0,056	0,92	0,056
BPD NTBS	0,95	0,052	0,97	0,037
BTPNS	0,93	0,061	0,94	0,062
BAS	0,93	0,042	0,96	0,031
BJBS	0,83	0,067	0,86	0,074
MS	0,71	0,050	0,84	0,090
AVERAGE	0,85	0,05	0,92	0,048

Source: Processed data (2020)

The standard deviation represents the efficiency level, Table 5 shows that the average standard deviation on the CRS and the VRS models are 0,05 and 0,048 respectively, the standard deviation value can also be interpreted as the risk level experienced by commercial sharia banks, meaning that the difference in value or the average risk is only about 5% and 4,8%. It is noticeable that BSM has the lowest standard deviation value both in the CRS and VRS model, but BMI also got the same amount of standard deviation in the VRS model as BSM, meaning that BSM and BMI have strong stability in responding to shocks from efficiency factors. Meanwhile, the highest standard deviation value in CRS is positioned by BMI, while MS has the highest standard deviation value in the VRS model, indicate that BMI and MS have the lowest and more vulnerable stability against shocks from the efficiency factor.

DISCUSSION

Technology is an essential thing to be maximized on its utilization, especially in the practice of banking services because it can reduce operating costs, consequently, bank income can be maximized. With 64% of the number of internet users in Indonesia from the total population, access to banking services should also be easier for the public to reach. However, the results of the research in Table 5 show that banking technology services as measured by Technology-Service Quality (TSQ) and Branchless Banking (BB) still have a very small effect on banking operational income, with a dominant influence on Third-Party Funds (DPK). The results of research that show the positive influence of digital banking services on banking operating income in this study confirm the research of Dinh, Le, and Le (2015) which concluded that there is a positive impact of internet banking on non-interest income is by increasing the level of profitability at banks, but the effect is identical takes a time lag after 3 years and has a relatively small degree.

Technological advancement as the mobile banking system is not well optimized even though the coverage scope is good and giving easier banking access, considering the viewpoint in software-wise and user-wise. Several mobile banking apps are not lightweight and incompatible with older mobile devices, suggesting code problems but there is a lot of room for tweaking. User accessibility also had to be advertised and promoted as older aged people prefer to physically go to banks than using mobile banking, giving tutorials may become an answer to this problem. Connection issues also need to be improved especially in rural areas, cities with high population

density also having this problem as people working from home may absorb the signal thus lagging the mobile banking apps. The mobile banking product can be innovated with online alms and donations from customers to those in need and giving merchandise, discount, or cashback in return for customer's donations. However, Omar, Rahman, Yusof, and Majid (2006) emphasized that along with the increase in technology, a massive spread of technological knowledge is required. Training and technical expertise should be constantly upgraded along with technological evolution.

The role of technology in the banking sector is also supported by OJK through POJK No.3 of 2017 concerning the Implementation of Digital Banking Services by Commercial Banks, which can be provided either through banks directly or through partnerships with third parties, both in the form of Financial Services Institutions (LJK) and non- LJK. Christmastianto (2017) stated that there are two opportunities from the implementation of financial technology in banking institutions in Indonesia, namely, *first*, public awareness is starting to grow to save and borrow financial needs through banking services, because it is safer and more profitable in terms of deposit rates, and low-interest costs on loans. *Second*, the presence of OJK in establishing regulations and supervision can minimize criminal acts in banking, and reduce public concerns in using digital banking services.

Susanto (2017) explained that in order to increase customer loyalty, the bank can provide customer needs through various types of transactions via i-banking or m-banking through a seamless network without restriction network (not accessible). In addition to connectivity in accessing digital banking services, service display, ease of access, and consumer experience must also be considered in presenting financial technology, so that all groups of people, both young and old, who live in urban and rural areas can easily take advantage of this service. Raza, Umer, Qureshi, and Dahri (2020) asserted that to measure customer satisfaction and loyalty in using digital banking services, the efficiency along with site organization, responsibility, reliability, users' friendliness, personal need become important features of internet Banking Service Quality (iBSQ)

Another form of digital banking services except i-banking and m-banking is Branchless Banking (BB), which is defined by Bank Indonesia as the activity of providing limited payment and financial system services that are carried out not through a physical bank office, but by using technological means and/or third-party services, especially for serving unbanked people. This is an unconventional step for financial institutions to expand the reach

of services. In the BB model developed by banking, services are carried out by collaborating with retail shops and post offices, provided that they have a telecommunications network that can be connected to the bank's information system (Bank Indonesia, 2013)

The small influence of BB on banking operating income is evidence of technology services that have not been effectively and efficiently utilized by banks and customers, the results of this study are also suitable with Nastiti and Kasri (2019) who summed up that the regulations regarding financial technology have not been effective in achieving banking objectives, at least in the short term. Therefore, the authorities should seek to intensively encourage Islamic banking to implement and use branchless banking, especially for the features of financing services, to improve the performance of Islamic banking in Indonesia.

DPK, as the most dominant variable affecting PENDOP, however, needs to be continuously increased, because these funds can be maximized as a distribution of business credit to people in need. Increasing third party fund through mutual assistance campaign with other organizations such as non-bank financial services and mass organizations may be utilized with crowdfunding and additional partnership contract to fund vulnerable bank customers, banks may act as an intermediary from those organizations and distribute funding, banks may also entice funder with installment payment in the long run from the customers.

For commercial sharia banks which considered as having low stability may utilize better specification for customer funding, as the level of credit risk happening now is the consequence of the credit risk level in the past (Iqbal, 2017) this condition puts the importance of Sharia Supervisory Board (SSB) core competency.

CONCLUSION AND RECOMMENDATION

In the current disruptive era, technology is an important key in connecting access for information to customers, especially for the financial sector industry. Assessment of the image of a bank in society can be presented informatively through technology intermediaries, such as websites, mobile banking, and also access to the capital market, the banking sector must be able to keep up with the times because this includes aspects of transparency and accountability in banking to foster a positive image for society so that it is expected to be able to add customers to banking. Furthermore, the

government also focuses on this problem where there is a comprehensive regulation through the OJK, namely POJK No. 12/POJK.03/2015 concerning stimulus in financing is expected to be able to improve the development of Islamic banking in general from the intermediary side.

The main findings of this study indicate that technology-supported through policies plays a positive role in increasing Third-Party Funds (DPK) which are expected to be able to become an instrument for accelerating Islamic bank financing. This is evident where DPK has the greatest positive impact on the operating income of Islamic general banking in Indonesia followed by Technology Service-Quality (TSQ) and Branchless Banking (BB). Sharia banking in Indonesia is expected to be able to grow the quality of assets related to the funds raised by responding to support through POJK No. 3 of 2017 concerning the implementation of digital services, meaning that Islamic Commercial Banks in Indonesia do not have to open branches in areas where access is quite difficult to reach, it is enough to increase digital services and placing agents in the accessible areas or made through third-party partners, aimed to increase segmentation and the number of customers that can be connected through digital banking services, eventually, it will give an impact on the increase in deposits as a form of a variable in terms of the quality of banking assets.

Concerning the small number of Islamic Commercial Banks in Indonesia that has yet conducted Initial Public Offering (IPO), this has an impact on the limited presentation of access to transparency and accountability of Islamic Commercial Banking in Indonesia because only two Islamic Commercial Banks have made Initial Public Offerings, namely BRIS and BTPNS with ticker code (PNBS), these issues become a challenge for the Stakeholders. As well as using the TSQ feature as a form of a marketing campaign is still not maximized by the majority of Islamic Commercial Banks in Indonesia, only a few Islamic Commercial Banks use Service-Quality Technology as segmentation for their marketing campaigns such as those dominated by state-owned Sharia Commercial Banks (BUMN).

Furthermore, in terms of policymakers, the Authority must also strive intensively to encourage sharia banking in implementing and using Branchless Banking and the use of Technology Service-Quality (TSQ), especially about service features for providing information to customers and features of financing services. which is user friendly. For stakeholders in the management of Islamic banks, this research can be useful in guiding the potential impact of TSQ through the Financial Services Authority (OJK)

policy on improving institutional performance. And finally, for academics, the limitation in this study is that in the future it can include sectoral analysis consisting of case studies for Islamic Commercial Banks in Indonesia, as well as adding variables that include asset quality in Islamic general banking in Indonesia in transforming it into a financing instrument.

These findings are expected to enrich and provide policy input from both the regulator and the stakeholders of Islamic banking management in Indonesia in further development related to Islamic General Banking in Indonesia. Despite findings revealed by this research, several limitations such as the short period of data (2017-2020), the scoping study which only focused on Indonesia, and to exclusion of the Islamic Banking Unit (UUS), might be considered to be added for the future research.

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