Measuring Islamic Rural Banks Productivity in Indonesia 2016-2021: Quadrant Analysis, Technological Change, And Covid-19 Pandemic Impact

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The Islamic finance industry in Indonesia is currently a global concern, one of which is financial institutions, so productivity measurement is essential for BPRS in Indonesia. This study tries to analyze the BCC model as a basic model to see the level of productivity in 92 BPRS using the Malmquist productivity index, both in terms of changes in efficiency and changes in technology during the six-year observation period (2016-2021) using the Malmquist Index. There are several findings from this study. First, the overall level of productivity in BPRS shows an increase, and it is known that changes in efficiency and technology affect the increase in productivity of BPRS. Furthermore, in the analysis of each BPRS, it is known that the productivity of the BPRS fluctuates from year to year. Second, the regional study between Java and Non-Java found that BPRS in Java has higher productivity levels than BPRS outside Java, considering that Java is the center of the Indonesian economy and the impact of high technological changes on BPRS in Java. Third, the following finding is related to the productivity of BPRS before and after the Covid-19 pandemic, which showed a decline during the Covid-19 pandemic. Still, the decline was not significant when viewed from the results of statistical tests. Then based on the analysis of the Malmquist Index quadrant, it shows that the BPRS dominates quadrant 2 with the category of high technology and low efficiency, namely back to 25 BPRS, then followed by quadrant 4 with the type of technology and low efficiency, opening 24 BPRS, next is quadrant 3 with a total of 23 BPRS and quadrant one which has the highest category reaches 20 BPRS.

Keywords: BPRS; Malmquist Index; Productivity

INTRODUCTION

Covid-19, which first appeared in China in December 2019, has spread massively throughout the world. The impact of the Covid-19 Pandemic that has arisen has not only attacked from a health perspective but has also incurred global economic costs (Zheng and Zhang, 2020). The spread of this virus and the preventive measures taken by the government to reduce it are the main reasons for the cessation of production and consumption activities (Arianto, 2021). Likewise experienced by one of the economic sectors, namely the banking industry which is the heart of a country's economy (Adeabah and Andoh, 2020).

The high risk of credit and financing during the corona virus pandemic, accompanied by a decrease in capital and third-party funds (DPK) has the potential to create liquidity risks for the banking sector, especially banks whose core business is lending such as credit banks. Sukendri (2021) and Sumadi (2020) found that the Covid-19 pandemic had an impact on national banking liquidity. So that the role of financial institutions is very important, one of which is through the Deposit Insurance Corporation (LPS) in carrying out credit or financing restructuring programs in banks and other policies to maintain the stability of the banking financial system then LPS has additional authority in terms of placing funds during the economic recovery as a result of the pandemic Covid-19 to Banks with liquidity problems. This authority is one of the functions of a risk minimizer in deposit insurance. IDIC not only plays an important role during the pandemic but also during the post-covid-19 pandemic, which is a risk minimizer in the financial system for Handling the Covid-19 Pandemic.

The banking industry becomes an institution that acts as an intermediary institution and a source of funding for developing countries. In addition, the banking industry has an important role in the economy of Indonesia (Phase & Abma, 2003). In Indonesia in particular, banking functions as an institution that collects and distributes social funds in supporting the implementation of national development and increasing equitable development, economic development, and national stability, leading to an increase in the standard of living in Indonesia (OJK, 2016).

As part of the banking industry ecosystem, the existence of BPR and BPRS aims to provide banking products and services for people belonging to the economically weak class, as well as Small and Micro Enterprises (UKM) both in urban and rural areas. In general, the two types of banks share characteristics and objectives with Microfinance Institutions (LKM), namely in the context of commercial and community development (Buchori, 2003). BPR and BPRS function to offer financial services similar to Islamic commercial banks, but BPR is not permitted to handle payment flows, such as clearing. BPR & BPRS can only be owned by Indonesian residents, legal entities, local governments, or joint ventures between Indonesian citizens, legal entities, and local governments (Fatimatuzahra, 2016; Wardiwiyono, 2020).

In a report published in September 2021, the Financial Services Authority (OJK) stated that the number of BPRs and BPRS in Indonesia has reached 1,646 units. This number consists of 1,481 BPRs and 165 BPRS. This number shows a decrease compared to 2016, the number of BPR and BPRS was still recorded at 1,799 units, then in 2017, it decreased to 1,989 units. Furthermore, in 2018 BPR and BPRS again recorded a decrease to 1,764 units. Two years later, namely in 2019 and 2020 which in that year was the year the covid 19 pandemic emerged, the number of the two types of banks remained at 1,709 and 1,669 units respectively. Seeing that data on the number of BPRs and BPRS in Indonesia continues to decrease every year, measurement of the performance of BPRs and BPRS must be carried out in the banking industry, especially in BPRS.

Several studies have shown that BPRS is still less efficient than BPR. This empirically shows that the performance of BPRS is still developing. Even though the competition between conventional and sharia rural banks is still small, BPRS has a place in society. Consequently, research on the productivity of the BPRS sector has become a significant component of the banking literature. In addition, examining shifts in banking sector productivity should interest both bankers and policymakers. Increased productivity is expected to be a positive indicator of a bank's ability to manage its resources more efficiently, lower prices, and improve the quality of its services.

Productivity refers to the most efficient use of business resources to achieve effective and efficient goals within an agreed value framework. The discussion of productivity in a particular business requires the efficient use and integration of existing resources. This stage is necessary for the growth and development of the company and the internalization of various subsystem

improvements. The Malmquist Index is a unique measure of productivity because it allows researchers to break down the productivity change index into components, thereby explaining the reasons for increasing or decreasing productivity. This method is a comprehensive instrument for analyzing the performance of a sector whose operational activities involve many inputs and outputs (Mohd Salleh & Rani, 2020).

The development of a BPRS must be accompanied by a productivity analysis that quantifies the output growth of the banking industry. Productivity is measured in this study by using Total Factor Productivity (TFP) by not distinguishing the factors of production parts. TFP is very important because it is a productivity measure that incorporates all the important aspects of production. In addition, there is a dearth of literature on banking productivity in developing countries. In addition, this disparity encourages additional research to assess the productivity performance of BPRS and BPRs, especially in developing countries such as Indonesia.

LITERATURE REVIEW

Islamic People's Financing Bank (BPRS)

According to the Financial Services Authority (OJK), Rural Banks (BPR) are banks that operate traditionally or based on sharia principles but do not provide payment services. The activities of BPRs are very limited compared to those of commercial banks because BPR are not allowed to accept demand deposits, foreign exchange transactions, or insurance. Meanwhile, BPRS is a bank that operates based on sharia principles and does not carry out payment traffic.

The legal framework for establishing a BPRS is regulated in Law Number 7 of 1992 concerning Banking and Government Regulation (PP) Number 27 of 1992 concerning Bank Profit Sharing. The BPRS conducts business activities based on sharia principles, as stipulated in the Decree of the Director of Bank Indonesia No. 32/36/KEP/DIR/1999 dated 12 May 1999 concerning Rural Banks Based on Sharia Principles (Rural Banks Based on Sharia Principles) (Sutisna et al., 2021).

Although BPRS is statistically lower than BPR and conventional commercial banks, the role of BPRS in the Indonesian economy is prominent because BPRS tends to have a social and commercial mission (Seibel and Agung, 2006). In addition, BPRS can be a solution to filling the gap in sources of financing for small and medium enterprises (SMEs) by sharia principles. BPRS has an important role in the progress of SMEs in Indonesia, and it is well known that SMEs have a high contribution in Indonesia (Masyita and Ahmed, 2013). BPRS has a specific purpose, namely providing financing and providing assistance to low-income communities and Micro, Small, and Medium Enterprises (MSMEs) as an effort to reduce poverty and realize community welfare.

In addition, BPRS can provide financing to micro-enterprises, thereby increasing their capital. However, this promise could not be fully realized as BPRS continued to face various obstacles, including overlapping institutional features, lack of management resources, and lack of capital in Microfinance Institutions. Researchers propose solutions for institutional efforts to strengthen the Law on Microfinance Institutions and the government's commitment to linking small and medium enterprises with the development of microfinance institutions (Andriyani et al., 2020).

Deposit Insurance Agency (LPS)

The definition of the Deposit Insurance Corporation in Article 1 point (24) reads: "The Deposit Insurance Corporation is a legal entity that organizes activities to guarantee deposits of depositors through insurance schemes, buffer funds or other schemes" and Article 37 B reads as follows: (1) Every bank is obligated to guarantee public funds kept at the bank concerned; (2) to guarantee public deposits at the bank as referred to in paragraph (1) a Deposit Insurance Corporation is established; (3) The Deposit Insurance Corporation as referred to in paragraph (2) is an Indonesian legal entity; (4) the need for a guarantor for public funds and the Deposit Insurance Corporation is further regulated by government regulation.

Establishing a Deposit Insurance Corporation of course has functions, duties, and authorities aimed at customer convenience. Between the functions, duties, and authorities of the Deposit Insurance Corporation as such mentioned in the article (4)(5)(6) of the Deposit Insurance Corporation Act.

The functions of the Deposit Insurance Corporation are contained in article 4. Which contains

as follows: (1) Guarantee deposits from depositors; (2) Participate actively in maintaining the stability of the banking system in accordance with its authority.

Productivity

Efficiency and productivity are often used as measuring tools to calculate the achievement of a financial institution. This is usually associated with financial institutions achieving their goals. Therefore, efficiency and productivity can be seen in financing and operations as outputs and fixed assets, labor, and customer funds as inputs. Efficiency can be known by calculating the ratio of output and input, while productivity is the relationship between output and input (Mongid & Tahir, 2010).

Kopelman (1986) defines productivity as the proportion of one or more physical outputs to the physical inputs used in production. In other words, total production (output) is affected by the amount of capital and labor invested. According to Fare et al., (1994), productivity can be broken down into smaller segments based on efficiency changes through innovative technological advances, assuming that output equals output, and the total factor productivity growth index captures technological changes. Therefore, Total Factor Productivity (TFP) can be equated with changes in technology (from a technical perspective), which can be measured as changes in performance, which can be modified appropriately by adjusting the selected inputs. Increasing productivity will increase bank profitability (Firmansyah, 2019). In other words, when the level of productivity increases in the context of the banking industry, the greater output can be achieved with the same quantity of input.

PREVIOUS RESEARCH

Research on the productivity of BPR and BPRS is still very rarely carried out by previous researchers and most of them focus more on research on banking efficiency, one of which is BPR and BPRS, for example, Hosen & Warninda (2014) who tries to analyze the efficiency and profitability matrix of Islamic BPRs in Indonesia. , as well as analyzing the factors that influence the efficiency of Islamic BPRs. Furthermore, in 2015, Warninda & Hosen again analyzed the efficiency and profitability of BPRS in Indonesia using the Variable Returns to Scale model in Data Envelopment Analysis (DEA) and the efficiency-profitability matrix.

Sandono (2017) in his research measures technical efficiency and identifies factors that influence BPR inefficiency in East Java Province. Furthermore, Jatmiko (2017) examines whether the ownership structure affects the technical efficiency of both BPRs and BPRS in Indonesia. Agustina et al., (2019) measured and analyzed the technical efficiency of Indonesian BPRS using panel data from the first quartile of 2011 to the fourth quartile of 2016. Nugrohowati (2019) measured the level of efficiency of BPRS in Indonesia from 2012 to 2015 according to regional zones. In addition, Anwar et al., (2020) analyzed the efficiency of BPRs in Indonesia, particularly in two provinces, West Java and Bali.

Although research on the productivity of BPR and BPRS is still very rare, several studies can be used as references in measuring productivity, including Afiatun & Wiryono (2010) analyzing the efficiency and changes in Total Factor Productivity of the banking industry during the 2004-2009 period and looking at the performance of Islamic banking as a new player in the Indonesian banking industry. Abbas et al (2015) calculated the Malmquist Index of Islamic and conventional banks to compare performance in the 2005-2009 sample period. Kamarudin et al (2017) explored the level of productivity of Islamic banks, especially in selected Southeast Asian countries from 2006 to 2014. In addition, this study also investigated the potential determinants of bank-specific characteristics and macroeconomic conditions that could affect the productivity of the banking sector.

This research tries to fill the research void regarding bank productivity. As is well known, in addition to measuring efficiency, measuring bank productivity, especially BPR and BPRS, is also very important so that several stakeholders such as banking practitioners and regulators can evaluate and develop future strategies to maintain stability and advance the banking industry in Indonesia. This study focuses on all BPRS in Indonesia that have met the research sample criteria. Furthermore, this research also analyzes the effect of the Covid-19 pandemic on the productivity of BPRS in Indonesia.

RESEARCH METHODS

Sten Malmquist first created the Malmquist index in 1953 to measure productivity. However, in its development, the Malmquist Index was introduced by Caves et al. (1982). Two things are taken into account in

measuring the Malmquist index: catch-up and frontier shift effects. The catch-up effect measures the rate of change in relative efficiency from period 1 to period 2. Meanwhile, the border shift effect measures the rate of change in technology, input, and output combinations from period 1 to period 2. The border shift effect is often referred to as the innovation effect (Caves et al., 1982; Rani et al., 2017; Rusydiana, 2018; Rusydiana & Nugroho, 2017).

The Malmquist index has several advantageous characteristics. First, this index is a non-parametric method, so it does not require the specification of the production function. Second, the Malmquist index does not require assumptions about the behavior of economic units of production, such as minimizing costs or maximizing profits. Third, the calculation of this index does not require price data which is often not available. So, it is helpful if the destination is a different or unknown DMU. Fourth, the Malmquist productivity index can be divided into two components, namely changes in efficiency and changes in technology (Marlina et al., 2018).

The analytical tool used in this study to measure the Malmquist productivity index is DEAP 2.1 software. The research was conducted on 92 BPRS in Indonesia during the period from 2016 to 2021. All related data was collected from the annual BPRS reports which are available in OJK publication reports. In selecting the BPRS sample, all relevant data is required over six years from 2016 to 2021, resulting in a sample of 92 BPRS in Indonesia.

The data used to analyze productivity includes fixed assets, labor costs, third-party funds, the amount of financing provided, and operating income. Adopting an intermediation approach to measure the productivity of financial institutions, the first three data variables are taken as inputs and the last two variables as outputs. BPRS productivity calculations use the BCC or VRS approach with an output orientation.

Figure 1: Input and Output Variable

No.	Input	Output
1	Fixed assets	Amount of financing provided
2	Labor costs	Operating income
3	Third-party funds	

In this study, the estimated growth of TFP and its components refers to the Malmquist Index and uses the Cobb-Douglas production function. The Cobb-Douglas production function can be written as follows:

$$Y = A * L^a * K^{(1-a)} \quad (4)$$

The equation is expressed as a measure of total factor productivity, where scalar A has economic value. The input geometric weighted average (geometric weighted average) is used to generate the actual output. Thus, A can be interpreted as real output per unit of input. This is a better productivity measure than Y/L and Y/K, partial productivity measures that do not take into account the possible amounts of other inputs used. Then, the method used to measure efficiency in this study is part of the Data Envelopment Analysis (DEA), namely the Malmquist Productivity Index (MPI).

The change in total factor productivity change (TFPCH) is assigned to the change in technology (TECHCH) and change in efficiency (EC) (EFFCH). The efficiency change index can be further decomposed into a mutually comprehensive PECH (pure efficiency change) component, calculated relative to the VRS technology, and a SECH (scale change) component to capture the change in a deviation between the VRS and CRS technology.

There are two Malmquist productivity indices, namely the Malmquist input quantity index and the Malmquist output quantity index. The former is used for units of production, at observed times t and t + 1, for the reference technology in periods k, k = t and t + 1, and measures the change in the observed quantity of inputs between times t and t + 1, where:

$$MI_k(y_k, x_t, x_{t+1}) = \frac{E_k^I(y_k, x_t)}{E_k^I(y_k, x_{t+1})}, \qquad k = t, \qquad t + 1$$

The output index is used for units of production, at the time of observation t and t + 1, for the reference technology in the period k, k = t and t + 1. This index only measures the change in the quantity of output observed between times t and t+1, where:

$$MO_k(y_t, y_{t+1}, x_k) = \frac{E_k^O(y_{t+1}, x_k)}{E_k^O(y_t, x_k)}, \qquad k = t, \qquad t + 1$$

Bjurek (1996) introduced a new definition of the Malmquist productivity index for units of production between t and t + 1 based on the level of technology at times k, k = t, and k = t + 1, following the tradition of most productivity indices. The index constructed is the ratio between the output index and the input index, according to the Tornqvist productivity index, where:

$$MTFP_k = \frac{MO_k(y_t, y_{t+1}, x_k)}{MI_k(y_k, x_t, x_{t+1})} = \frac{E_k^O \frac{y_{t+1}, x_k}{E_k^O}(y_t, x_k)}{E_k^I \frac{y_k, x_t}{E_k^I}(y_k, x_{t+1})},$$

$$k = t, \qquad t+1$$

The above equation expresses the relationship between the output index and the Malmquist input index. Productivity increases if the productivity index value is greater than one. However, if the index value is less than one, the production rate falls. If it is equal to 1, the productivity level remains constant.

Factors of change in productivity can be seen through the values of the change in efficiency index (EFFCH) and the index of technological change (TECHCH) to explain the reasons for changes in productivity. In addition, the pure efficiency change index (PECH) and scale efficiency change index (SECH) were used to determine the cause of the change in the efficiency change index (EFFCH). The value of total factor productivity (TFP) shows a change in the index. M value> 1 indicates an increase in productivity; M = 1 indicates no increase in productivity, and M < 1 indicates falling.

RESULTS AND DISCUSSION

BPRS Productivity in Indonesia During the Observation Period

Productivity change factors can be identified through the Efficiency Change Index (EFFCH) and Technology Change Index (TECHCH) values. Whereas the Pure Efficiency Change Index (PECH) and Scale Efficiency Change Index (ECH) are used to determine the causes of changes in EFFCH. Furthermore, the value of Total Factor Production (TFP) is intended to see any changes in the index. If the value of M > 1, then this indicates an increase in productivity, and vice versa, whereas if M < 1 indicates a decrease in the value of productivity. If M = 1 then there is no increase in productivity.

The table below describes the results of the analysis using the Malmquist Productivity Index (MPI) from BPRS in Indonesia which is the object of observation in this study.

Figure 2: Average Score of SRB Malmquist Index per Year

YEAR	EFFCH	TECHCH	PECH	SECH	TFPCH
2016-2017	1,115	0,980	1,091	1,022	1,092
2017-2018	0,884	1,158	0,944	0,936	1,023
2018-2019	1,067	1,077	1,025	1,041	1,150
2019-2020	0,991	0,959	1,011	0,980	0,951
2020-2021	1,072	0,923	1,064	1,008	0,989
Mean	**1,022**	**1,016**	**1,026**	**0,997**	**1,039**

The table above describes the changes in the total productivity (Tfpch) of BPRS and the factors that influence them, namely changes in technology (Techch) and changes in efficiency (Effch) during the observation period. From the MPI results of 92 BPRS in Indonesia, it can be concluded that productivity trends fluctuate from year to year. The results of the average score show that the value of bank productivity has increased (1.039) which was both caused by an increase in changes in efficiency (1.022) and changes in technology (1.016). This explains that changes in efficiency and changes in technology have contributed to increasing the productivity of BPRS in Indonesia.

In 2016-2017 the average BPRS productivity level increased (1.092) with the highest change in efficiency (1.115) during the six observation periods. While technological changes decreased (0.980). It can be

concluded that technology in this period has not been able to make an optimal contribution to the productivity of BPRS in Indonesia. The results for the 2016-2017 period are in contrast to the results for the 2017-2018 period, where the BPRS productivity level increased (1.023) with changes in efficiency that experienced the lowest decrease (0.884) during the observation period, and technological changes showed an increase (1.158). That means, in the 2017-2018 period changes in efficiency have not made an optimal contribution to the productivity level of BPRS in Indonesia.

Furthermore, in 2018-2019 the productivity level experienced the highest increase in productivity during the six observation periods (1,150) which were equally affected by increases in changes in efficiency (1,067) and changes in technology (1,077). Then, for 2019-2020, the productivity level experienced the lowest decline during

the six-year observation period, namely (0.951). This is influenced by a decrease in the rate of change in efficiency (0.991) and changes in technology (0.959). It can be concluded that during the two periods from 2018 to 2020, changes in efficiency and changes in technology both contributed to increasing or decreasing the productivity of BPRS in Indonesia.

And for 2020-2021 the productivity of BPRS in Indonesia will still decrease (0.989), as well as technological changes which will also decrease from the previous year (0.923). However, in 2020-2021, the rate of change in BPRS efficiency shows an increase (1,072). If analyzed further, productivity in 2020-2021 has increased compared to the previous year, namely 2019-2020 by 0.038. The increase in productivity this year compared to the previous year can be affected because the rate of change in efficiency has increased, whereas in the previous year the change in efficiency has decreased.

Trends in EFFCH, TECHCH and TFPCH BPRS in Indonesia

The next analysis is to look at trends in efficiency changes (EFFCH), technology changes (TECHCH), and BPRS productivity changes (TFPCH) during the 2016-2021 observation period. Figure 1 below shows a chart of the EFFCH, TECHCH, and TFPCH trends.

Figure 3: Trends in EFFCH, TECHCH and TFPCH
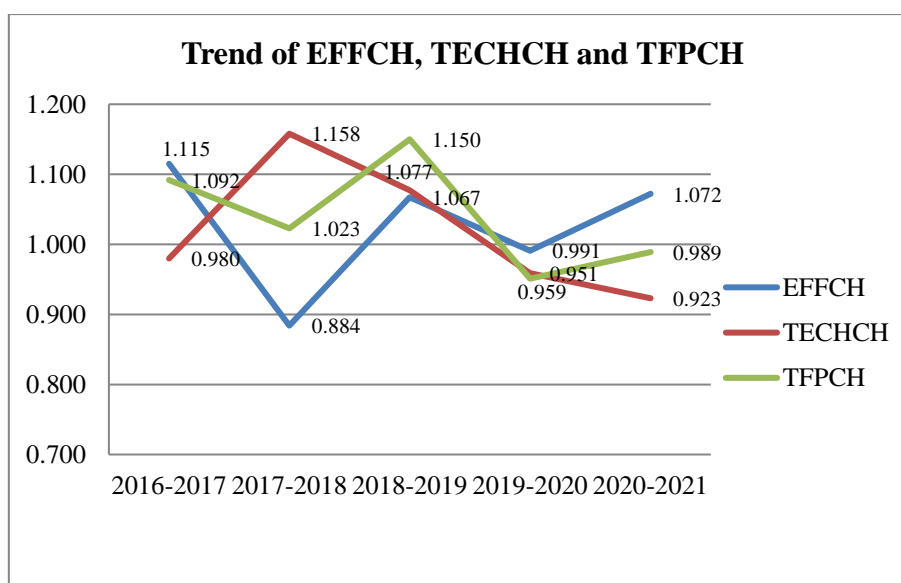
Based on the graph in Figure 1, it can be concluded that changes in efficiency (EFFCH), changes in technology (TECHCH), and productivity (TFPCH) both experience fluctuations from year to year. In the graph of changes in efficiency, the lowest decrease occurred in the 2017-2018 period, which then increased again in the following period. However, in the 2019-2020 period changes in efficiency decreased again and increased again in the 2020-2021 period. For the graph of technological change, there was the highest increase in the 2017-2018 period, which then decreased sustainably for the following three periods. Furthermore, for graphs of productivity levels, there is a trend that fluctuates from year to year, the same is the case with the trend pattern of changes in efficiency. That means, it can be concluded that from the trend graphs of EFFCH, TFCHCH, and TFPCH, changes in efficiency are the factors that most influence the productivity level of BPRS in Indonesia.

Summary of the Average Malmquist Index of BPRS in Indonesia

Figure 4: Average BPRS Productivity for 2016-2021

firm	effch	techch	pech	sech	tfpch
1	0,993	1,039	0,998	0,994	1,032
2	1,032	0,964	1,029	1,003	0,996
3	0,946	1,013	0,998	0,948	0,959
4	0,993	1,004	1,043	0,952	0,997
5	0,979	1,023	0,990	0,989	1,002
6	1,050	1,167	0,998	1,052	1,226
7	1,000	1,121	1,000	1,000	1,121
8	0,903	1,020	0,912	0,991	0,921
9	1,001	1,089	1,000	1,001	1,090
10	0,968	1,008	0,987	0,981	0,975
11	0,958	0,937	0,990	0,968	0,898
12	1,114	1,029	1,144	0,974	1,147
13	0,997	1,051	1,014	0,983	1,048
14	1,007	1,073	1,043	0,966	1,080
15	1,054	1,045	1,060	0,995	1,102
16	1,027	0,983	1,012	1,014	1,009
17	1,019	1,025	1,034	0,986	1,045
18	1,191	1,041	1,101	1,083	1,240
19	1,005	1,063	0,991	1,014	1,068
20	1,023	1,070	1,011	1,012	1,095
21	0,952	1,018	1,014	0,939	0,970
22	0,990	0,893	1,000	0,990	0,884
23	0,984	1,072	0,987	0,997	1,054
24	1,140	1,133	1,026	1,111	1,291
25	1,030	1,052	1,020	1,010	1,084
26	1,097	1,017	1,079	1,017	1,116
27	1,075	1,036	1,081	0,995	1,113
28	1,095	1,042	1,115	0,982	1,141
29	1,128	0,964	1,153	0,978	1,087
30	1,269	0,921	1,299	0,977	1,169
31	0,909	1,052	0,951	0,955	0,956
32	0,795	0,989	0,794	1,002	0,786
33	0,936	0,910	1,000	0,936	0,852
34	0,959	0,926	1,000	0,959	0,887
35	0,937	1,032	0,997	0,940	0,967
36	1,023	1,003	1,001	1,021	1,025
37	1,080	1,020	0,988	1,093	1,101
38	1,099	0,979	1,104	0,995	1,076
39	0,988	1,005	0,963	1,026	0,994
40	1,007	1,013	0,982	1,025	1,020
41	0,976	0,906	0,962	1,015	0,884
42	0,963	0,917	0,952	1,012	0,884
43	0,893	1,013	0,950	0,940	0,905
44	1,036	1,005	1,098	0,943	1,042
45	1,076	1,183	1,087	0,990	1,273
46	1,068	1,301	1,065	1,003	1,389
47	0,954	1,115	1,101	0,867	1,064
48	1,041	1,186	1,021	1,020	1,235
49	1,027	1,091	1,016	1,011	1,120
50	0,985	1,123	1,000	0,985	1,106
51	1,003	1,172	0,992	1,012	1,175
52	1,147	1,208	1,141	1,006	1,386
53	1,152	1,071	1,100	1,047	1,234
54	1,159	1,121	1,104	1,050	1,299
55	1,055	1,114	1,045	1,010	1,175
56	1,121	1,010	1,101	1,018	1,132
57	1,084	0,947	1,090	0,994	1,026
58	1,175	0,969	1,170	1,004	1,138
59	1,096	0,986	1,126	0,974	1,081
60	1,125	0,986	1,145	0,982	1,109
61	0,965	0,962	0,988	0,977	0,928
62	0,983	1,000	0,998	0,985	0,983
63	0,851	1,014	0,901	0,945	0,863
64	0,920	1,040	0,971	0,948	0,957
65	1,000	1,599	1,000	1,000	1,599
66	0,870	0,980	0,829	1,050	0,853
67	0,983	0,995	0,985	0,999	0,978
68	1,134	0,966	1,114	1,018	1,096
69	1,169	0,939	1,187	0,984	1,097
70	1,129	0,940	1,125	1,003	1,061
71	1,069	0,909	1,073	0,996	0,972
72	1,055	0,906	1,064	0,992	0,955
73	0,977	0,962	0,973	1,004	0,940
74	1,009	1,020	1,019	0,991	1,030
75	1,094	1,049	1,063	1,029	1,147
76	1,091	1,024	1,032	1,057	1,117
77	1,067	1,002	1,031	1,034	1,069
78	1,002	0,965	0,970	1,032	0,967
79	1,068	0,900	1,083	0,986	0,961
80	1,076	0,993	1,094	0,984	1,068
81	1,057	1,001	1,058	0,999	1,059
82	0,994	1,032	1,007	0,987	1,026
83	1,007	0,786	1,008	0,999	0,792
84	1,008	0,912	1,001	1,007	0,919
85	1,168	0,896	1,185	0,986	1,046
86	1,354	0,933	1,363	0,994	1,263
87	1,020	0,880	1,003	1,017	0,897
88	0,886	0,861	0,876	1,012	0,763
89	0,876	1,029	0,868	1,009	0,902
90	0,824	1,027	0,822	1,002	0,847
91	0,844	1,066	0,850	0,994	0,900
92	1,009	1,023	1,011	0,998	1,032
Mean	**1,022**	**1,016**	**1,026**	**0,997**	**1,039**

Based on the table, the average BPRS productivity throughout the study period shows an increase in productivity (1.039). This increase in productivity was influenced by an increase in the average value of changes in efficiency (EFFCH) with a value of (1.022) and changes in technology (TECHCH) with a value of (1.016). The increase in efficiency can be due to an increase in one of the EFFCH forming factors, namely an increase in Pure Efficiency Change (PECH) with a value of (1.026), although in terms of the Scale Efficiency Change (SECH) factor it has decreased by -0.3% (0.997).

Furthermore, the analysis carried out individually at BPRS can be concluded that of the BPRS in Indonesia, the BPRS with the highest productivity is BPRS Mitra Cahaya Indonesia Sleman with a score of (1.599). The high level of productivity at BPRS Mitra Cahaya Indonesia Sleman was influenced by an increase in EFFCH (1,000) and an increase in TECHCH (1,599).

Figure 5: Comparison of BPRS Productivity in Java and Non-Java
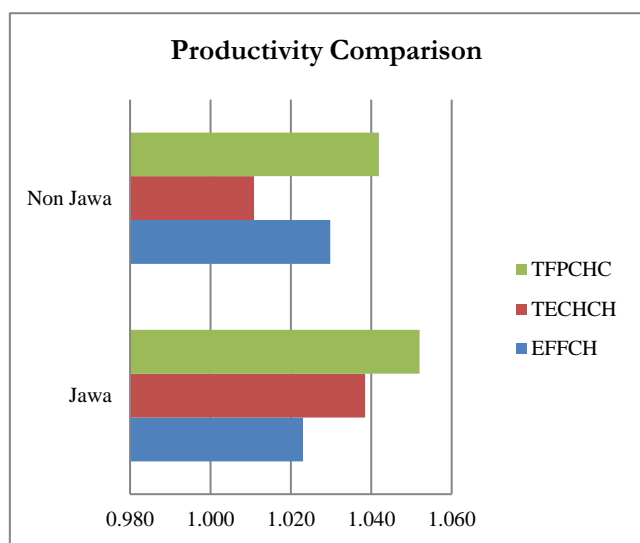
From the picture above, it can be concluded that the productivity level of BPRS in Java Island is (1.052) higher than that of BPRS outside Java Island (1.042). Although productivity in Java and Non-Java are both affected by changes in efficiency and changes in technology. Furthermore, if elaborated further, the use of technology (1,038) BPRS in Java is higher than the use of technology (1,011) BPRS outside Java. However, in terms of changes in efficiency, BPRS outside Java are superior with a score of (1.030) compared to BPRS in Java with a score of (1.023).

Then, BPRS with the lowest productivity value was obtained by BPRS Tengku Chiek Dipante Pidie Aceh with a productivity value of (0.763). Where, low productivity is affected by decreased EFFCH (0.886) and TECHCH (0.861).

Comparison of BPRS Productivity in Java and Non-Java

BPRS are spread across almost all islands in Indonesia. Java Island is one of the major islands in Indonesia which is also the center of the national economy. In addition, the majority of BPRS spread across Indonesia are located on the island of Java. For this reason, it is necessary to carry out further analysis related to productivity comparisons between BPRS in Java Island and outside Java Island. And the following figure is the result of an analysis related to the comparison of BPRS in Java and outside Java.

BPRS Productivity in Indonesia Before and During the Covid-19 Pandemic

The emergence of Covid-19 in 2019 and starting to spread in Indonesia in early 2020 certainly had a global impact not only on the health sector but also on the economic sector, especially in the banking industry. For this reason, the following analysis explains the productivity of BPRS before and during the Covid-19 pandemic.

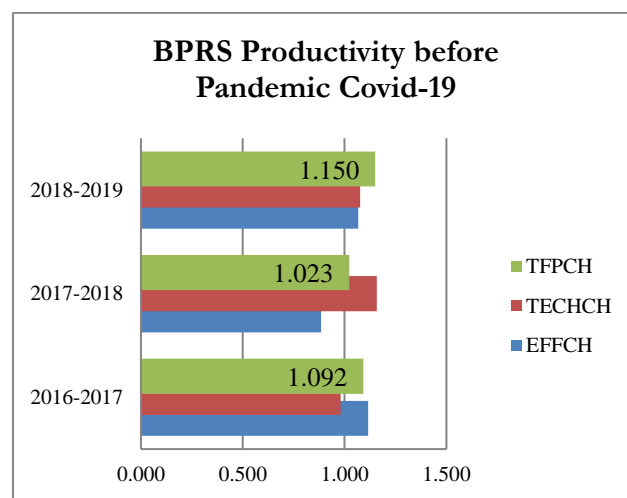**Figure 6:** BPRS Productivity Before the Covid-19 Pandemic

Figure 6 above represents the level of BPRS productivity before the Covid-19 pandemic. It can be concluded that before the Covid-19 pandemic hit Indonesia, the productivity level of Indonesian BPRS had increased, and the highest productivity level was in

the 2018-2019 period with a value of (1.150). The increase in productivity in this period was equally influenced by the contribution of an increase in EFFCH (1.067) and TECHCH (1.077). In the 2016-2017 period, the productivity rate increased (1,092) due to an increase in EFFCH. While TECHCH in this period decreased (0.980). This explains that in the 2016-2017 period technological changes have not optimally contributed to increasing BPRS productivity. Furthermore, in the 2017-2018 period the increase in productivity (1.023) was influenced by an increase in technological change (TECHCH) with a value of (1.158). Meanwhile, changes in efficiency (EFFCH) with a value of (0.884) have not optimally contributed to increased productivity.

The next analysis is the productivity of BPRS during the Covid-19 pandemic, starting from the 2020-2021 period. The following is a picture showing BPRS productivity during a pandemic.

Figure 7: SRB Productivity During the Covid-19 Pandemic

Figure 7 shows the productivity level of BPRS in Indonesia during the Covid-19 pandemic. At the beginning of the Covid-19 period, namely in the 2019-2020 period, the average productivity level of BPRS experienced a significant decline, namely the value (0.951). This is influenced by a decrease in efficiency change (EFFCH) of -0.9% (0.991) and a change in technology (TECHCH) with a value of (0.959). Then in the next period, namely 2020-2021, there is still a decline in the level of productivity (0.989). However, when compared to the previous period during the Covid-19 pandemic, there has been an improvement in productivity levels, as seen from productivity in this period which is better than the 2019-2020 period. The level of productivity in this period can increase compared to the previous period because it is influenced by an increase in the change in efficiency (EFFCH) with a value of (1.072), although the technology change (TECHCH) still shows a decrease (0.923). So, it can be concluded that during the two years of the Covid-19 pandemic that took place in Indonesia, the productivity level of BPRS decreased, and changes in efficiency (EFFCH) became the main factor in decreasing and increasing the productivity of BPRS in Indonesia.
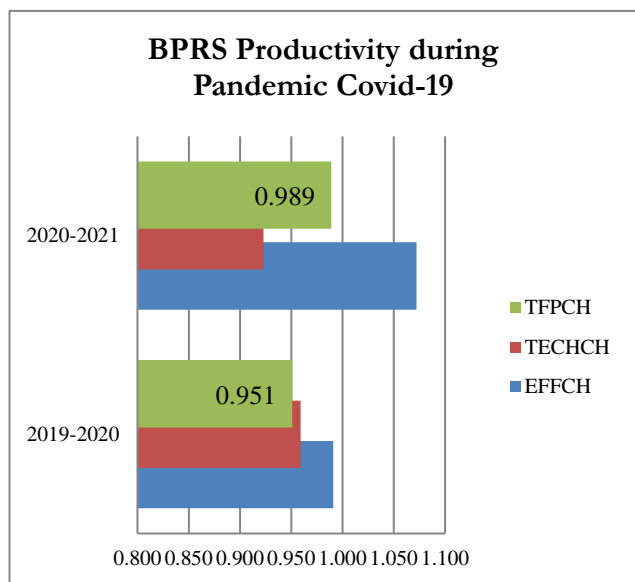
Robustness test with t-test

Figure 8: Robustness Test

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
TFPCH Before - During	0.11650	0.06293	0.04450	-0.44893	0.68193	2.618	1	0.232
EFFCH Before - During	0-.05450	0.07283	0.05150	-0.70887	0.59987	-1.058	1	0.482
TECHCH Before - During	0.17050	0.02899	0.02050	-0.08998	0.43098	8.317	1	0.076

A robustness test was conducted to see whether there was a significant difference between the productivity values of BPRS before and after the Covid 19 pandemic. Based on the results of the t-test on the values of TFPCH, EFFCH, and TECHCH, the significance value was above the standard error of 0.05. This means that in general there is no significant difference between the productivity value of BPRS before and after the covid-19 pandemic.

Malmquist Index Quadrant

At this stage, BPRS will be grouped into four quadrants based on changes in efficiency (EFFCH) and changes in technology (TECHCH), with high and low categories. The value of EFFCH and TECHCH is seen from the industry average, if the value of EFFCH and TECHCH is higher than the industry average, it indicates a high category, and vice versa, if EFFCH and TECHCH are below the industry average, it indicates a low category.

Quadrant 1 describes a BPRS with changes in efficiency and changes in technology in the high category, and it can be considered that the bank has a high level of productivity. Quadrant 2 includes high technological changes, but on the other hand, efficiency changes are still low. Quadrant 3, includes the BPRS group with low technological change, and high-efficiency change. And quadrant 4, explains that the BPRS group with changes in technology and changes in efficiency both show a low category.

Table 5: Quadrants of the BPRS. Malmquist Index

Quadrant 1 (High Technology, High Efficiency)	Quadrant 2 (High Technology, Low Efficiency)
BPRS AlMasoem Bandung	BPRS Adeco Langsa Aceh
BPRS Artha Amanah Ummat Semarang	BPRS Al Washliyah Medan
BPRS Asad Alif Kendal	BPRS Al-Yaqin Simalungun Sumut
BPRS Bahari Berkesan Ternate	BPRS Aman Syariah Lampung Timur
BPRS Bandar Lampung	BPRS Amanah Bangsa Simalungun
BPRS Bangka Belitung	BPRS Amanah Sejahtera Gresik
BPRS Barkah Gemadana Kab Banjar Kalsel	BPRS Amanah Ummah Bogor
BPRS Barokah Dana Sejahtera Yogyakarta	BPRS Arta Leksana Banyumas
BPRS Berkah Dana Fadhlillah (Perseroda) Kampar Riau	BPRS Artha Surya Barokah semarang
BPRS Dinar Ashri Kota Mataram NTB	BPRS Attaqwa Tanggerang
BPRS Harta Insan Karimah Bekasi	BPRS Baiturrahman Aceh Besar
BPRS Harta Insan Karimah Parahyangan	BPRS Baktimakmur Indah Sidoarjo
BPRS Harta Insan Karimah Tangerang	BPRS Bina Finansia kota semarang

BPRS Harum Hikmahnugraha	BPRS Dana Hidayatullah Yogyakarta
BPRS Hikmah Wakilah Aceh	BPRS Harta Insan Karimah Surakarta
BPRS Insan Cita Artha Jaya Bogor	BPRS Hasanah Pekanbaru Riau
BPRS Insan Madani Sukoharjo	BPRS Hijra Alami Jakarta Selatan
BPRS Karya Mugi Sentosa Surabaya	BPRS Mitra Amanah Palangkaraya Kalteng
BPRS PNM Patuh Beramal Kota Mataram	BPRS Mitra Cahaya Indonesia Sleman
BPRS Pudu Arta Insani Deli Serdang	BPRS Patuh Beramal Kota Mataram NTB
	BPRS Sindanglaya Kotanopan Deli Serdang Sumut
	BPRS Unisia Insan Indonesia Kota Yogyakarta
	BPRS Way Kanan (Perseroda) Lampung
	BPRS Aman Syariah
	BPRS Mitra Amal Mulia

Quadrant 3 (Low Technology, High Efficiency)	Quadrant 4 (Low Technology, Low Efficiency)
BPRS Al Ihsan Bandung	BPRS Al Mabrur Babadan Ponorogo
BPRS Artha Madani Bekasi	BPRS Al Salaam Amal Salman Kota Depok
BPRS Berkah Ramadhan Tanggerang	BPRS Amanah Insani Bekasi
BPRS Bina Amwalul Hasanah Depok	BPRS Amanah Rabbaniah Bandung
BPRS Dharma Kuwera Klaten	BPRS Baiturridha Pusaka
	BPRS Bobato Lestari Kota Tidore Kepulauan Maluku Utara
BPRS Fajar Sejahtera Bali Kab Badung Bali	BPRS Buana Mitra Perwira
BPRS Haji Miskin Kab Tanah Datar Sumbar	BPRS Cilegon Mandiri
BPRS Kotabumi (Perseroda) Lampung Utara	BPRS Formes Sleman
BPRS Lampung Timur	BPRS Gala Mitra Abadi Grobogan
BPRS Lantabur Tebuireng	BPRS Gayo Aceh Tengah
BPRS Manfaatsyariah Penajam Paser Utara	BPRS Gebu Prima Medan
BPRS Mitra Harmoni Yogyakarta	BPRS Gunung Slamet Cilacap
BPRS Muamalah Cilegon	BPRS Kota Juang Aceh Jeumpa
BPRS Muamalat Harkat Bengkulu	BPRS Mentari Pasaman Saiyo Pasaman Barat Sumbar
BPRS Mulia Berkah Abadi Tanggerang	BPRS Metro Madani Kota Metro Lampung
BPRS Musyarakah Ummat Indonesia Tangerang	BPRS Mitra Agro Usaha Bandar Lampung
BPRS Rahmah Hijrah Agung Aceh	BPRS Mitra Harmoni Kota Malang
BPRS Rajasa Lampung Tengah (Perseroda)	BPRS Mitra Harmoni Kota Semarang
BPRS Saka Dana Mulia Kudus	BPRS Patriot Bekasi
BPRS Serambi Mekah Langsa Aceh	BPRS Rahmania Dana Sejahtera Aceh Jeumpa/Bireuen
BPRS Taman Indah Darussalam Aceh	BPRS Sukowati Sragen
BPRS Tani Tulang Bawang Barat Lampung	BPRS Suriyah
BPRS Tanmiya Artha Kota Kediri	BPRS Tengku Chiek Dipante Pidie Aceh

Based on the table above, it can be concluded that the existing BPRS in quadrant 1 amounted to 20 banks, quadrant 2 amounted to 25 banks, quadrant 3 amounted to 23 banks and in quadrant 4 there were 24 banks. Based on this, many BPRS in Indonesia has adopted the technology. However, the productivity level of BPRS is still relatively low.

FINDINGS

Based on the results of the analysis in this study, several interesting findings were obtained regarding the measurement of the productivity level of BPRS in Indonesia using the Malmquist Productivity Index (MPI) during the 2016-2021 period. The results of this study can be used as a reference for practitioners,

regulators, or academics for the development of BPRS in the future.

The first finding in this study explains that in general the level of productivity at BPRS in Indonesia has increased. The increase in the productivity of the BPRS is equally influenced by the increase in efficiency change (EFFCH) and technological change (TECHCH). Furthermore, seen from each BPRS, it can be concluded that the productivity level of BPRS in Indonesia fluctuates.

The second finding in this study is seen from the productivity level of BPRS in Java with BPRS outside Java (Non-Java). Based on the results of the comparison between the two, it was found that the productivity level of BPRS in Java, with the largest contribution influenced by technological changes, was superior to that of non-Javanese BPRS with the main contribution being influenced by changes in efficiency. This can be caused because Java is the center of the economy in Indonesia, so its economic activity is also high.

The third finding based on the results of the analysis explains that the productivity level of BPRS in Indonesia before the Covid-19 pandemic increased. However, in the Covid-19 period, starting from 2020-2021, the productivity level of BPRS in Indonesia tends to decrease. This explains that the Covid-19 pandemic has affected bank productivity, particularly BPRS in Indonesia. However, if we look at the results of statistical tests, it shows that the decrease is not significant.

And the fourth or final finding is based on the Malmquist index quadrant, where it is found that the BPRS in Indonesia dominates quadrant 2 with a total of 25 BPRS, then followed by quadrant 4 with a total of 24 BPRS, quadrant 3 with a total of 23 BPRS and the last is quadrant 1 totaling 20 BPRS. Quadrant 1 represents the BPRS with the highest position, namely technological changes, and high-efficiency changes. While quadrant 4, shows the lowest position, with the category of technological change and low-efficiency changes. This explains that the productivity of BPRS in Indonesia is not good enough, although the use of technology in BPRS has begun to be widely applied, apart from that, there are still many BPRS with relatively low technology and efficiency.

Based on several findings in this study, it is explained that technology is a major contributing factor to the productivity of BPRS in Indonesia. For this

reason, BPRS must be able to transform into digital. Banna & Alam (2021) and Banna et al (2021) explain that to maintain smooth operations, banks can take advantage of the implementation of digital financial services (Digital Financing Services/DFS) and Digital Financial Inclusion (DFI). Furthermore, the implementation of DFI in banking can increase financial mobility and reduce the risk of default (Banna & Alam, 2021; Banna et al, 2021). For this reason, it is important for the Islamic banking industry, especially BPRS, to adapt to existing technological developments, for example by updating services, seeing from the experience of conventional banking that transforming to digital can improve work process efficiency and improve customer service quality. In addition, BPRS by digitizing has made long-term investments for the future, and it is projected that digital services will become one of the main drivers of sustainable growth in the banking industry (Sumadi, 2020).

The phenomenon of the COVID-19 pandemic that spread in Indonesia in early 2020 was a major blow to the BPRS industry as a micro-scale intermediary institution. Coupled with the economic slowdown, payment activity has decreased. However, on the other hand, the acceleration of digital financial technology is growing rapidly. Of course, this is a challenge as well as a separate opportunity for BPRS to be able to compete in the banking industry. The BPRS must be able to take advantage of this momentum to develop its business, increasingly widespread digital economic, and financial transactions accompanied by the increasing use of e-commerce platforms and digital instruments, coupled with stronger public preferences and acceptance of digital (Mawarni et al.., 2021).

CONCLUSION

This study analyzes the productivity level of BPRS in Indonesia during the 2016-2021 period using the Malmquist Index. The results of the Malmquist Productivity Index (MPI) score in this study explain that the overall level of productivity in the BPRS shows an increase, and it is known that changes in efficiency and changes in technology both affect the increase in productivity of the BPRS. In the analysis of each BPRS, it is known that the productivity of BPRS fluctuates from year to year. Furthermore, the regional analysis between Java and Non-Java found that BPRS in Java is more productive than BPRS outside Java, considering that Java is the center of the economy in Indonesia, as

well as the impact of high technological changes on BPRS in Java.

Furthermore, the analysis during the Covid-19 pandemic found that the productivity of the BPRS before the pandemic was higher than the productivity level of the BPRS during the pandemic. That means, during the Covid-19 pandemic period, there was a decline in the productivity of BPRS. And the analysis of the Malmquist Index quadrant which is categorized into four quadrants shows that the BPRS dominates quadrant 2 with the category of high technology and low efficiency which is 25 BPRS, then followed by quadrant 4 with the category of technology and low efficiency, totaling 24 BPRS, next is quadrant 3 with a total of 24 BPRS. 23 BPRS and quadrant 1 which has the highest category is 20 BPRS.

RECOMMENDATION

Based on the results of the study, several recommendations can be used as references by BPRS practitioners, regulators, especially the Deposit Insurance Corporation (LPS), and academics. For SRB Practitioners, it is hoped that they can increase the productivity of their banks, by adopting or maintaining the quality of their technological innovations and maximizing the potential of existing technologies to increase their competitiveness. The BPRS is expected to develop a policy strategy for managing existing resources to be more efficient and effective as well as to maintain its financial liquidity to increase revenue. In addition, BPRS must also be more transparent in the publication of financial reports to increase public trust. It is hoped that BPRS will pay more attention to HR, given its important role in managing company resources, for example by conducting ongoing training or evaluations to improve and develop HR competencies.

For the Regulator, LPS as a customer deposit insurance institution must pay more attention to the productivity of the BPRS by conducting periodic and ongoing performance evaluations. It is hoped that the regulator will be able to provide regulatory support and digitization to BPRS which are micro-scale banks. Bearing in mind, the capital of the BPRS itself is also relatively low, making it vulnerable to default and even bankruptcy. In order to increase public trust in micro-banks such as BPRS, regulators, especially LPS, should be able to socialize to the public that LPS also guarantees deposits of BPRS customers. It is hoped that in this way, more customers will save their money in the BPRS so

that they can increase financing which in turn will increase the income of the BPRS.

This research is inseparable from shortcomings, for it is hoped that academics, especially future researchers, will continue to update this research by using other relevant approaches, updating information and productivity data on BPRS, using other variables, measuring the financial performance of BPRS in Indonesia, analyzing the use of technology. on BPRS and so on, to obtain more comprehensive results so that they can recommend more targeted policy suggestions.

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